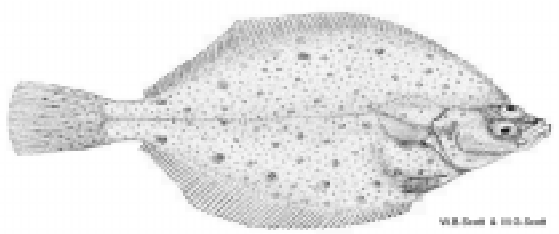


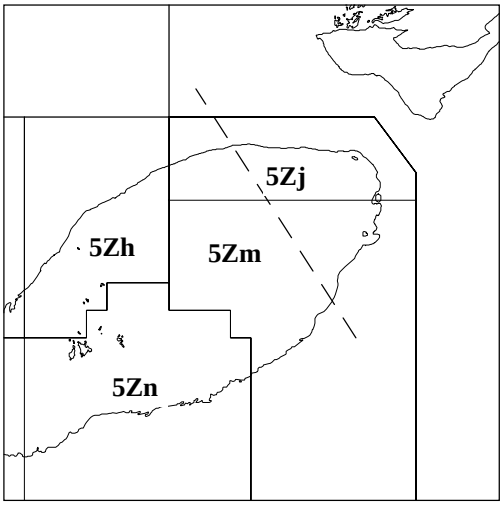
Yellowtail Flounder On Georges Bank

Background

Yellowtail flounder range from Labrador to Chesapeake Bay and are considered relatively sedentary. A major concentration of yellowtail occurs on Georges Bank to the east of the Great South Channel. While tagging work indicates limited movement from Georges Bank to adjacent areas, knowledge of seasonal movement of yellowtail flounder on Georges Bank is poor. Yellowtail are most commonly caught at depths between 37 and 73 meters (20 and 40 fathoms).

On Georges Bank, spawning occurs during the late spring period peaking in May. From the distribution of both ichthyoplankton and mature adults, it appears that spawning occurs on both sides of the international boundary. Yellowtail flounder appear to have variable maturity schedules, with age 2 females considered 40% mature during periods of high stock biomass to 90% mature during periods of low stock biomass.

The Canadian fishery is mainly pursued using otter trawl gear from vessels less than 65'. The directed fishery for yellowtail flounder is a relatively recent development, with significant landings first occurring after the introduction of specialized gear in 1993. The trawls are specially equipped with small rollers and employ less headline flotation, giving a smaller vertical opening. The fishery occurs in a relatively limited portion of Georges Bank known as the Yellowtail Hole, and with current management restrictions, operates in the latter half of the year only.



The Fishery

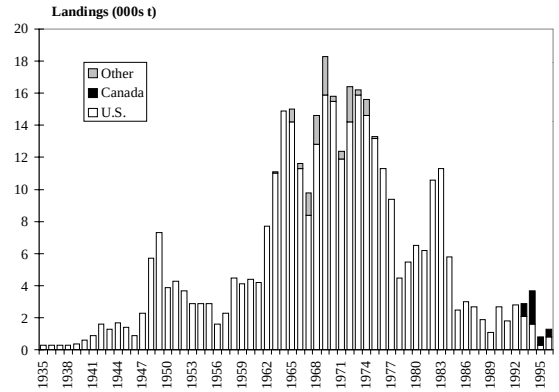
Landings (thousand metric tons)

Year	70-79 Avg.	80-89 Avg.	1992	1993	1994	1995	1996
TAC	-	-	-	-	-	0.4	0.4
Canada[1]	<0.1	<0.1	<0.1	0.2	1.3	0.4	0.4
Canada[2]	-	-	-	0.7	2.1	0.5	0.5
USA	12.0	5.2	3.0	3.3	1.7[3]	0.3[3]	0.8[3]

[1] Canadian landings specified as yellowtail.
[2] Canadian yellowtail landings, plus prorated unspecified flounder (see text below)
[3] Estimated values, provided by US NMFS, includes discards

Total landings of Georges Bank yellowtail flounder peaked during the mid 1960s through to the mid 1970s. Most of the landings have been made by the USA fishery, although there were landings by other countries during the late 1960s and early 1970s. The Canadian directed fishery started in 1993, and peaked in 1994, with landings of 2,142 t. Under quota control for the first time in 1995, landings were 495 t against a quota of 400 t. In 1996, the TAC increased slightly to 430 t, and landings were 483 t (including an estimated 11 t of regulatory discards from the scallop fishery).

