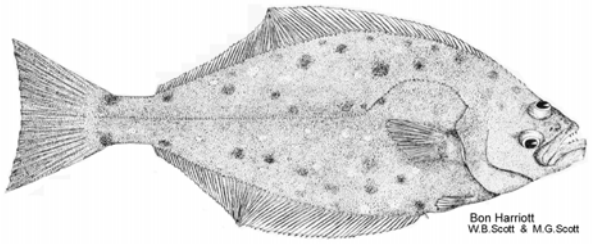
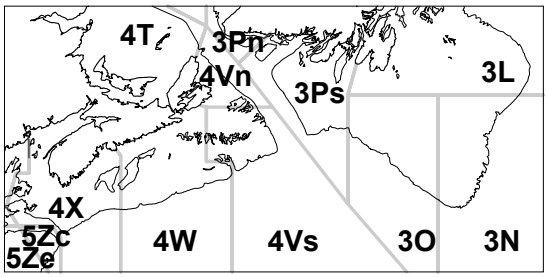




Atlantic Halibut on the Scotian Shelf and Southern Grand Bank (Div. 4VWX 3NOPs)

Background

Atlantic halibut (Hippoglossus hippoglossus), 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 Browns Bank area may be an important rearing area for juvenile halibut and that there is a north-eastward 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.

Summary

- FRCC recommended increases in TAC in 2000 and 2001, resulting in a current TAC of 1150t.
- White hake, cusk, cod, and a range of other species, are caught in association with halibut. This has management implications in an ecosystem context.
- There are recent indications of increased abundance of pre-recruits (fish < 82 cm).
- Adult halibut have a low catchability to the RV trawl, resulting in highly variable estimates of adult abundance.
- The halibut longline survey provides the capacity to monitor the halibut population.
- Halibut longline survey commercial index and fixed station estimates of abundance show little change in population size from 1998 – 2001.
- The halibut population appears to be relatively stable; however we are unable to determine if current landings are sustainable.

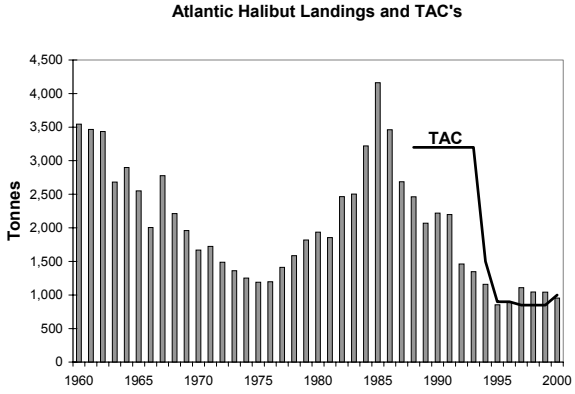
The Fishery

Landings (000's t)

Year	Avg 1970-79	Avg 1980-89	Avg 1990-96	1997	1998	1999[1]	2000[2]
TAC	na	na	3.2	0.85	0.85	0.85	1.0
4VWX	1.0	1.7	0.9	0.7	0.6	0.6	0.5
3NOP[3]	0.5	1.0	0.5	0.4	0.4	0.4	0.4
TOTAL	1.5	2.7	1.4	1.1	1.0	1.0	1.0

1. Fishing year, landings and TAC refer to the 15-month period from January 1, 1999 to March 31, 2000. Landings in 2000 are for Scotia-Fundy only.
2. Commencing in 2000, fishing year, landings and TAC refer to the period from April 1 of the current year to March 31 of the following year.
3. The table contains landings from 3Pn which total less than 40t in recent years.

Recommendations made by the Fisheries Resource Conservation Council resulted in an increases in the TAC for this stock from 850t to a current TAC of 1150t. Landings in the 2001 fishing year totalled 511t from April to 24 October.



Comments made by members of the halibut fishing community and the fishing community in general indicate that halibut were prevalent in inshore waters of 4X in 2000 but not in 2001. It was also indicated that there were large numbers of small (less than 82 cm) halibut caught off Cape Breton in 2001.

By-catch rates in the halibut fishery were estimated from commercial catch statistics for NAFO areas 4Vs and 4W which currently represents the bulk of the fishery. These by-catch rates are an estimate of the minimum impact of the halibut fishery on the ecosystem. It is an estimate of minimal impact because it does not take into account additional impacts such as mortality of non-commercial species, impacts of the bait fishery, impacts on the bottom or other sources of impacts. It is recognized that by-catch rates will be specific for season, area, and gear type. It is presented to put the fishery in its broader ecological context. It shows that halibut are caught as part of a suite of species, most notably, white hake, cusk, and cod. As is the case for other fisheries, management decisions that regulate the overall take of targeted species must recognize the impact of other species caught as by-catch.

