

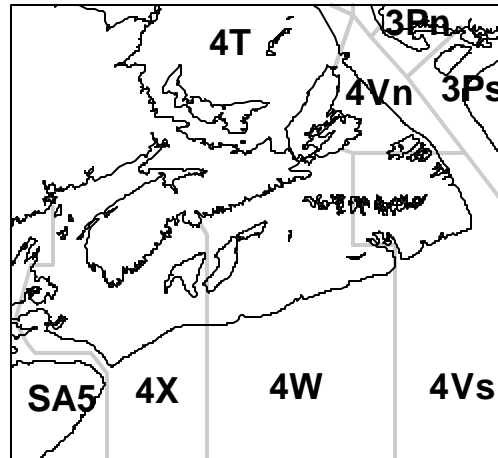
Updates on Selected Scotian Shelf Groundfish Stocks in 1999

Cod in Sydney Bight (May-October) (Subdiv. 4Vn).....	4
Cod on the Eastern Scotian Shelf (Div. 4VsW)	7
Haddock on the Eastern Scotian Shelf (Div. 4TVW).....	9
White Hake on the Scotian Shelf and Northeastern Georges Bank (Div. 4VWX and 5Zc).....	12
Cusk on the Scotian Shelf (Div. 4VWX)	15
Witch Flounder on the Scotian Shelf (Div. 4VWX).....	18
American Plaice, Yellowtail Flounder, and Winter Flounder on the Eastern Scotian Shelf (Div. 4VW).....	21
American Plaice, Yellowtail Flounder, and Winter Flounder on the Western Scotian Shelf (Div. 4X).....	24
Atlantic Halibut on the Scotian Shelf and Southern Grand Banks (Div. 4VWX3NOPs).....	27
Monkfish on the Scotian Shelf and Northeast Georges Bank (Div. 4VWX and 5Zc).....	31
Winter Skate on the Eastern Scotian Shelf (Div. 4VsW)	33

Updates on Selected Scotian Shelf Groundfish Stocks in 1999

Background

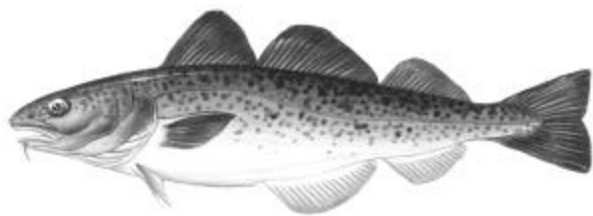
The most recent full assessments of the following Maritimes Region stocks are summarized in stock status reports from 1996 to 1998: 4Vn cod, 4VsW cod, 4TVW haddock, 4VWX+5Zc white hake, 4VWX cusk, 4VWX witch flounder, 4VW flatfish, 4X flatfish, 4VWX3NOPs Atlantic halibut, 4VWX+5Zc monkfish and 4VsW winter skate. The SSR reference for the last complete assessment is listed under the "Background" section of each update. This report provides a brief update of stock status based on recent fishery and survey data.



Summary

- Stock biomass for **4Vn cod** remains low with little recruitment, thus leading to little or no recovery and no change in outlook.
- The productivity of the **4VsW cod** stock is very low and there are several factors causing increased mortality overall, as well as seal predation on the younger ages. The spawning stock biomass has not rebuilt since the closure of the fishery. The 1999 survey showed the first recruitment in many years.
- Good recruitment and improved condition for the **4TVW haddock** stock are observed, but the low spawning stock biomass suggests that the stock status has not yet improved significantly.
- The downward trends in abundance indices for **white hake** in 4X/5 suggest that this portion of the stock may be at risk of collapse. Abundance indices of the 4V and 4W components of the stock have remained near record lows.
- This Scotian Shelf **cusk** stock appears to have collapsed since 1992 and remains very low.
- Recent **witch flounder** data confirms improved recruitment to this stock.

- Recent **eastern Scotian Shelf flatfish** catches have led to some improvements but further rebuilding is required.
- Current **southwest Scotian Shelf flatfish** information indicates some stability in stock status in recent years.
- Abundance estimates and landings of **Atlantic halibut** are both low and show reduced size ranges. Despite reduced landings in recent years, the research vessel abundance estimates remain low.
- There continues to be insufficient information regarding Scotian Shelf **monkfish** stock to determine appropriate harvest levels.
- Reduced catches of Scotian Shelf **skate** appear to have stabilized catch rates but total mortality remains high for such a slow-growing species.



Cod in Sydney Bight (Subdiv 4Vn) May- October

Background

The 4Vn region is known to represent a mixing ground between the resident 4Vn cod stock and larger neighbouring stocks, the 4TVn stock to the west and the 4VsW stock to the south. In addition, 4TVn cod overwinter along the shelf edge from Sydney Bight as far as Banquereau Bank region, leaving the Gulf in the late autumn and returning in the spring. During this period, the catch of cod in 4Vn would be comprised of both Gulf and resident cod, although 4TVn cod would make up the bulk, being a much larger stock. Thus, unknown quantities of 4Vn cod have been caught during the overwintering period. Mixing of Gulf of St. Lawrence (4TVn) cod with the resident stock and inability to apportion landings according to stock have complicated the assessment and management of the 4Vn stock.

Cod in 4Vn grow more slowly than the 4VsW stock to the south but more quickly than 4TVn cod. They are assumed to be fully mature at age 5, at a length of 48 cm. Tagging studies suggest that they overwinter in deeper water. 4Vn cod spawn in Sydney Bight in May.

The most recent full assessment of this stock was conducted in spring 1998 (SSR A3-02 (1998)). An update was conducted in fall 1998 (SSR A3-35 (1998)).

The Fishery

Landings (tonnes)

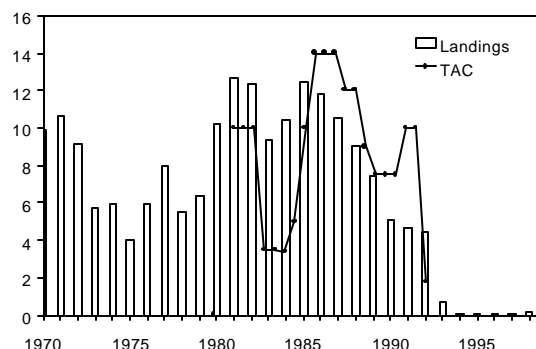
	1993	1994	1995	1996	1997	1998	1999
TAC	1800	1	1	1	1	1	1
Landings	715	57	46	58	106	176	

¹ Bycatch only

The 4Vn cod fishery remains closed to directed fishing, as it has been since the fall of 1993.

Landings data from 1997 represent additional information since the last SSR (DFO, 1998). Less than 200 tonnes of cod landings per year have been reported since 1994, most of which were taken annually as bycatch in redfish and flounder fisheries. The 1999 landings to September 10th, are 30t.

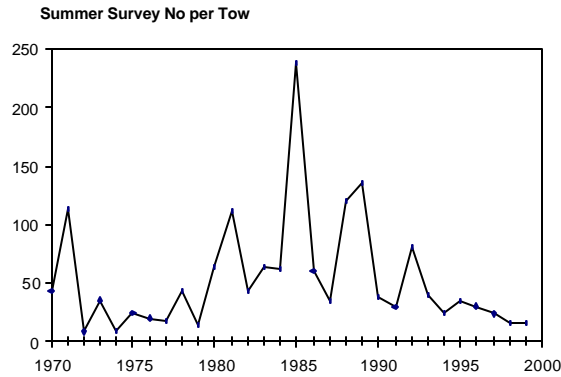
Landings and TAC (tonnes)



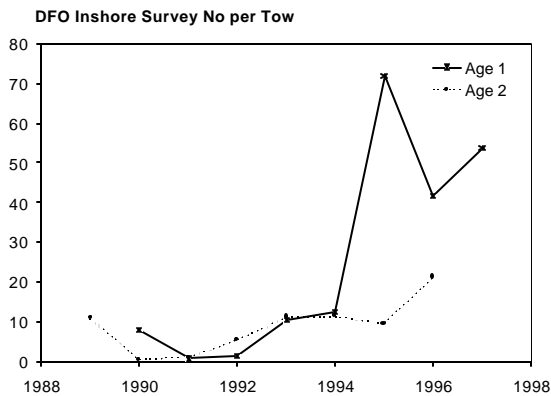
Resource Status

DFO Summer Survey data for 1999 and Sentinel Survey and DFO Inshore Survey data for 1998 represent new information available since the last update.

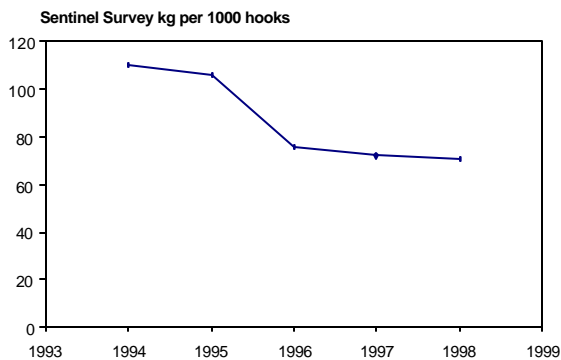
The 1999 **Summer Survey** shows a similar abundance to 1998 at a very low level compared to the historic average of 53 fish per tow.



The DFO **Inshore Survey** catches more small cod than the Summer Survey. Indices of age one and two cod show recent improvement. These fish must survive and recruit to the spawning population before a recovery of the stocks can take place.



A **Sentinel Survey** has been carried out since 1994 using commercial vessels. This survey has shown a declining trend in catch rates since its inception.



Outlook

Excerpts from the Outlook of the last Stock Status Report (A3-02) for this stock, based on an assessment (Mohn et al. 1998) are as follows:

“The 1993 and 1994 year-classes are the first good year-classes to enter the fishable population since that of 1987. However, spawning biomass is very low and has not shown any recovery, although the 1997 biomass is slightly larger than the low seen in 1996. This increase is due to the growth of fish in the population and not due to recruitment.”

The new information available since the last assessment does not suggest that the above outlook needs to be revised.

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References

- DFO, 1998. Cod in Sydney Bight. DFO Sci. Stock Status Report A3-02 (1998).
- DFO, 1998. Updates on Selected Scotian Shelf Groundfish Stocks in 1998. DFO Sci. Stock Status Report A3-35(1998).

Mohn, R., T. Lambert, S. Wilson, and G. Black. 1998. Update of the status of 4Vn cod: 1997. DFO Canadian Stock Assessment Secretariat Research Document 98/09.



Cod on the Eastern Scotian Shelf (Div. 4VsW)

Background

The cod resource on the Eastern Scotian Shelf is a complex of spawning components including at least two major offshore groups (Western/Sable and Banquereau), smaller offshore groups (Middle Bank, Canso Bank) and a chain of smaller coastal spawning groups. The situation is complicated by the presence of both spring and fall spawning in several of the spawning components (Sable/Western offshore and various inshore areas).

Growth rates differ between 4Vs and 4W so that in the 1970s fish in 4Vs reached 68cm at age 7 while in 4W reached 72cm. In the mid-1980s growth declined in both areas and the average length at age 7 dropped to 59 and 54 cm respectively from 1985 to 1995.