Canadian landings of unspecified flounder from Georges Bank were substantial in 1993 and 1994. Industry sources have indicated that most landings of unspecified flounders were yellowtail flounder. Total landings of yellowtail flounder were obtained by adding landings of known yellowtail plus a prorated amount of unspecified flounder (in proportion to the ratio of known yellowtail flounder, American plaice and winter flounder). With improvements in dockside monitoring, landings of unspecified flounder have decreased to 49 t in 1996.



Industry reports indicate that discarding of yellowtail in 1996 was less of a concern than was the case in 1994 and 1995.

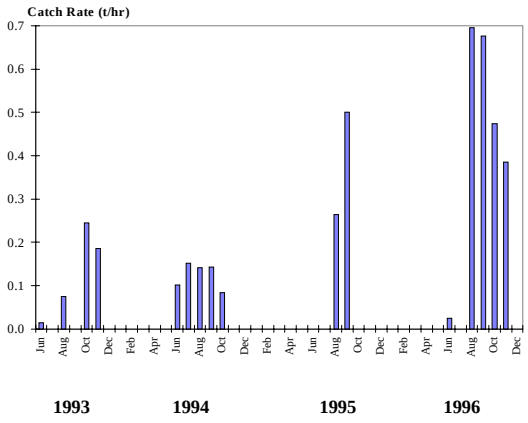
USA landings and discard estimates for 1994 and 1995 have been substantially revised over those available in last year's assessment, due to the implementation of new procedures for estimating those values. Notably, the estimates of discarding have been revised substantially downwards, reflecting management measures such as an increase in mesh size from 140 to 152 mm (square or diamond) in 1994. The USA fishery has also changed its distribution, with more activity on the southern flank of Georges Bank in 1996 than was the case before.

About 85-90% (by numbers) of the 1993-1996 landings range between 28 and 48 cm. Males for 1993-1996 peaked at 30, 31 34 cm while females peaked at 34, 35 and 40 cm during the same period. The **size composition** of the landings has been expanding over the past three years.

Resource Status

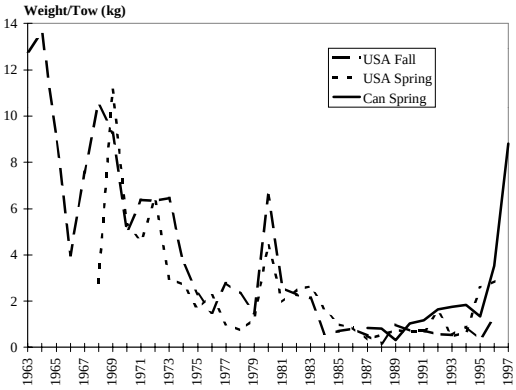
A virtual population analysis (VPA) was employed which incorporated indices of abundance from the USA and Canadian spring surveys, the USA fall survey and the USA scallop survey (young yellowtail flounder is a common bycatch in scallop surveys). In light of concerns over the reliability of the recent catch at age, an age-aggregated approach (referred to later as the surplus production method) was also used. That approach required total catch as input, as well as indices of abundance from the USA and Canadian spring surveys and the USA fall survey.

Canadian mobile gear **catch rates** have increased significantly between 1994 and 1996. Factors other than abundance which may have caused such an increase were reviewed with industry, and it was concluded that the increases in catch rates probably reflect increased abundance. However, an unexplained decline in monthly catch rates was also noted in 1996. While catch rates may prove to be useful as an index of abundance for this resource, the time series is too short to be included directly in the assessment.



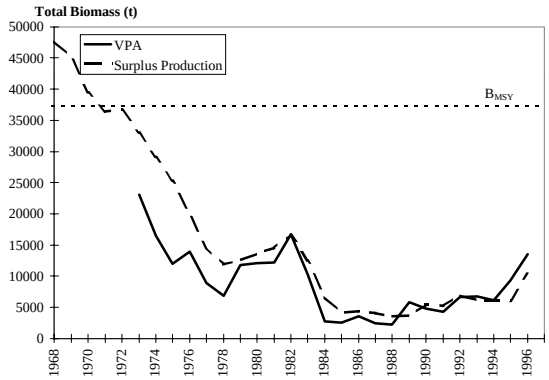
There are three **research surveys** conducted annually on Georges Bank. The mean weight per tow from the Canadian spring survey has been increasing considerably since 1995, with the 1997 value being the highest in the series.

The USA spring survey series shows an increase since 1994, but abundance remains low compared to the late 1960s and early 1970s. The USA fall survey series follows a similar trend to the spring survey, but the recent increase observed in the spring surveys is not evident. This is likely attributable to low sampling in key yellowtail flounder habitat during those years. Consistent with observations from the fishery, the average length of fish observed in the survey has been increasing over the past three years.