NAFO Area 4Vs SPECIES	% of Halibut weight	NAFO Area 4W SPECIES	% of Halibut weight
White hake	13.94	White hake	14.61
Cod	9.86	Cusk	13.58
Cusk	8.05	Cod	6.86
Turbot	1.85	Turbot	3.99
Haddock	1.18	Haddock	2.80
Skate	0.41	Pollock	1.80
Redfish	0.38	Skate	0.83
Pollock	0.36	Other Groundfish	0.70
At least 15 other spp.	1.15	Catfish	0.54
		Dogfish	0.54
		Monkfish	0.53
		Redfish	0.31
		At least 17 other spp.	1.18

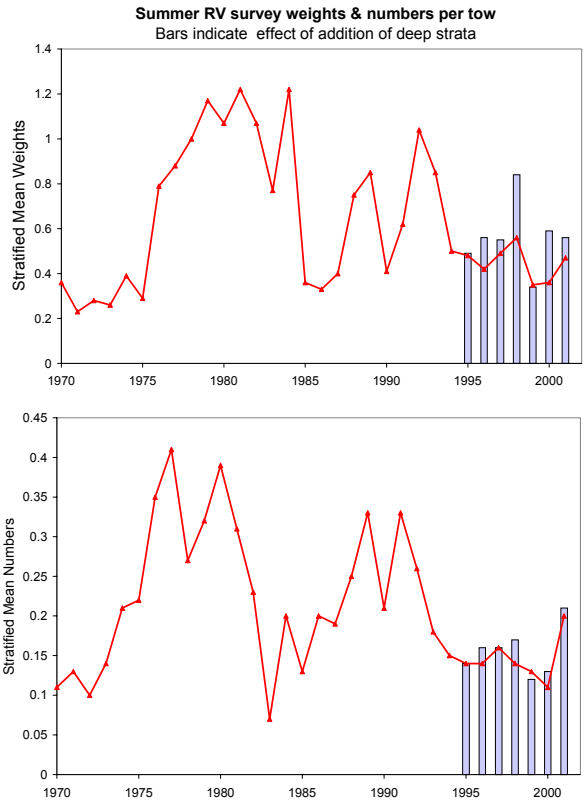
Resource Status

Research vessel survey information on the annual spatial distributions and size composition from 1995 to 2001 are contained in Branton and Black (2001).

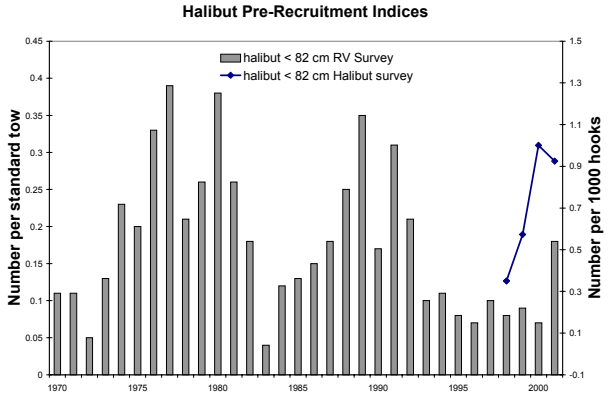
Research vessel (RV) summer survey results are highly variable from year to year because these surveys have a low catchability for halibut. The most recent RV survey results show that weight per tow estimates remain below the long-term average while numbers

per tow increased to about the average in 2001.

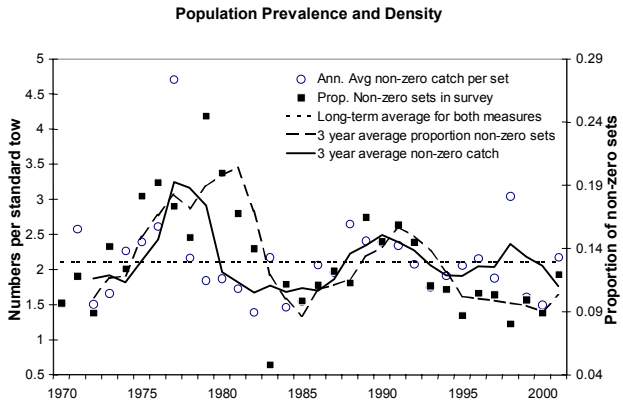
In 1995, a number of deep-water strata (>200 fm) were added to the summer survey area (bars on figure) Although the survey results including these strata are not comparable to the previous survey series, the estimates including these strata are higher. This reflects the relatively deep-water distribution of halibut. This index will increase in utility as the time series lengthens.