The fishery for 4VsW cod was prosecuted primarily by foreign vessels until the extension of jurisdiction in 1977. Since that time, the Canadian offshore trawler fleet accounted for 70-75% of the landings and longliners most of the rest. Catches from 1958-79 were about 40-50% from 4Vs, however, as the stocks rebuilt in the early 1980s, the fishery shifted more to the east each year and 4Vs accounted for 60-80% of the landings from 1980-93.

The most recent full assessment of this stock was conducted in spring 1998 (SSR A3-03 (1998)). An update was conducted in fall 1998 (SSR A3-35 (1998)).

The Fishery

Landings (tonnes)

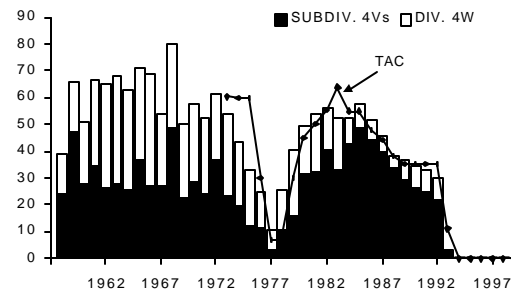
Year	1993	1994	1995	1996	1997	1998	1999
TAC	11000	0*	0*	0*	0*	0*	0*
4Vs	2320	180	180	160	104	110	
4W	1160	190	90	150	127	152	
TOTAL	3470	370	270	310	231	262	

* bycatch only

The 4VsW cod fishery remains closed to directed fishing, as it has been since the fall of 1993.

Landings from 1998 and 1999 represent additional data since the last assessment (DFO, 1998a). Catches have been taken as bycatch in other groundfish fisheries and in the Sentinel Program commercial index. The 1999 landings, to September 10, are 152t. Detailed historical information on the cod fishery is available in Mohn et al. (1998).

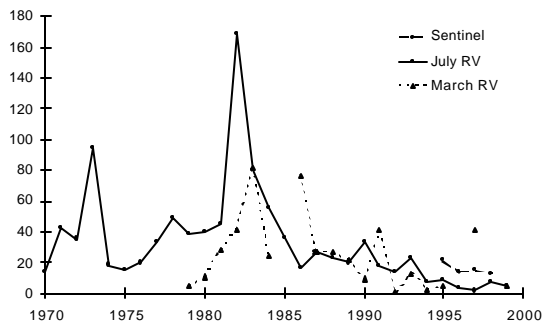
Landings, 1000's of tonnes



Resource Status

Data from September 1997 and the 1998 Sentinel surveys, and March and July 1998 and 1999 research vessel surveys, represent new information available since the last assessment. Information on the annual spatial distribution and length frequency from the July research vessel surveys from 1995 to 1999 is contained in Branton and Black (1999).

Survey indices (ages 3+ numbers per set)



The most recent surveys all remain low with respect to their series. In particular, the large 1997 estimate from the March research vessel survey stands out as an anomaly, not representative of abundance.

Outlook

The two research vessel survey series indicate continuing low abundance and have not indicated any major recruitment events in recent years. Until recruitment of several large year-classes is seen, there does not appear to be any basis to expect stock growth.

The Outlook from the last Stock Status Report (DFO, 1998a) for this stock, based on an assessment of the stock (Mohn et al., 1998) included the following:

“The short-term prospects for this fishery remain dismal. The productivity of the stock is very low, there are several factors causing increased mortality overall as well as seal predation on the younger age groups. The spawning stock biomass, while not declining, has not rebuilt since the closure of the fishery.”

The new information available since then does not suggest that the above outlook need be revised.

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- Mohn R.K., L.P. Fanning, and W.J. MacEachern. 1998. Assessment of 4VsW cod in 1997 incorporating additional sources of mortality. DFO. Canadian Stock Assessment Secretariat Research Document. 98/78.



Haddock on the Eastern Scotian Shelf (Div. 4TVW)

Background

The haddock resource on the eastern Scotian Shelf and southern Gulf of St. Lawrence is considered a single management unit distinct from the adjacent stock in 4X. The majority of 4TVW haddock occur on the offshore banks of the Scotian Shelf ranging from Emerald Bank in the west to Banquereau Bank in the east.

Haddock prefer hard sand or gravel bottoms at depths ranging from less than 50 m to about 350 m, and temperatures ranging from 4 - 8° C. During summer haddock are distributed on the tops of banks while in winter months they move to deeper waters to avoid cold temperatures. Spawning occurs in spring and the principal spawning areas are the complex of banks in 4W including Emerald, Western and Sable Island banks. In the past, these spawning aggregations were the target of intense fisheries until the imposition of a closed area, which encompasses Emerald and part of Western banks in 1987.

A large female haddock (about 60 cm or 24 inches) can produce several hundred thousand eggs which are liberated near the bottom and rise to the surface during an average incubation period of two weeks. During the first year of life, young haddock actively feed on plankton in the surface waters and gradually descend to the bottom as juveniles in mid-summer. Thereafter, they remain on bottom, feeding and growing at a rate of about 5-10 cm (2-4 inches) in length per year. When sexual maturity is reached after 3-5 years, growth rates diminish. Haddock are relatively long-lived (>10 years) and age is determined from the pattern of rings in their otoliths (earbones). The 4TVW haddock otoliths have been particularly difficult to interpret in the past. However, completion of a recent age validation study has resolved this problem.

Since 1987, the haddock fishery has been regulated through a combination of bycatch restrictions and trip limits. The year-round nursery ground closure established in 1987 (initially exempt to fixed gear) remains in effect. In 1993, the area was closed to all groundfish fishing.

The most recent full assessment of this stock was conducted in 1997 (SSR A3-06). An update was conducted in 1998 (SSR A3-35(1998)).

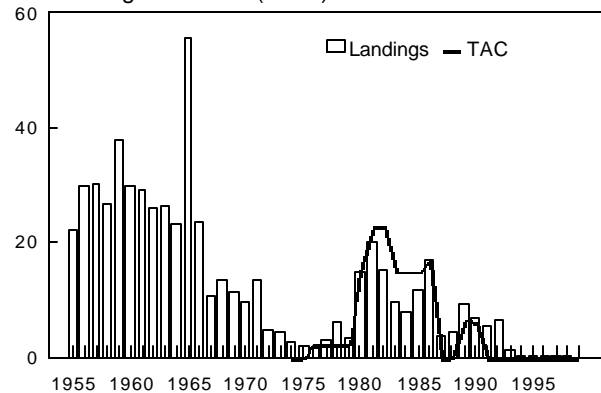
The Fishery

Landings, tonnes

Year	1993	1994	1995	1996	1997	1998	1999
TAC	--*	--*	--*	--*	--*	--*	--*
Total	1,351	103	135	201	127	124	

* = bycatch only

Landings and TAC ('000 t)



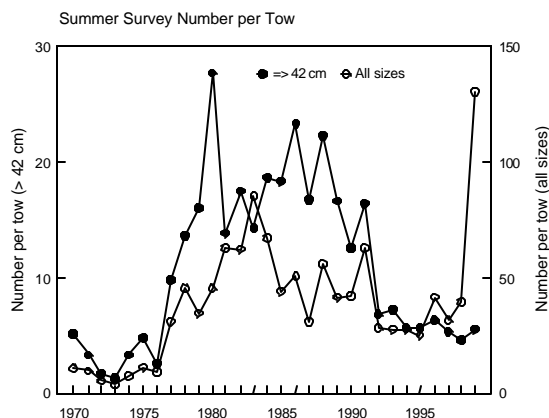
Landings data from 1998 represent additional information since the last SSR. In 1999 (to July 1st), reported bycatch of haddock in other fisheries amounted to 36t.

Resource Status

DFO research vessel **summer survey** data from 1999 represent new information available since the last update. Information on the annual spatial distributions and length frequencies from 1996 to 1999 are contained in Branton and Black (1999).

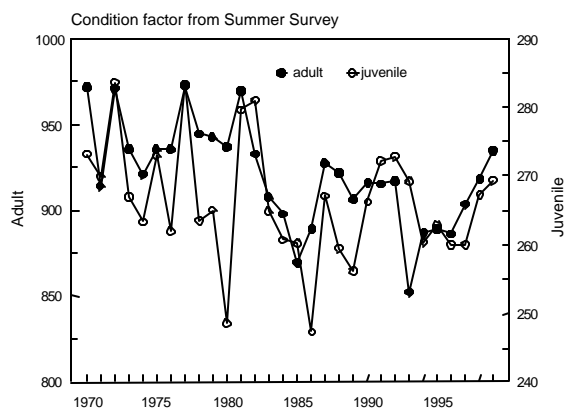
A dramatic increase in the number per tow was evident in 1999, due to an extraordinary abundance of 0-group (~10 cm haddock). In addition, the 1995, 1996, and 1997 year-classes are near the long-term average. The adult or fishable component (haddock > 42

cm) of the population has remained low since 1992.



Currently, the stock is concentrated on Emerald, Western and Sable Island Banks. This pattern was observed during the summer surveys as well as the fall industry/science survey. In general, haddock distribution was confined to the haddock closed area in Div. 4W. It is notable that the 1999 year-class was widely distributed throughout the Scotian Shelf.

Growth (size at age) remains well below average for ages three and older. Condition has been steadily improving and is now above average for both juvenile and adult haddock. The reproductive potential of the stock and/or survival of offspring may be improving given the strength of the recent year-classes.



Outlook

The outlook from the last Stock Status Report (DFO, 1997) for this stock indicated that the short-term prospects for this stock were not encouraging. However, the longer term prospects are better. Improvement in recruitment has been noted with the 1995-1997 year-classes approaching long-term average values. The 1999 year-class is widely distributed, consistent with previous large year-classes.

Despite current growth being well below average, condition has been steadily improving and is now above average for both juvenile and adult haddock. Improvement in the condition of adults may be contributing to the succession of average to above-average year-classes seen in the last five years.

While these indicators show improvement, they are not sufficient to change the view of the status of the stock.

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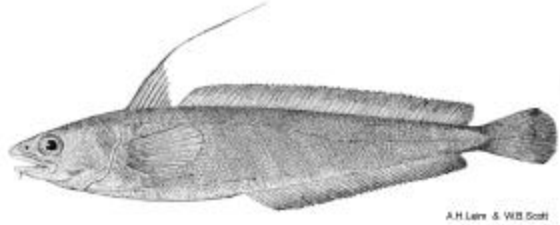
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DFO, 1998. Updates on selected Scotian Shelf Groundfish Stocks in 1998. DFO Sci. Stock Status Report A3-35 (1998).

Frank, K.T., R.K. Mohn, and J.E. Simon. 1997. Assessment of 4TVW haddock in 1996. DFO Canadian Stock Assessment Secretariat Research Document 97/107.



White Hake on the Scotian Shelf and Northeastern Georges Bank (Div 4VWX and 5Zc)

Background

White hake (*Urophycis tenuis*) are bottom dwelling fish found in areas with a mud bottom from the southern Grand Banks to the mid-Atlantic Bight. Their depth range varies with life history stage, with age 2 and older fish occurring predominantly at depths between 50 to 200m. They favour temperatures between 3° and 10°C.