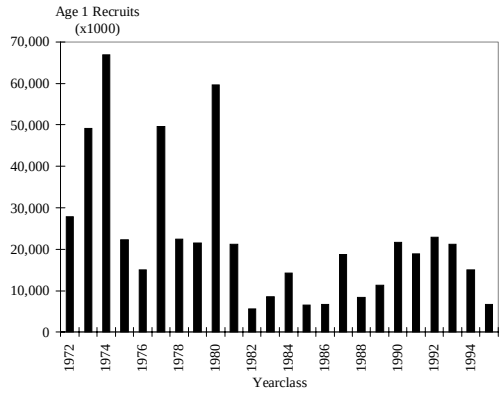


Most of the catch of yellowtail flounder taken in Canadian surveys occurs in the 5Zm area. In the past five years, the proportion of biomass in Canadian waters has been 40, 67 and 59% , as indicated in the Canadian and USA spring and fall surveys, respectively. There is, however, considerable interannual variation in the proportion of biomass in Canadian waters.

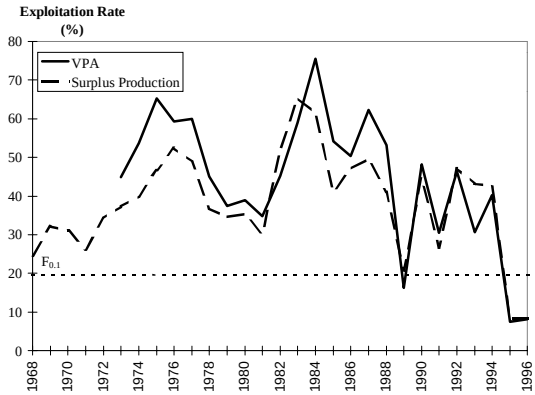
Population abundance estimates (total biomass) provided from both assessment models show good concurrence. Both models indicate a steady decline in population biomass from the early 1970s, an increase in the early 1980s attributable to the strong 1980 year-class, then a decrease to under 4000 t in 1988. Biomass has been recovering since then, and in 1996 was estimated as 10,365 and 13,495 t from the surplus production and VPA models, respectively. However, biomass remains low compared to the biomass at maximum sustainable yield, as indicated from the surplus production model (37,540 t).



Recruitment (from the VPA) during the 1980s has been considerably poorer than that experienced during the 1970s. Recruitment in the 1990s improved in general, but no exceptional year-classes were noted, such as the 1974 or 1980 year-class. The strength of the 1995 year-class is uncertain at this point. The VPA indicates that the 1995 year-class is the weakest since the 1986 cohort. However, the 1997 Canadian survey indicated above average numbers of fish at a mode of 25 cm, which are probably the 1995 year-class. The current VPA also indicates that the 1992 year-class is not as strong as previously estimated.



The VPA and surplus production models produce similar patterns of **exploitation rate** over time. Exploitation rate was well above the target level of 20% during the 1983 to 1987 period, declined somewhat during the 1988 to 1994 period, and in 1995-1996 was at the lowest values observed in the series.



Outlook

Since two assessment models were used, two projections are provided, with scenarios illustrating exploitation rates equivalent to the status quo F_{96} and for $F_{0.1}$. In the F_{96} option, the fishing mortality in 1997 is equal to that in 1996. The $F_{0.1}$ option implies an exploitation rate of 20% in 1997. The $F_{2/3MSY}$ is the exploitation rate corresponding to two-thirds of the exploitation rate observed at MSY from the surplus production model and is comparable to the $F_{0.1}$ option from the VPA.

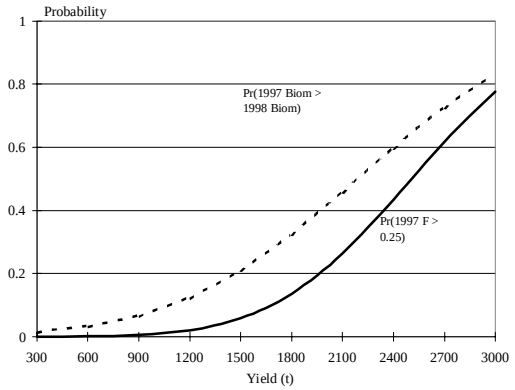
		Yield 1997	Biomass 1997	Biomass 1998
F_{96}	VPA	1053	12268	14013
	Production	2014	16856	25321
$F_{0.1}$	VPA	2470	12268	12533
$F_{2/3MSY}$	Production	4526	16856	22336

Status quo yield estimates for 1997 range between 1053-2014 t. Fishing at $F_{0.1}$ in 1997 implies a yield of 2470-4526 t.