Fishery recruitment can be estimated from RV survey results since the modal size of halibut in the survey is between 40 and 50 cm. The numbers of fish <82 cm caught annually provides an estimate of pre-recruits coming into the fishable population. These results indicate that recruitment has been low since 1993 and that the most recent estimate is slightly above average (0.18 per standard tow, 1970 - 2000). The total number of fish (<82 cm) caught each year in the halibut longline survey (line in figure below) indicate that numbers of pre-recruits have increased since 1998.



Population prevalence (the degree to which halibut occupy their historic geographic range within the survey area) is currently near average. **Population density** (as measured by catch per unit of effort in those locations where halibut are caught) is also near average (Zwanenburg et al 2001).

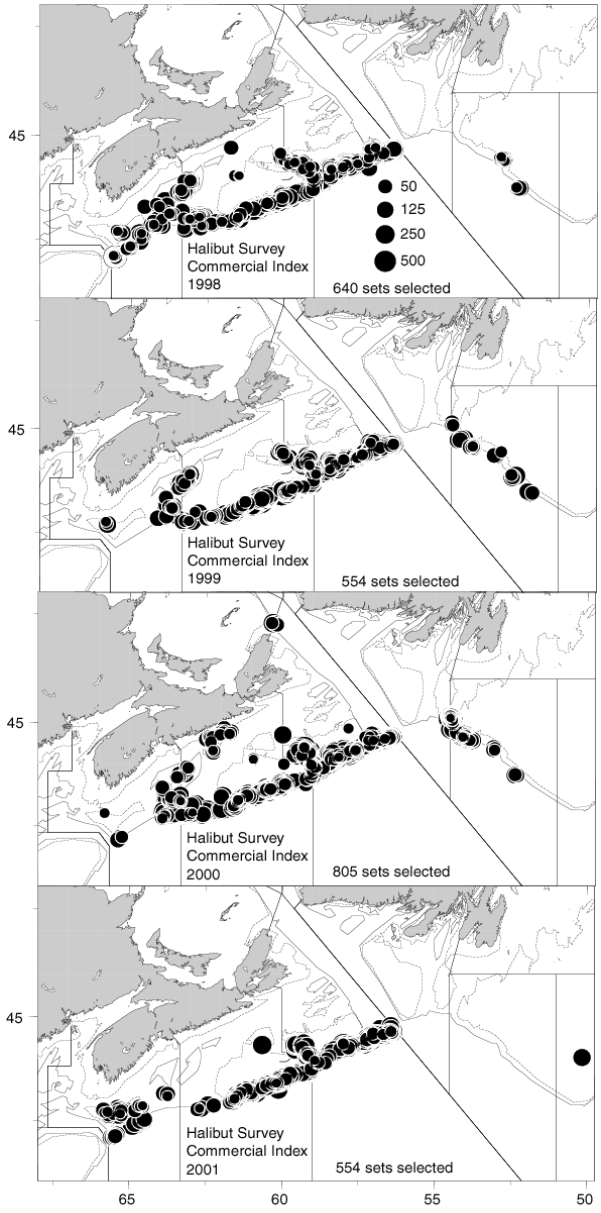


An **industry / DFO longline halibut survey** on the Scotian Shelf and Southern Grand Banks was initiated in 1998. Four years of this survey have now been completed. The survey consists of two phases, a fixed station phase and a commercial index phase. During the fixed station phase, pre-selected locations