The spawning areas and times on the Scotian Shelf and in the Bay of Fundy are not well understood. There appear to be two spawning components -- late spring/early summer and late summer/early autumn. White hake are highly fecund, having several million eggs per female. They are pelagic spawners, with the eggs and larvae drifting in the upper 50 meters for about a month. The larvae change shape into juveniles in the pelagic zone and subsequently migrate into the shallow coastal zone. At an age of about 2 months the small pelagic juveniles (approximately 4cm) move to the bottom in shallow water. They appear to stay in shallow water for a year and then migrate to the offshore adult distributional area at some time during their second year. In the Bay of Fundy they are about 10cm in length in August of the first year, and 30cm in length at age 1 (August). Growth rate varies with area. In the Gulf of Maine area, white hake begin maturation and reproduction at ages two and three, at lengths between 35 and 45cm. The age span is about 20 years, with fish potentially growing to lengths as large as 189cm.

The stock structure in 4VWX and 5Zc may be complex, with several self-sustaining components. White hake in the 4Vn Laurentian Channel slope waters are contiguous with 4T. Those in the Bay of Fundy and approaches are contiguous with 5Z and 5Y (i.e. the Gulf of Maine area). The central Scotian Shelf (parts of 4X and 4W) may be separate from those to the east and west. The present management units (4T, 4VWX, 5Zc, and USA 5+6), do not reflect discontinuities in adult distributions. About two thirds of the white hake landed in 4VWX and 5Zc are from 4X and 5Zc.

The landings from all areas have declined in recent years. Canadian fishing effort for this species was unregulated in 4VWX and 5 until 1996. It has become increasingly a directed fishery. Longliners and gillnets take about 40% of the catch each, with small draggers (less than 65') taking most of the rest. The landed value in 1997 was about \$2 million.

The most recent full assessment of this stock was conducted in 1998 (Fowler, 1998; SSR A3-10 (1998)).

The Fishery

Landings (tonnes)

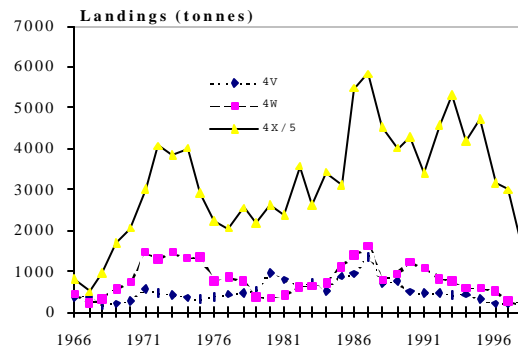
Year	1993	1994	1995	1996	1997	1998	1999
cap*				2920	2400	2800	1382
4X/5	5315	4189	4723	3175	2983	1610	
cap*				500	700	700	310
4VW	1185	1035	912	717	470	407	

* Catch limit allocated to the fixed gear sector

Landings from 1998 and 1999 represent additional data since the last assessment.

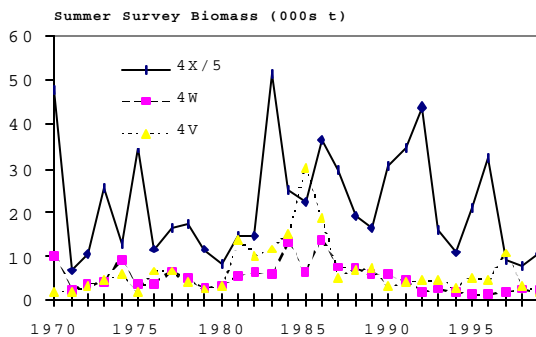
Reported landings in 4VWX/5 during 1998 were the lowest reported since 1968. Landings for 1999 to September 22nd are 1440t.

Until 1996, there were no restrictions on fishing effort for white hake in 4VWX/5, when the first catch limit (cap) was introduced and allocated to the fixed gear sector. In addition, other fleet sectors are regulated through bycatch restrictions (20% for the ITQ fleet, 10% for large trawlers). The cap was restrictive to fishing until 1998, when the cap could not be reached. In 1999, the cap was halved, and allocations are no longer transferable between management boards.



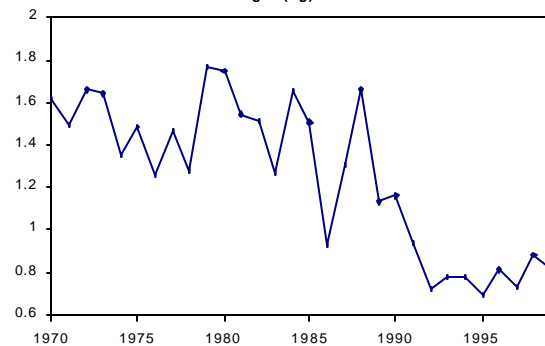
Resource Status

Summer **research vessel survey** biomass estimates for 4X, which typically contains about 75% of the biomass for the 4VWX/5 stock unit, have dropped sharply since 1996, with the 1998 estimate the lowest since 1971. The size composition has shifted towards smaller fish since 1995. Summer survey estimates for 4W declined from 1986 to a record low in 1995, and rose slightly but consistently throughout 1996-1998, mostly due to growth rather than recruitment, and declined slightly in 1999. Summer survey estimates for 4V dropped sharply from 1985 to 1987, and have since remained low but relatively stable. An increase in 1997 was not maintained in 1998, and 1999 represents a new record low for the 4V component.



Mean **individual weights** of white hake in summer surveys in general declined through the 1980s, bottomed out in 1992, and have since remained low.

Mean Individual Weight (kg)

*Outlook*

The outlook from the last Stock Status Report (DFO, 1998), based on the 1998 assessment (Fowler, 1998) was as follows:

“The downward trends in abundance indices for 4X/5 suggest that this portion of the stock may be at risk of collapse. Abundance indices of the 4W and 4V components of the stock have remained near record lows. Present management has not been effective in protecting white hake.”

None of the new information shows any signs of improvement in this stock. The fisheries in both management units should be restricted to bycatch only to achieve the lowest possible landings.

For More Information

Contact:

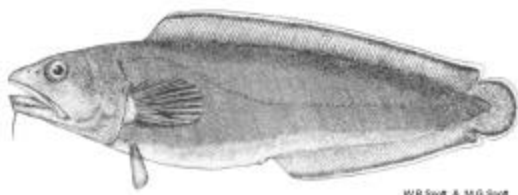
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DFO Sci. Stock Status Report A3-
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Canadian Stock Assessment Secretariat
Research Document 98/143.



Cusk on the Scotian Shelf (Div. 4VWX)

Background

Cusk (*Brosme brosme*) is a solitary, slow swimming species, found primarily on the southwestern Scotian Shelf and Slope and in the Fundian Channel, that seldom moves from bank to bank. Based on July research surveys, cusk occur in temperatures ranging from 3 to 11°C with most being caught in the 6-10°C range, at depths of 75-150 m. They also prefer a rocky bottom, or gravel and occasional mud but seldom sand.

Spawning on the Scotian Shelf is believed to occur from May to Aug., peaking in June. The buoyant eggs are 1.3-1.5 mm in diameter with a pinkish oil globule. The pelagic larvae are about 4 mm when hatched, migrating to the bottom when they have grown to approximately 50 mm in length. Males appear to grow slightly faster than females, (reaching 45 cm at five years of age) and appear to mature more rapidly.

The diet of cusk on the Scotian Shelf is unknown, as their stomachs evert when they are brought to the surface. In European waters, cusk feed primarily on crabs and molluscs, along with the occasional starfish. Observations on this side of the Atlantic revealed cusk feeding on crabs and the occasional mollusc off the coast of Maine. The only known predation record was by a hooded seal off Greenland. There is no record of cusk occurring in seal stomachs on the Scotian Shelf.

The most recent full assessment of this stock was conducted in 1998 (SSR A3-14(1998)).

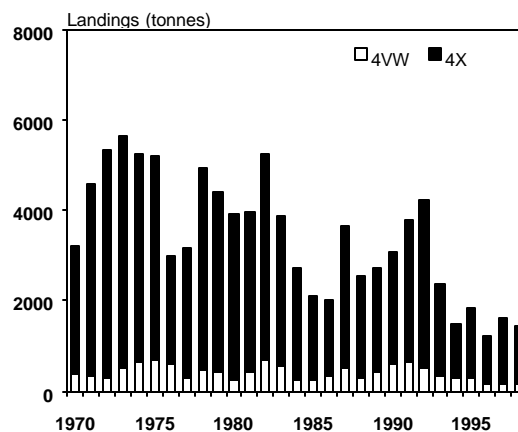
The Fishery

Landings (tonnes)

Year	1992	1993	1994	1995	1996	1997	1998
4VW	513	314	294	290	164	174	181
4X	3678	2039	1209	1531	1044	1468	1267
TOTAL	4191	2353	1502	1820	1208	1642	1457

Cusk was placed under bycatch limitations for the first time in 1999. A cap of 1000t was placed on the combined catches of all fixed gear fleets. The 1999 landings, to July 31, are 446t. It is predicted that if the fishery continues at the current rate, the total landings for 1999 will be below the 1000t cap.

Cusk are primarily caught by longline (95%), with over 80% of the landings coming from 4X. In 4X, landings have varied from a maximum of 5,130t in 1973 to a low of 1044t in 1996. The general pattern of landings is one of a gradual decrease from the early 1970s to the present. Landings in Division 4W have rarely exceeded 500t, while landings in Division 4V have been negligible.



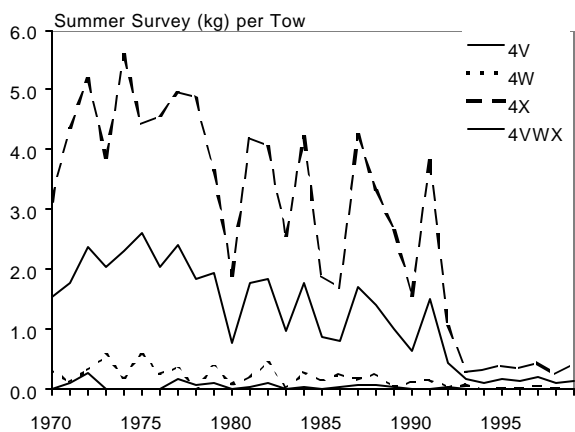
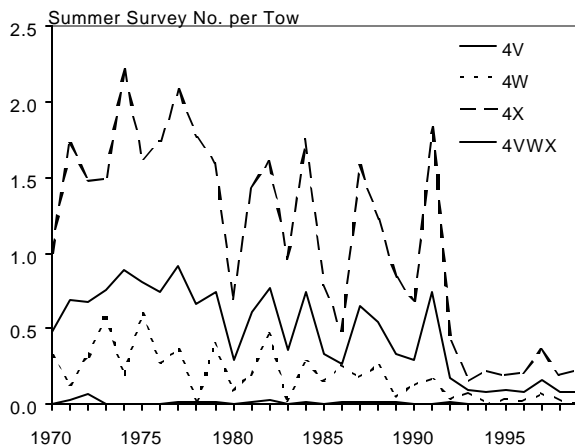
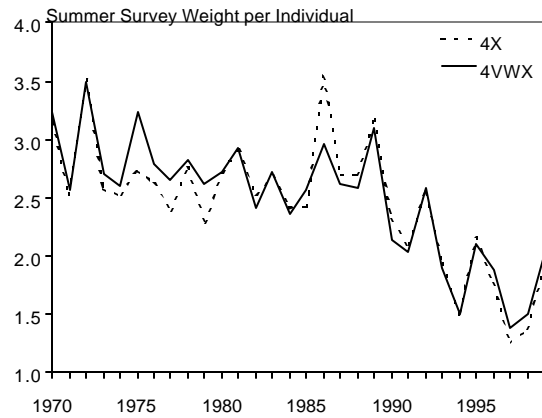
The most common (modal) size in commercial length frequency samples of cusk from the early 1970s and early 1980s was between 64 to 67cm, similar to modal size in the research vessel survey over the same period. These are consistent with modal sizes reported by Oldham (1972) from LaHave Bank in the mid 1960s. The size composition from commercial samples since

1988 has shown no consistent pattern with modes ranging from 52-61 cm. The most abundant size was 52 cm in two of the past three years.