Projection results differ because the production model projection assumes an average long-term population growth rate, and age-based projections use estimated abundance at age and average 1994-1996 stock conditions (partial recruitment, mean weight, maturation). The assessment of Georges Bank yellowtail flounder is complicated by low levels of sampling. The changing spatial patterns of fishing and low levels of sampling, particularly in 1994 and 1995, contribute to the **uncertainty** in estimates of recent age composition of both the USA and Canadian catch. In particular, the size of the 1995 year-class is a major source of concern.

Because of such uncertainties, two assessment approaches were employed, each with strengths and weaknesses. For example, the VPA should generate more precise projections, since age structure in the current year is known. However, as indicated earlier, there are significant uncertainties in the age composition of the landings in 1996 which will impact the reliability of the projections. The uncertainty in the size of the 1995 year-class is not a concern in the short-term, as that year-class will not be recruited to the 1997 fishery.

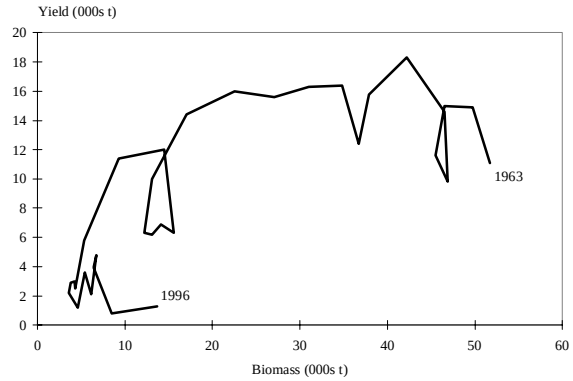
The projections of biomass and fishing mortality from the VPA relative to $F_{0.1}$ also have some uncertainty. For example, compared with other groundfish resources, a large decrease in yield in 1997 is required to achieve a modest increase in the probability of not exceeding the target mortality or reducing population biomass in 1997. The uncertainty reflected below does not include other sources such as recent age composition, catch information and variation in natural mortality.



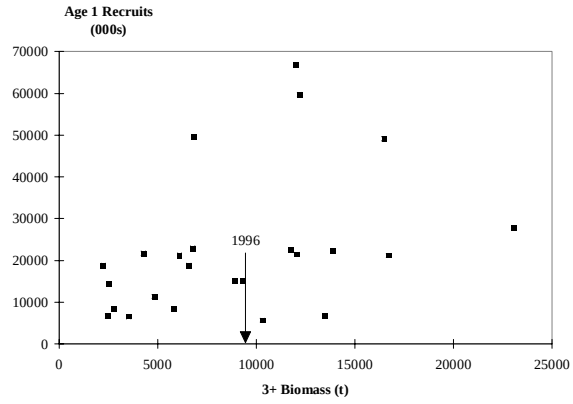
The surplus production approach attempts to capture separate elements of stock dynamics such as growth and recruitment in a simplified model but may have limited ability to project stock status. The model indicator of stock growth is obtained from observations throughout the entire survey series, and may not reflect the most recent stock conditions. In particular, current relatively low biomass levels may be unlikely to produce adequate recruitment, and estimates of yield from the surplus production model may be optimistic. However, use of all available survey information in the surplus production model does allow a description of resource productivity during the entire period, which the VPA does not due to problems in reconstructing the fishery catch at age prior to 1973.

Management Considerations

The surplus production model allows a description of the potential yield from the resource at various biomass levels. The equilibrium relationship between yield and biomass is expected to be dome-shaped. As indicated below, recent management actions by both Canada and the USA have resulted in movement of the path of the relationship to the right, and have had the desired effect of rebuilding the population biomass.



There is a relationship between higher levels of biomass and the number of recruits produced. As stock rebuilding continues, the adult biomass should soon reach levels where the probability of good recruitment is enhanced.



In summary, the yellowtail flounder resource is rebuilding on Georges Bank. Recent estimates of exploitation rate are below commonly-used targets such as $F_{0.1}$. Both assessment approaches indicate increasing population biomass. Other measures of stock abundance such as fishery catch rates and survey size composition support the view that the resource is recovering. However, it appears as though most of the population growth is attributable to growth rather than recruitment. Given the potential for rapid growth of the population indicated by the results of the surplus production model, maintaining moderate levels of exploitation should ensure the continued rebuilding of this resource.

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References

Neilson, J.D., Gavaris, S., Hunt, J.J. 1997. Assessment of Georges Bank yellowtail flounder. DFO Canadian Stock Assessment Secretariat Doc. 97/55.

This report is available from the:

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