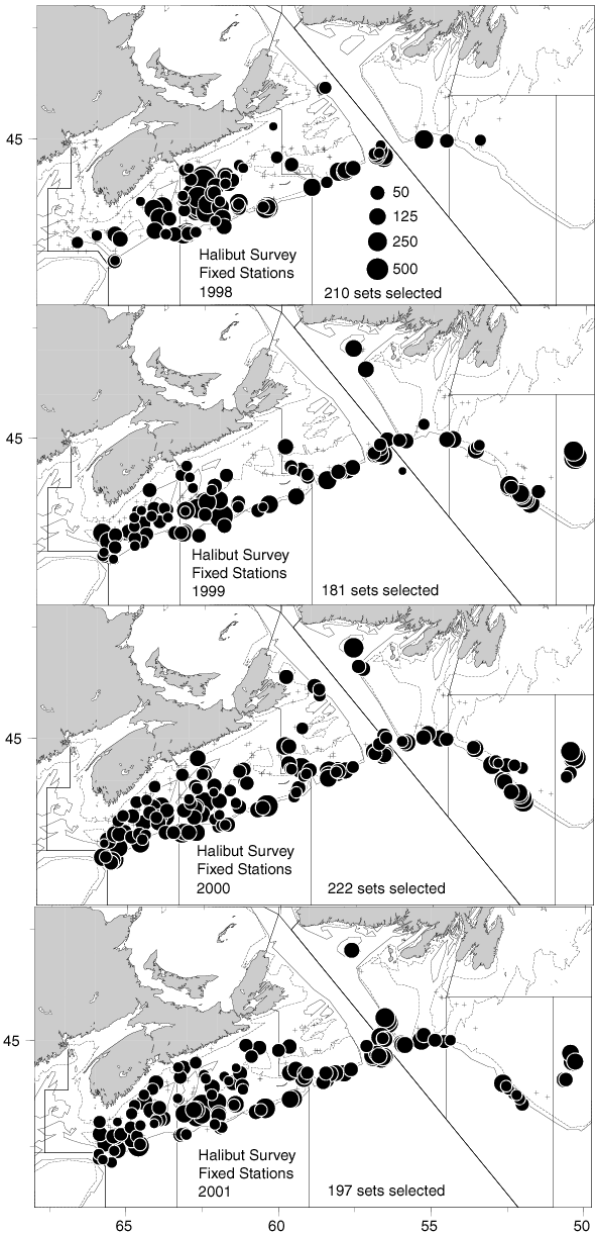
are fished using prescribed survey fishing protocols (hook-size, number of hooks, and minimum soak times), while during the commercial index phase, participants fish with their own fishing protocols and locations of their choosing (Zwanenburg and Wilson, 2000; Zwanenburg and Wilson 2001; for detailed description of survey protocols and results).

The distribution of survey locations and standardized catches for both phases of the survey are shown below. Note that the most significant alteration of fixed station survey protocol occurred between 1998 and 1999 when survey sets in the approaches to the Bay of Fundy were discontinued due to high cost and very low halibut catch rates. In the commercial index phase, it has been difficult to fish Sub-Area 3. In the first and most recent years, this was the result of the strict imposition of by-catch rates for cod, which precludes the conduct of the commercial index phase. This is also affecting the fixed station phase in that boats are reluctant to undertake the expensive trip to the Grand Banks without the compensating income of the commercial index phase.

Geographic distribution of halibut survey commercial index catch rates (kg per 1000 hooks adjusted for soak time) are mapped below.

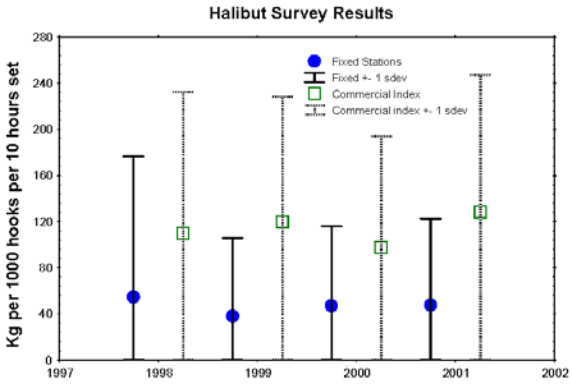


Geographic distribution of halibut survey fixed station catch rates (kg per 1000 hooks adjusted for soak time) are mapped below.

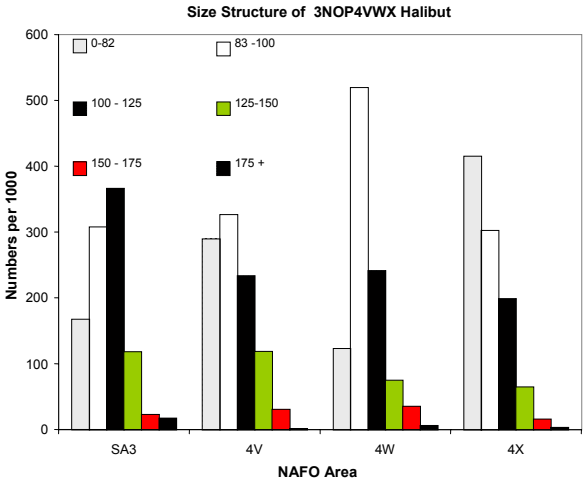


Given the short time series of the survey, we can as yet draw only a few conclusions about overall population size and trajectory. Both the commercial and fixed station indices show little change in population size in the past 4 years. Estimates of abundance from these surveys will become more valuable as the survey time series lengthens.

The halibut survey allows for a detailed estimation of population size structure. Results of the fixed station phase (where all halibut are measured, including the undersized fish that are released) gives an indication of the number of pre-recruits entering the fishable population (see section on recruitment above). Pre-recruit abundance estimates have increased since 1998.