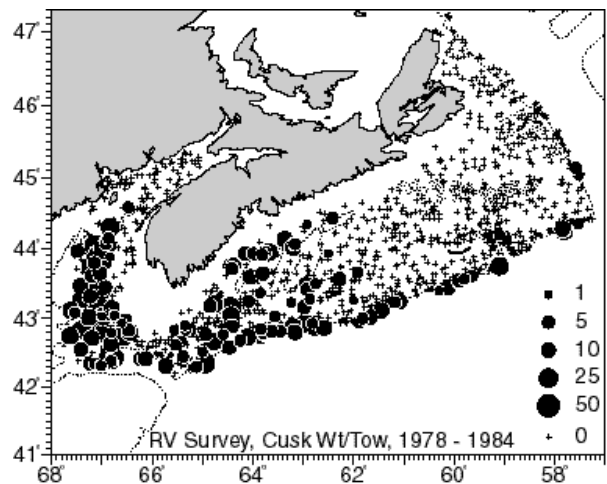
Resource Status

Summer **research vessel** survey indices in both 4W and 4X (the centre of the historic distribution) has shown a gradual decline since the start of groundfish research vessel surveys in 1970. Research survey indices show a gradual decrease in both numbers per tow and weight per tow since the late 1980s with an apparent collapse in 1992.

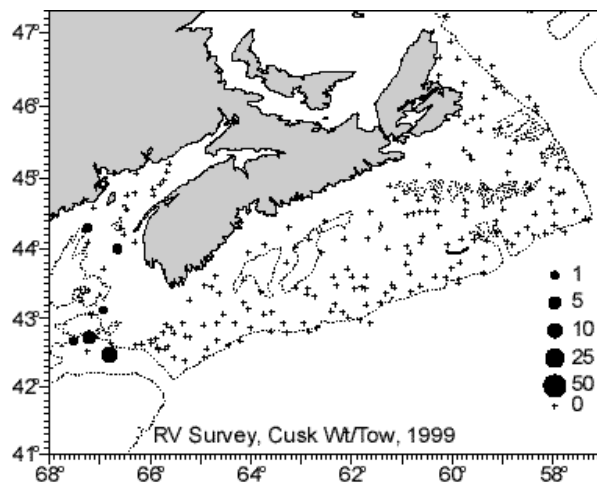
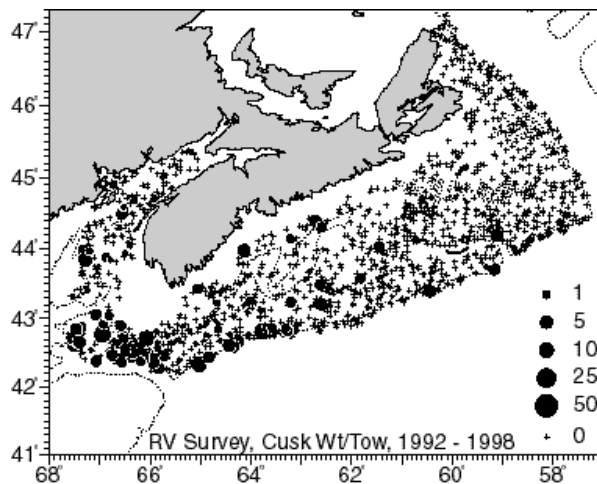
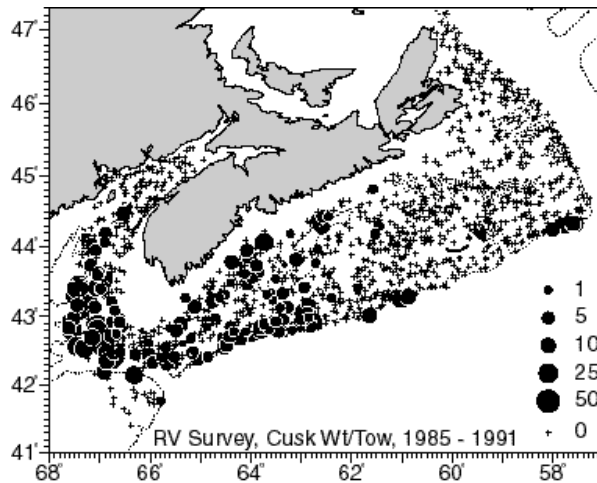
Mean weight per individual from the research vessel survey has declined since 1989.



A comparison of the **geographic distribution** from summer research vessel surveys indicates a significant contraction of cusk distribution in recent years. Since 1992, few cusk are distributed along the seaward edges of Western/Emerald/Sable Island and Banquereau banks. The 1999 survey only caught cusk in the Gulf of Maine area.



Summer research vessel surveys also show a decrease in abundance of cusk greater than 50 cm.



Outlook

The outlook from the last Stock Status Reports (DFO, 1998) for this stock included the following:

“Given the apparent collapse of the cusk population since 1992, immediate and substantial restrictions on cusk landings are required. Elimination of the directed fishery is necessary. Rebuilding of the stock will probably require a combination of both traditional and innovative measures. A restrictive bycatch would aid in rebuilding efforts, but may be difficult to implement without discarding.”

“Whatever is done to conserve and rebuild the cusk stock, an integrated management plan which deals with the fisheries interactions of this area will undoubtedly be required. An essential initial requirement is the accurate recording of the location of all catches.”

The new information available does not suggest that the above outlook need be revised.

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References

Oldham, W.S. 1972. Biology of Scotian Shelf cusk, *Brosme brosme*. ICNAF Res. Bull. 9:85-98.

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Witch Flounder on the Scotian Shelf (Div. 4VWX)

Background

Witch flounder occur in the Northwest Atlantic from off southern Labrador to Cape Hatteras, usually at 50 - 300m in water of 2 to 6° C. but they have been recorded between 18 and 1570m and at -1 to 11° C.. They occur most commonly in deep holes and channels and along the shelf slope on muddy bottom. There is no evidence that witch undertake extensive migrations but there are seasonal changes in concentration associated with spawning. The spawning period is protracted, and on the Scotian Shelf is thought to occur from May to October with a peak in July-August. The post-larval, pelagic phase is unusually long, lasting up to one year, and it is thought that the first few years of demersal life are spent in much deeper water than adults. Food consists of primarily of worms supplemented by other benthic invertebrates such as small crustaceans and bivalve molluscs. Witch is a long-lived, slow growing species; a maximum age of about 30 years and a maximum size of 78 cm (weight of about 5 kg) have been recorded.

Stock structure of witch flounder is not known and Div. 4VWX is a management unit based on administrative, rather than biological considerations. There is continuity in distribution of witch between Div. 4V and Div. 4RST and Div. 3P that suggest some affinities between these populations. Similarly, concentrations of witch in western Div. 4X are continuous with those in the rest of the Gulf of Maine.

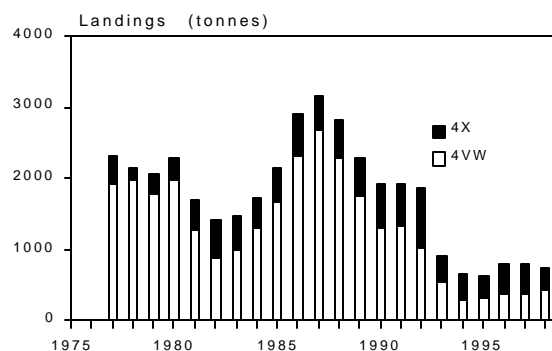
The most recent full assessment of this stock was conducted in 1997 (SSR A3-19). An update was conducted in 1998 (SSR A3-35(1998)).

The Fishery

Landings (tonnes)

Year	1993	1994	1995	1996	1997	1998
Canada	905	658	618	787	778	739
Foreign	49	3	19	25	20	7
Total	954	661	637	812	798	746

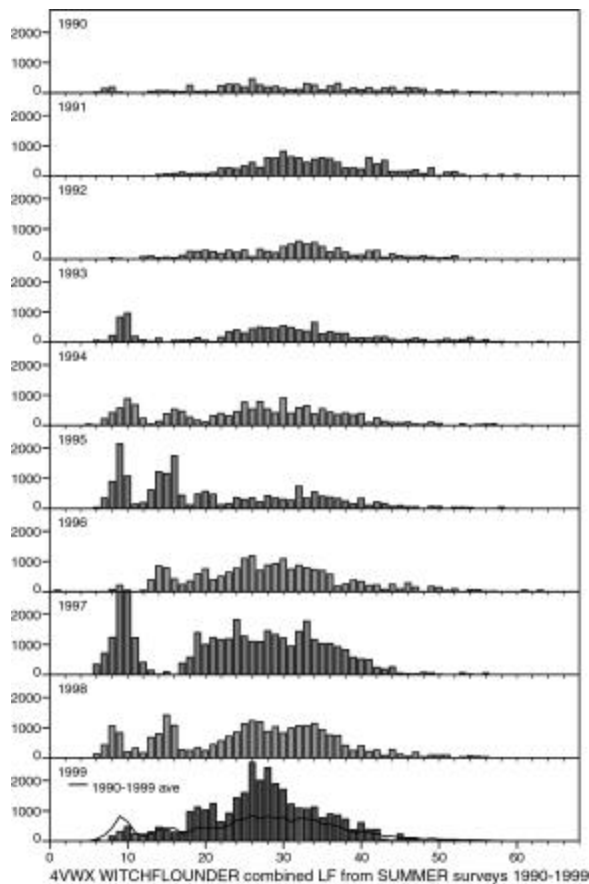
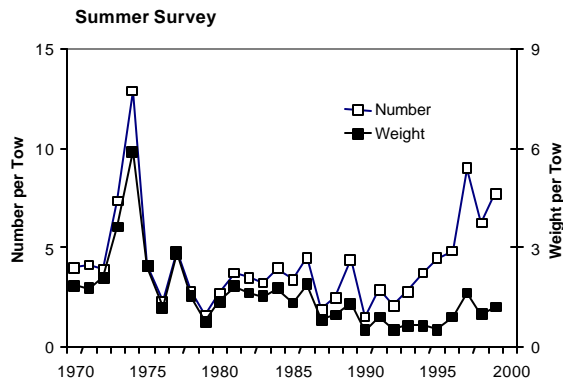
Landings from 1998 and 1999 represent additional information since the last assessment (DFO, 1997). The 1999 landings are 245t to September. Historical information on the witch flounder fishery is contained in McRuer et al. (1997). Witch flounder is managed as part of the flatfish TAC for 4X and 4VW.



Resource Status

Summer survey data from 1999 represents new information available since the last assessment. Information on the annual spatial distributions and length frequencies from 1996 to 1999 are contained in Branton and Black (1999).

Recruitment since 1993 has been stronger than in earlier periods, peaking in 1997. Through this period, the size composition of the population has improved with a modal length of 28cm.



Outlook

The outlook from the last Stock Status Report (DFO, 1997) included:

"It is not known to what extent this recruitment will contribute to the populations presently being fished in Subdiv. 4Vn and in Div. 4X. In any case, witch year-classes can be expected to progressively contribute to the fishery over a substantial number of years beginning at about age 6. Any concentration of fishing on recruiting age groups at this time would be detrimental to potential future yields, as well as result in the opportunity being missed to rebuild the population of commercial-sized fish.

Given the multi-species character of the flatfish TAC, there is substantial opportunity to direct increased effort towards witch flounder, which would be undesirable under present circumstances. Furthermore, the present flatfish TAC has not been limiting on catches from the species complex as a whole. Thus, the proportion of flatfish landings attributable to witch flounder should be maintained close to the status quo."

Data from the two research vessel surveys since the last assessment extend the upward trend in numbers and weight per tow. Recruitment remains stronger than in the 1980s and early 1990s and its contribution to the population is becoming evident in the size composition.

Although the new information continues to support a positive view of recovery, the short-term outlook for the stock remains unchanged.

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References

Branton, R. and G. Black. 1999. 1999 summer groundfish fish survey update for selected Scotia-Fundy groundfish stocks. DFO Canadian Stock Assessment Secretariat Research Document 99/151.

DFO, 1997. Witch Flounder in Div. 4VWX. DFO Sci. Stock Status Report A3-19 (1997).

DFO, 1998. Updates on Selected Scotian Shelf Groundfish Stocks in 1998. DFO Sci. Stock Status Report. A3-35 (1998).

McRuer, J., R.G. Halliday, R.M. Branton, M.A. Showell, and R. Mohn. 1997. Status of witch flounder in Div. 4VWX in 1997. DFO Canadian Stock Assessment Secretariat Research Document 97/106.

American Plaice, Yellowtail Flounder, and Winter Flounder on the Eastern Scotian Shelf (Div. 4VW)

Background

Flatfish are bottom dwelling fishes primarily associated with soft substrate (mud and sand bottom). They are unique among other fish in being asymmetrical, both eyes lying on one side of the highly flattened body. Early in life they start swimming on one side, and the eye on the underside migrates to the upper side. Flatfishes lie on the bottom on the blind side. Principal food items include crustaceans, molluscs, polychaete worms and small fishes.

Prior to 1994, yellowtail flounder, witch flounder and American plaice were managed as one stock complex (4VWX); winter flounder was excluded from management considerations. In 1994, the management area was divided into an eastern (4VW) and western (4X) component, winter flounder was included, and the overall Total Allowable Catch (TAC) partitioned between the two areas based on catch history. The flounder fishery in 4VW was placed under the Individual Transferable Quotas (ITQ) program in August 1994. The 1996 and 1997 management plans set the 4VWX flatfish TACs at 6,875t and 6,000t respectively, with 3,375t and 3,000t being allocated to the 4X fishery.

Management of the four species together under one TAC reflected the fact that it has been impossible to obtain reliable statistics on landings separated by species. The reported witch flounder landings are generally considered to be reliable, due to the higher price paid for this species. But the unreliability of the catch data for the other three species, coupled with the reports from the fishing industry of serious mis-reporting of other species as flatfish prior to 1991 eliminates the value of that information in determining resource exploitation. Initiation of ITQ logs and dockside monitoring of landings has had limited success in separating catch to individual species because landings were not separated at weighout or were misidentified by the weighmaster. It was decided to consider witch flounder separately from the other three species in 1997.

The Fishery

The most recent full assessment of this stock was conducted in 1996 (Annand and Beanlands, 1996; DFO, 1996). An update was conducted in 1998 (SSR A3-35 (1998)).

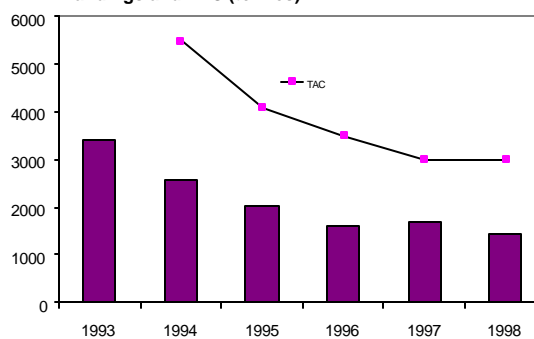
Landings (tonnes)

Year	1993	1994	1995	1996	1997	1998	1999
TAC	--	5500	4100	3500	3000	3000	3030
Flatfish	3960	2828	2344	1974	2068	1900	

The TAC and landings include witch flounder and unidentified flatfish.

Landings data since 1996 represents additional information since the last assessment. The 1999 landings of all flatfish (including witch flounder) in 4VW to September 22nd, are 1,457t. Historical information on the American plaice, yellowtail flounder and winter flounder is contained in Annand and Beanlands (1996).

Landings and TAC (tonnes)



In 1999, the fishing log database was used to substitute species identifications where unspecified flounder was entered in the commercial landings database (Fowler and Stobo, 1999). The results of this analysis suggest that Scotia/Fundy flatfish landings from 4VW during 1992-1997 would be:

Revised Landings (tonnes)

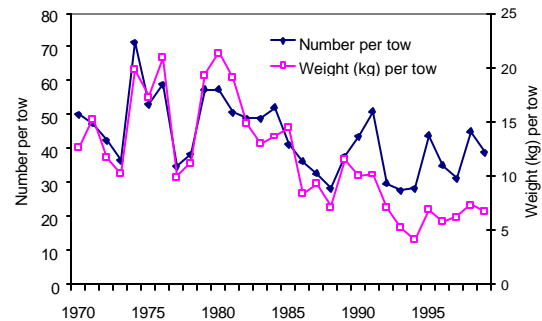
Year	PLAICE	YELLOWTAIL	WINTER FLOUNDER	WITCH FLOUNDER	UNSPEC. FLATFISH	TOTAL
1992	4 79	1 390	7	9 22	1 4 25	4 2 23
1993	7 78	1 864	3	5 27	7 14	3 8 86
1994	8 36	1 219	3	2 84	4 30	2 7 71
1995	8 43	9 21	0	3 03	2 16	2 2 84
1996	9 53	3 96	4	3 32	1 73	1 8 58
1997	1 206	8 7	2	3 06	3 49	1 9 50

These revised landings would indicate a much larger, and growing, fishery for American plaice in 4VW than previously thought, and a dramatically declining yellowtail fishery. Some reports from industry suggest very few yellowtail that are large enough to be worth catching. Note that the revised landings were based on December 1998 catch statistics for Scotia/Fundy, whereas the landings table at the beginning of this document has been updated to Sept 22 1999, and also includes any catches from 4VW that were landed outside Scotia/Fundy (hence the two tables have different totals).

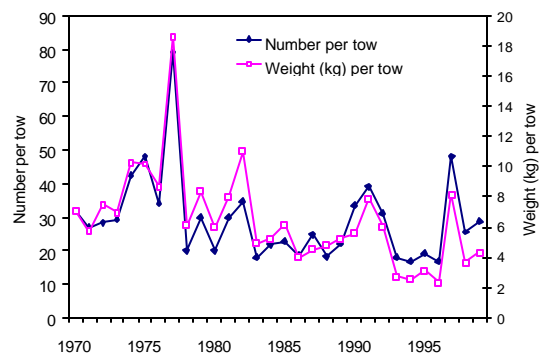
Resource Status

Summer research vessel survey summer research vessel data since 1995 represents new information available since the last assessment. The estimates suggest a slight improvement in American plaice and yellowtail flounder abundances in recent years. The slight improvement in yellowtail abundance appears due to increased availability of older fish, not new recruitment. The winter flounder population in 4VW is too small to provide reliable abundance estimates. Information on the annual spatial distributions and length frequencies from 1996 to 1999 are contained in Branton and Black (1999).

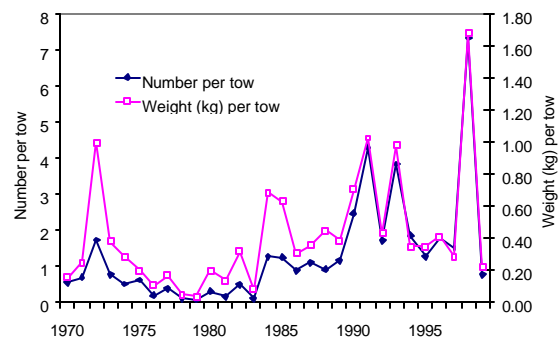
American Plaice



Yellowtail Flounder



Winter Flounder



Outlook

The outlook from the last Stock Status Report (DFO, 1996) for these stocks, based on an assessment (Annand and Beanlands 1996), noted several negative indicators of stock status, concluding that:

“Catch, at or above the 1996 level, would not likely promote recovery of this resource. As stated in previous evaluations, stock rebuilding can only take place if effort is kept at a very low level.”

More recent data suggests that the situation may be improving, but not sufficiently to warrant a change in outlook at this time.

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- Branton, R., and G. Black. 1999. 1999 summer groundfish fish survey update for selected Scotia-Fundy groundfish stocks. DFO Canadian Stock Assessment Secretariat Research Document 99/151.
- DFO, 1996. Eastern Scotian Shelf American plaice, yellowtail and winter flounder Stock Status Report 96/70E (1996).
- DFO, 1998. Updates on Selected Scotian Shelf Groundfish Stock in 1998. Stock Status Report A3-35 (1998).

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American Plaice, Yellowtail Flounder, and Winter Flounder on the Western Scotian Shelf (Div. 4X)

Background

Flatfish are bottom dwelling fishes primarily associated with soft substrate (mud and sand bottom). They are unique among other fish in being asymmetrical, both eyes lying on one side of the highly flattened body. Early in life they start swimming on one side, and the eye on the underside migrates to the upper side. Flatfishes lie on the bottom on the blind side. Principal food items include crustaceans, molluscs, polychaete worms and small fishes.