The size structure of halibut differs between the western and north-eastern portions of the population area. NAFO Div. 4X has the largest number of small (<82 cm) fish and 3P has the largest number of large fish (>175 cm). This observation is consistent with either age-dependent migration of halibut from west to east, or differences in growth and survival between the two areas favouring Div. 3P.



The halibut longline survey has made large numbers of biological observations including collection of otoliths. The initial stage of an age-validation study has been completed. The results of this study, which uses the relative concentration of C^{14} to confirm the annual rings in the otoliths, will be used to age structure and growth rates of the population.

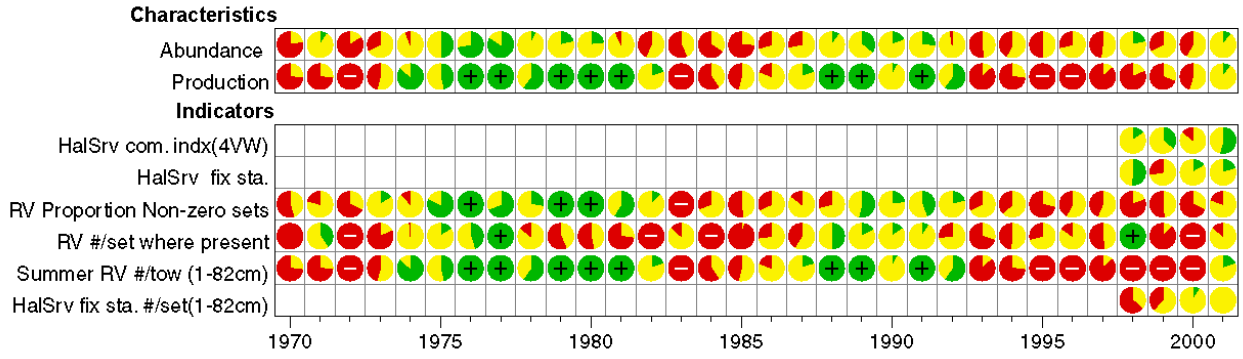
Sources of Uncertainty

Estimating the current **abundance** of the halibut population remains problematic. Catchability of the species to RV trawls is low and results in highly variable estimates of adult population abundance and size composition. Estimates of pre-recruits (<82 cm) abundance from RV surveys are considered to be more reliable than estimates of adult abundance. The RV survey does not cover the entire stock area.

Traffic Light Analysis

The **Traffic Light** table summarizes the indicators of stock status shown above. This table shows the annual values of each indicator as a combination of three lights depending on whether they are among the best values for that indicator, among the worst or in between. For indicators such as stock biomass and recruitment, high values are good and have a green light and low values are bad and have a red light. However, for indicators such as mortality, high values are bad and are assigned a red light whereas low values are good and receive a green light. Intermediate values (midpoint between red and green) are yellow. A value between red and yellow is expressed as a pie with increasing amounts of red in the pie as the value approaches the red threshold or cut point. Similarly, a value between the midpoint and the green cut point becomes increasingly green in the pie as the green cut point is approached. Empty cells in the table indicate no observation for that year. Uncertainties about the appropriate cut point resulted in a broad yellow zone.

In the traffic light system, indicators are summarised into groups that emphasise specific aspects of the resource. These groupings are called characteristics. The outlook is cast in terms of these characteristics and each is shown in bold in the Outlook section below.



Outlook

The implementation of the halibut longline survey has provided the capacity to monitor the **abundance** of this population. The survey has a much higher catchability for halibut than the RV survey and covers most of the stock area; however it has only been in place

for 4 years. The longline survey indices (both fixed station and commercial) show little variation over the past 4 years. This indicates a relatively stable population, although it is not yet possible to determine the size of the population relative to historical abundance.

Production, measured as numbers of pre-recruits, is slightly above average in the RV survey results for 2001. Pre-recruit prevalence and density are currently near the long-term average. The halibut longline survey results show an increase in the number of pre-recruits since 1998.

There are no estimates of mortality available for this stock. The first phase of a study confirming the presence of annual growth rings in halibut is now complete. This knowledge will be used to estimate halibut population age structure and **mortality rates** in future assessments**.**

It is essential that the halibut survey remain in place to monitor this resource. The two phases of the survey cover most of the stock area although there has been some difficulty in covering the southern Grand Banks. Measures to facilitate this coverage would improve the survey.

Overall the halibut population appears relatively stable with preliminary indications of improved recruitment recently. However, until further information on stock status is available, we are unable to determine if current levels of landings are sustainable.

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