Prior to 1994, yellowtail flounder, witch flounder and American plaice were managed as one stock complex (4VWX); winter flounder was excluded from management considerations. In 1994, the management area was divided into an eastern (4VW) and western (4X) component, winter flounder was included, and the overall Total Allowable Catch (TAC) partitioned between the two areas based on catch history. The flounder fishery in 4X was placed under the Individual Transferable Quotas (ITQ) program in August 1994. The 1996 and 1997 management plans set the 4VWX flatfish TACs at 6,875t and 6,000t respectively, with 3,375t and 3,000t being allocated to the 4X fishery.

Management of the four species together under one TAC reflected the fact that it has been impossible to obtain reliable statistics on landings separated by species. The reported witch flounder landings are generally considered to be reliable, due to the higher price paid for this species. But the unreliability of the catch data for the other three species, coupled with the reports from the fishing industry of serious mis-reporting of other species as flatfish prior to 1991 eliminates the value of that information in determining resource exploitation. Initiation of ITQ logs and dockside monitoring of landings has had limited success in separating catch to individual species because landings were not separated at weighout or were misidentified by the weighmaster. It was decided to consider witch flounder separately from the other three species in 1997. The bulk of landings in 4X of these three species is made up of winter flounder; plaice and yellowtail make a relatively small contribution to the fishery.

The Fishery

The most recent full assessment of this stock was conducted in 1997 (Stobo et al, 1997; SSR A3-21). An update was conducted in 1998 (SSR A3-35(1998)).

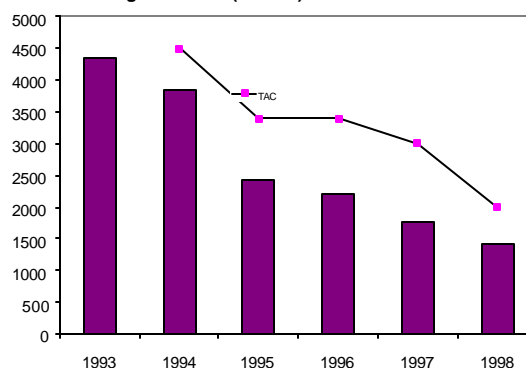
Landings (tonnes)

Year	1993	1994	1995	1996	1997	1998	1999
TAC	--	4500	3400	3400	3000	2000	2320
Flatfish	4720	4267	2735	2605	2184	1724	

The TAC and landings include witch flounder and unidentified flatfish.

Landings data since 1997 represents additional information since the last assessment. We have also included landings from 5Z (excepting 5Z yellowtail flounder, which is assessed separately) in this update, whereas the previous update (DFO, 1998) did not. The 1999 landings of all flatfish in 4X+5 to September 22nd, are 1,088t (including witch flounder, but excluding 5Z yellowtail flounder).

Landings and TAC (tonnes)



Historical information on the winter flounder, yellowtail flounder and American plaice is contained in Stobo et al. (1997). The biggest problem for managing flatfish stocks has been our inability to segregate the fisheries by species, such that we have had to apply single quotas to combined fisheries. In 1999, the fishing log database was used to substitute

species identifications where unspecified flounder was entered in the commercial landings database (Fowler and Stobo, 1999). The results of this analysis suggest that Scotia/Fundy flatfish landings from 4X/5Y (landings from 5Z not included) during 1992-1997 would be:

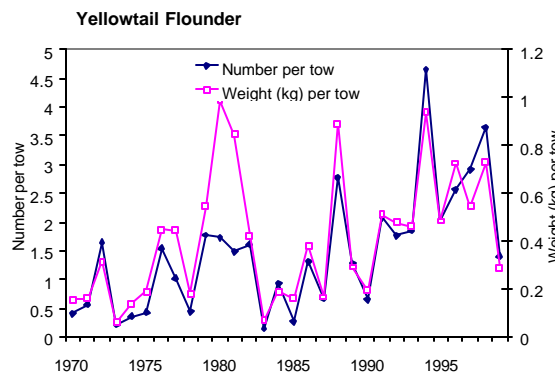
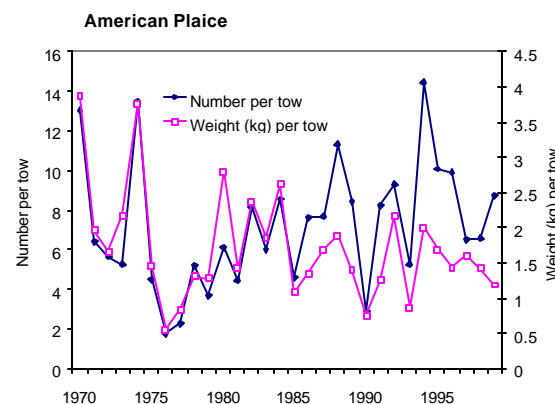
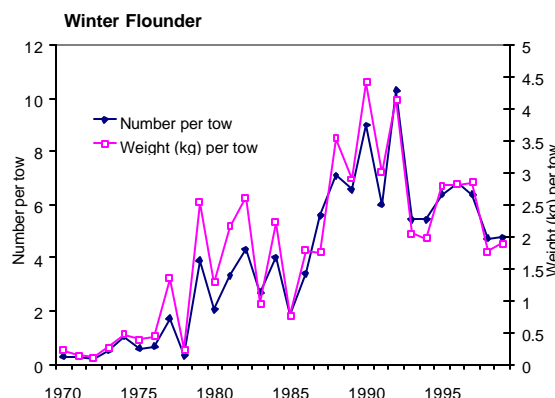
Revised Landings (tonnes)

Year	PLAICE	YELLOWTAIL	WINTER FLOUNDER	WITCH FLOUNDER	UNSPEC. FLATFISH	TOTAL
1992	1 128	283	880	1264	2344	5900
1993	1134	167	881	843	1044	4069
1994	628	190	991	968	500	3277
1995	372	164	1210	553	264	2563
1996	359	194	1181	571	152	2456
1997	315	45	890	469	234	1953

These revised landings would indicate a much larger, but declining, fishery for American plaice in 4X/5 than previously thought. Note that the revised landings are based on December 1998 catch statistics (the landings table at the beginning of this document includes reported landings through Sept 22 1999).

Resource Status

Summer research vessel survey data since 1997 represents new information available since the last assessment. A large pulse of young fish is a hopeful sign of future recruitment to the American plaice population. A large decline in the yellowtail flounder survey index for 1999 may be indicative of declining abundance, but needs cautious interpretation given the large year-to-year variations in survey estimates typical of this species. The 1999 winter flounder abundance is similar to the 1998 abundance. Both suggest a decline in abundance in recent years, a concern also expressed by some industry representatives. Information on the annual spatial distributions and length frequencies from 1996 to 1999 are contained in Branton and Black (1999).



Outlook

The outlook from the 1997 Stock Status Report (DFO, 1997), based on an assessment (Stobo et al. 1997) included:

“The 4X flatfish TAC has been both unrestrictive to, and unattainable by, industry throughout its existence. Since the downturns in recent years of major fisheries for cod, haddock and pollock, effort has been redirected to the flatfish. In 4X, this is of particular concern for winter flounder. Fishing efficiency has also continued to improve, such that any decline in catch rates may under-emphasize the magnitude of declines in availability of the fish. Finally, the RV survey shows a general reduction in the age range of all three species, and poor signs of incoming recruitment.

Industry representatives have expressed greater concern for the depleted state of these resources than the survey data would suggest. They expressed the opinion that abundance of all 4X flatfish resources are depleted with catch rates in some traditional fishing areas being insufficient to warrant fishing there. They suggested that a reduction in catch levels of at least 25% should be considered. Some industry representatives expressed concern about particular localised aggregations of winter flounder, because they are considered to consist of numerous, fairly discrete sub-groups.”

The TAC was reduced in 1998 to 2000 tonnes, in response to the need to reduce the fishing effort on 4X flatfish, but then increased to 2320t in 1999. Current information indicates some stability in stock status in recent years, and does not warrant any change in outlook for this stock.

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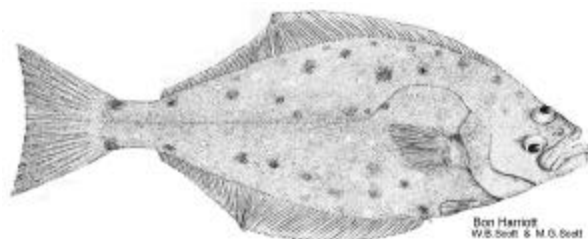
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- DFO, 1997. Southwest Nova Winter Flounder, American Plaice and Yellowtail Flounder Stock Status Report A3-21 (1997).
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- Fowler, G.M., and W.T. Stobo. 1999. Reconciliation of processed catch statistics with log data for 1992-97 flatfish in 4VWX/5Y. DFO Canadian Stock Assessment Secretariat Research Document 99/149.
- Stobo, W.T., G.M. Fowler, and S.J. Smith. 1997. Status of 4X winter flounder, yellowtail flounder, and American plaice. DFO Canadian Stock Assessment Secretariat Research Document 97/105.



Atlantic Halibut on the Scotian Shelf and Southern Grand Bank (Div. 4VWX 3NOPs)

Background

Atlantic halibut, the largest of the flatfishes, ranges widely over Canada's Atlantic fishing grounds. Halibut are demersal living on or near the bottom at temperatures within a few degrees of 5°C. Atlantic halibut are most abundant at depths of 200-500 m in the deep-water channels running between the banks and along the edge of the continental shelf, with larger individuals moving into deeper water in winter. The management unit definition (4VWX3NOPs) was based largely on tagging results which indicated that Atlantic halibut move extensively throughout the Canadian North Atlantic with smaller fish moving further than larger fish. Migrations of larger fish were thought to be related to spawning. Studies have shown that the Brown's Bank area may be an important rearing area for juvenile halibut and that there is a northeastward movement of fish as they grow. The geographic range of Atlantic halibut in the Northwest Atlantic extends from the coast of Virginia in the south to the waters off Disko Bay, Greenland in the north. Since the early 1990s, there appears to have been a significant reduction in the numbers of halibut in the northern portion of this range, especially along Labrador Shelf.

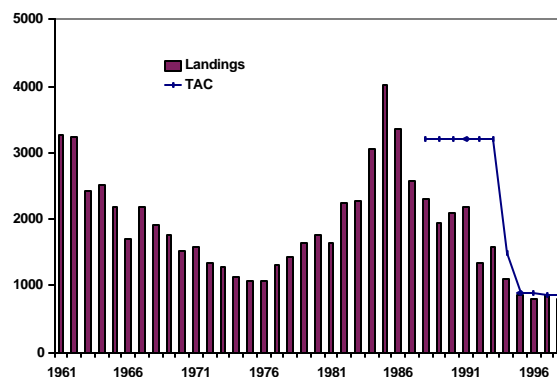
Although the growth and maturity cycles of Atlantic halibut require further study, it appears that females grow faster than males, and attain a much larger maximum size. Females reach 50% maturity at about 115 cm, while males 50% reach maturity at about 75 cm. In the absence of reliable growth information age at maturity remains uncertain. Present fishing regulations require that all halibut less than 82cm in length be released. Halibut are voracious feeders and up to a length of 30 cm, food consists almost exclusively of invertebrates. Between 30 cm and 66 cm both invertebrates and fish are eaten while halibut over this size eat fish almost exclusively.

The most recent full assessment of this stock was conducted in 1997 (Zwanenburg et al 1997). An update was conducted in 1998 (SSR A3-35 (1998)).

The Fishery

Landings (000's of tonnes)							
Year	1993	1994	1995	1996	1997	1998	1999
TAC	3.2	1.5	0.90	0.90	0.85	0.85	0.85
4VWX							
Canada	0.9	0.9	0.6	0.6	0.6	0.5	
Foreign	0.1	0.1					
3NOPs							
Canada	0.3	0.2	0.2	0.2	0.3	0.3	
Foreign	0.4	0.1	0.1				
Total							
4VWX	0.9	1.0	0.6	0.6	0.6	0.5	
3NOPs	0.7	0.3	0.3	0.2	0.3	0.3	
TOTAL	1.6	1.3	0.9	0.8	0.9	0.8	

Landings and TAC's (t)

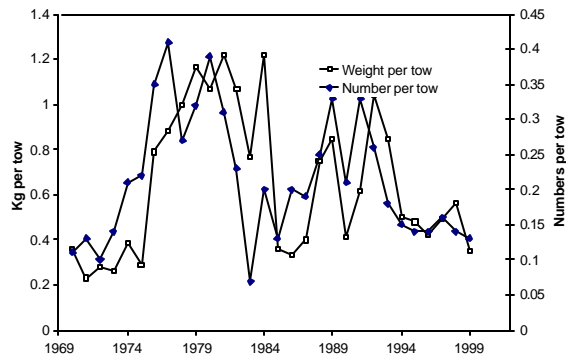


Landings data from 1998 represent additional information since the last SSR (DFO, 1997). Landings to September 22, 1999 total 514t. Detailed historical information on the halibut fishery is contained in Zwanenburg et al. (1997).

Resource Status

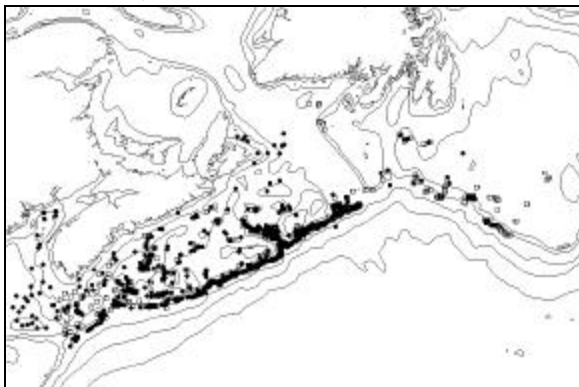
DFO research vessel **summer survey** data from the Scotian Shelf in 1999 represent new information available since the last SSR. Information on the annual spatial distributions and length frequencies from 1995 to 1999 are contained in Branton and Black (1999).

Summer survey weights and number per tow



Summer survey results show that both weight and numbers per tow remain below the long-term average for this series. Interannual variation in results indicates that halibut are not well sampled by this survey.

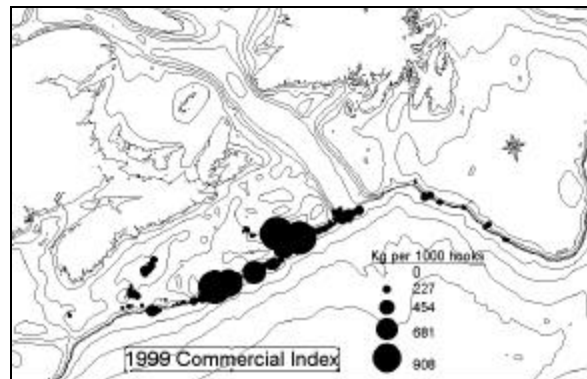
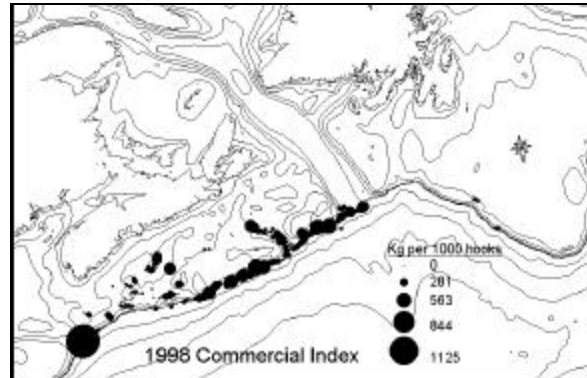
Halibut survey set locations 1998, 1999



An industry / DFO longline halibut survey on the Scotian Shelf and Southern Grand Banks was initiated in 1998. Two years of this survey have now been completed. The survey was designed to consist of two phases, a stratified random phase and a commercial index phase. During the stratified random phase, pre-selected locations are fished with survey fishing protocols, while during the commercial index phase, participants fish with their standard fishing protocols at locations of their choosing. A total of about 410 random stratified sets and about 1200 commercial index-fishing sets, distributed throughout the stock area, have been completed. Catch rates estimated from both

the stratified survey and commercial index phases for 1998 and 1999 are consistent and comparable between years.

Halibut survey commercial index catches rates

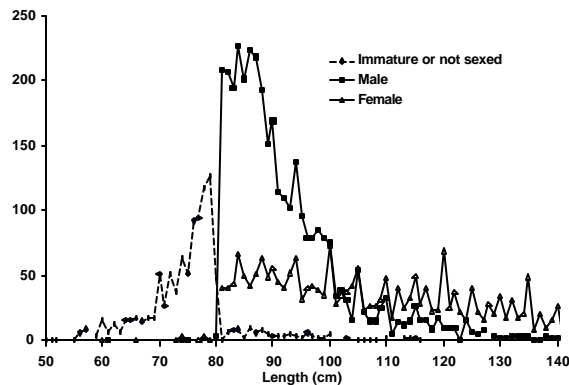


These data will augment the results of the summer surveys and improve annual estimates of halibut abundance and distribution. Estimates of abundance from surveys will become more valuable as the survey time series lengthens.

The halibut survey has also collected large numbers of biological observations. A total of over 13,000 halibut have been measured (length), and nearly 5,000 have been examined in detail (sex, weight, otoliths, and diet information). In conjunction with an age validation study initiated in 1998, this information will allow us to refine the estimates of total mortality for this population.

Sex-specific length compositions from the halibut survey suggest significantly different growth rates in males and females. This emphasizes the need for completion of the age validation study to refine estimates of population mortality rates.

Number of halibut caught at length (1998 halibut survey, all sets)



Results of a **conversion factor study** carried out as part of the 1998 halibut survey will improve our estimates of live weight removals based on common landed form (DFO 1999; Zwanenburg and Wilson 1999).

Outlook

The outlook from the last Stock Status Report (DFO, 1997) for this stock, based on assessment of the stock (Zwanenburg et al. 1997) included:

“... halibut **abundance**, as estimated from the results of research vessel surveys in the management unit, is presently low relative to the available time series. Present landings are also low relative to the long-term (1883 - 1996) history of this resource. Survey results for the geographic range of halibut suggest that declines in abundance have been more evident for the southern Grand Banks than for the Scotian Shelf.

There is no indication that effort on this resource should be increased but rather that the present restrictive measures should be continued”.

Loss rates [total mortalities + emigration] from the Scotian Shelf have increased from 1971 through 1996. The observed increase is likely due to increased mortality since halibut abundance in the northern part of the management unit (3NOPs), where migrating fish are predicted to go, has declined since the early 1980s. Length frequency data collected from all parts of the stock area, by the halibut longline survey, will help to improve the estimates of loss rates.

Halibut size compositions show a reduced range of sizes (1971 – 1996) relative to that for 1960; however, estimates of population size frequency used in the previous assessment did not include size information for 3NOPs while the 1960s size composition included data for this area. Data collected by the halibut longline survey will help determine whether or not such a reduction in size range has actually taken place over the entire stock area.

The new information presented here does not suggest that the previous outlook need be revised.

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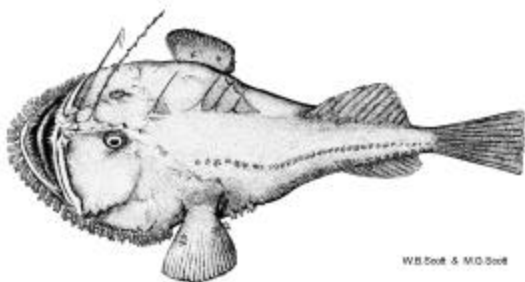
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Monkfish on the Scotian Shelf and Northeast Georges Bank (Div 4VWX 5Zc)

Background

Monkfish, *Lophius americanus*, also called goosefish or angler ranges from the Grand banks and Northern Gulf of St. Lawrence south to Cape Hatteras, North Carolina. Individuals have been collected from inshore areas to depths greater than 800m, although highest concentrations occur between 70-100m and in deeper waters of about 190m. They have been taken in water, ranging in temperature from 0-24°C, but in Canadian waters, appear most abundant between 3-9°C.

The goosefish has been described as mostly mouth with a tail attached, and reports of monkfish eating prey almost as big as themselves are common. Growth appears to be fairly rapid and similar for both sexes up to age 4, (47-48cm). After this, females grow a bit more rapidly and seem to live somewhat longer, up to 12 years, reaching a size of over 100cm while the males have not been found older than age 9, at approximately 90cm.

Sexual maturity occurs between ages 3 and 4 and spawning may take place from spring through to autumn depending on the latitude. Females lay a nonadhesive, buoyant mucoid veil that can be as large as 12m long and 1.5m wide. Incubation lasts from 7-22 days, after which the larvae spend several months in a pelagic phase, before settling to the bottom at a size of about 8 cm.

The stock structure of monkfish is unknown, but USA survey distributions suggest northern and southern components with the shallow waters of central Georges as a boundary zone. Canadian survey distributions do not suggest a discontinuity between the 4X, 4W and 5Z components of this stock. However, distribution patterns may suggest a separate 4V component. The degree of mixing in both USA and Canadian waters is unknown and large scale migrations have not been reported. Spawning appears to take place in Canadian waters during the summer months, thus suggesting some degree of independence between the various components.

The most recent full assessment of this stock was conducted in 1996 (SSR 96/97E). An update was conducted in 1998 (SSR A3-35(1998)).

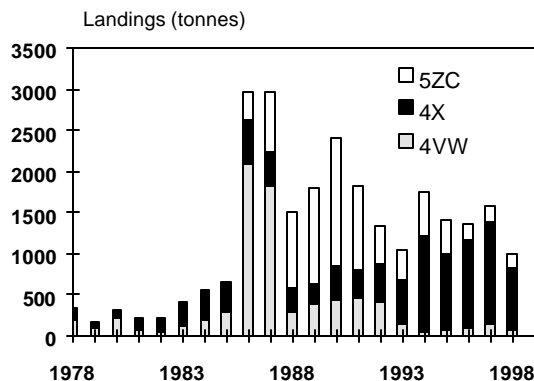
The Fishery

Landings (tonnes)

Year	1993	1994	1995	1996	1997	1998	1999
Quota	-	-	0.2	0.2	0.2	0.2	0.2
4VW	120	44	68	105	144	68	
4X	570	1159	935	1067	1249	748	
5Zc	354	541	418	184	189	190	
Total	1044	1744	1421	1356	1582	1006	

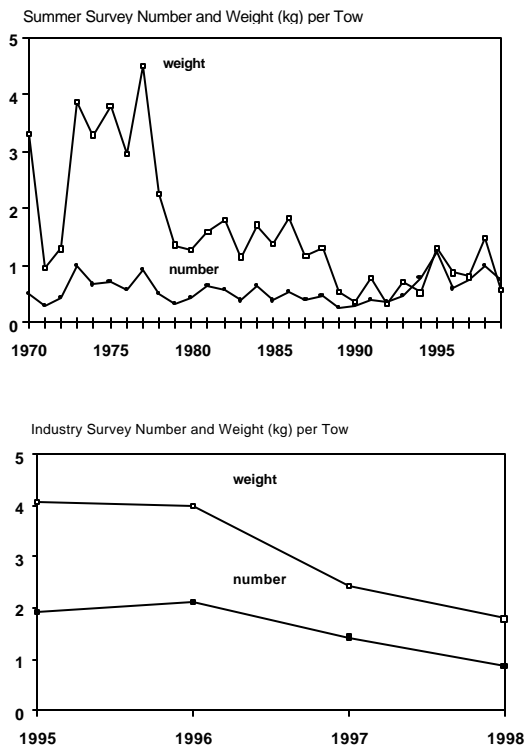
* - experimental directed monkfish fishery

Landings data from 1997 represent additional information since the last assessment (Beanlands and Annand, 1996). Detailed historical information on the monkfish fishery is contained in Beanlands and Annand (1996). The 1999 landings (to the 10th of September) are 57, 541, and 62 tonnes respectively, for 4VW, 4X, and 5Zc.



Resource Status

Research vessel **summer survey** and industry survey data from 1996 represent new information available since the last assessment. Summer survey results are variable, but show a modest increase in numbers, while industry survey results show a downward trend in both weights and numbers. Information on the annual spatial distributions and length frequencies in the summer survey from 1995 to 1999 are contained in Branton and Black (1999).



Outlook

In 1996, the outlook cited insufficient information to determine appropriate harvesting levels. This situation has not changed, however, the final survey in the five year industry survey series is currently underway and the data, along with the previous four years, will provide the basis for a full review in 2000.

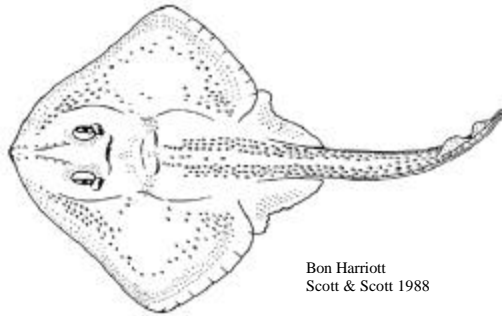
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Winter Skate on the Eastern Scotian Shelf (Div. 4VsW)

Background

Most elasmobranch fisheries have followed a general pattern of high initial exploitation followed by a rapid collapse. The intention has been that the 'developing' skate fishery on the eastern Scotian Shelf not follow this course. Our knowledge of skate on the Scotian Shelf is limited, however recent research is increasing our information base.

Winter skate occur in the southern waters of Georges Bank, inner Bay of Fundy and are near their northern limit of distribution on the offshore banks of the eastern Scotian Shelf. This latter area is unique because it is the only region where thorny skate overlaps with winter skate, the former being more abundant in northern waters. Winter skate are the primary focus of the commercial fishery and constitute greater than 90% of the catch. Thorny skate occur as a bycatch in this fishery and only the largest individuals are retained.

Like other elasmobranchs, skates are slow growing, produce very few young each year and thus are slow to increase in population numbers. Length at 50% maturity for female winter skate occurs around 75cm. Preliminary ageing of winter skate suggests that the length at 50% maturity coincides with individuals, which are 7-8 years old. Historical information shows that skates consume considerable quantities of sand lance. Skate predators have yet to be identified.

The most recent full assessment of this stock was conducted in 1998 (SSR A3-29(1998)).

The Fishery

Catch (tonnes)

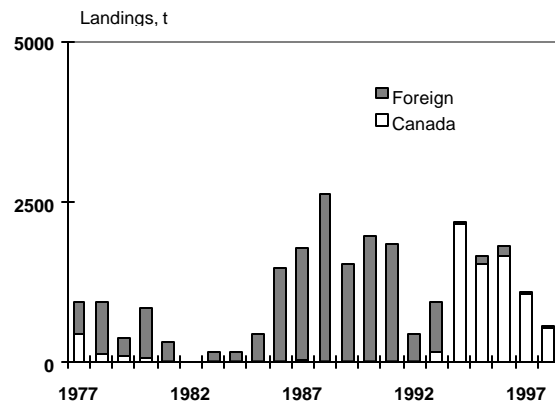
Year	1993	1994	1995	1996	1997	1998	1999
TAC ¹	-	2000	1600	1600	1200	1200	600
Foreign	465	12	70	103	32	30	
Canada ²	166	2152	1530	1654	1048	525	
Est. Disc. ³	289	136	126	81	68	51	
TOTAL	920	2300	1726	1838	1148	606	

¹ For 'developing' fishery only

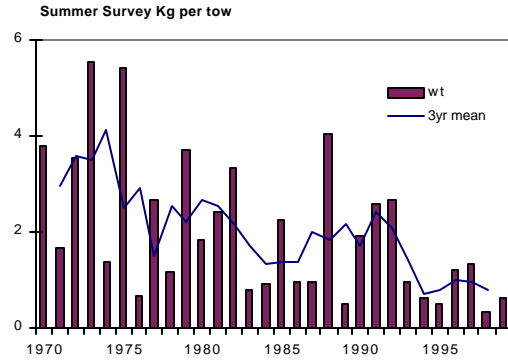
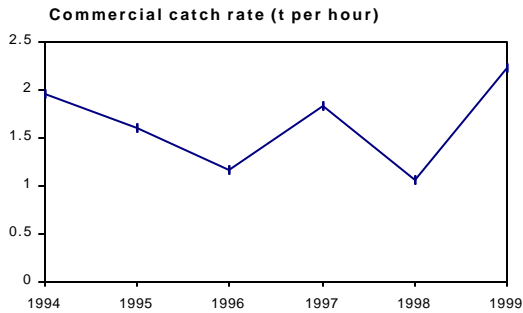
² Reported landings by Canadian vessels.

³ Estimated discards based on bycatch from Canadian groundfish directed fisheries.

Landings data from 1998 represent additional information since the last assessment (Simon and Frank, 1998). The projected fall fishery that year did not materialize due to poor market conditions, and the Canadian directed fishery landings were 525t. The 1999 TAC was reduced to 600t reflecting concern for the 'developing' fishery. In 1999 (to October 1st), reported catches were 18 t in the foreign fishery, 531t in the Canadian directed fishery and 51t estimated discards in other Canadian fisheries.



An examination of commercial catch rates of winter skate in the spring revealed no significant changes since the beginning of the directed fishery. In 1999, the spring catch rate (2.3 tonnes per hour) was the highest seen.



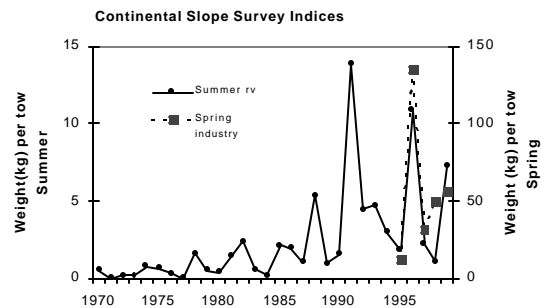
Commercial sampling of winter skates began in 1995. Catches in 1995 peaked at 76cm body length and included many fish up to and in excess of 100cm. In 1996, the peak shifted to 71cm and has remained there since. The percentage of fish greater than 90cm body length declined from 25% in 1995 to 6% in 1996 and less than 3% since 1997.

Resource Status

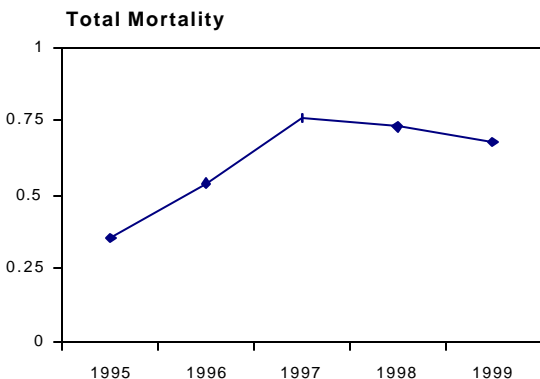
Research vessel **summer survey** data from 1999 represents new information available since the last SSR. Information on the annual spatial distributions and length frequencies from 1996 to 1999 are contained in Branton and Black (1999). Distribution changes towards the continental slope strata that were suggested from previous summer surveys appear to have continued, while a concentration of fish at the head of the Gully was noted.

The mean **weight per tow** from the summer survey indicates a progressive reduction since the beginning of the time series. The 1998 value was the lowest estimate in the series and remained low in 1999.

As part of the Conservation Harvesting Plan for skates established in 1994, industry agreed to conduct two **industry/science skate directed-surveys** per year in 4VsW. A comparison of the **catch rates** from the industry survey and the corresponding strata from the summer survey shows no consistent patterns. However, if only the continental **slope strata** are compared, the 1995-99 values from the spring industry survey follow the summer survey very closely. The generally increasing trend in the summer continental slope catch rate since 1985 suggests that there may have been some movement towards the edges of the banks and possibly beyond the maximum depth of the industry and RV surveys.



Estimates of **total mortality (Z)** were updated for 1999 and remain high.



Outlook

The outlook from the last SSR (A3-29(1998)) indicated that, given the response of the 4VsW skate population to the directed skate fishery, it was unlikely that the fishery was sustainable unless harvest levels were reduced. The restrictive market conditions in 1998 and TAC in 1999 have accomplished this goal with landings in the range of 600t for the last two years. Commercial catch rates improved in 1999 and no further contraction in the length range caught has been observed. Research vessel abundance in 1999 has shown a slight improvement and winter skate have been observed in areas not noted in the past.

The total removals from the 4VsW skate population in 1998 and 1999 were lower than in the previous four years. Total mortality rates based on population size structure are still extremely high for such a slow growing species. Skates produce very few young each year and thus any increases in population numbers will be slow.

The final survey in the five year industry survey series is currently underway and these data along with that of the previous four years will provide the basis for a full review in 2000.

The new information available does not suggest that the previous outlook be revised.

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ISSN: 1480-4913

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Correct citation for this publication

DFO, 1999. Updates on Selected Scotian Shelf Groundfish Stocks in 1999. DFO Sci. Stock Status Report A3-35(1999).