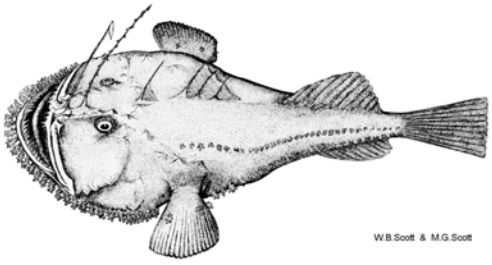
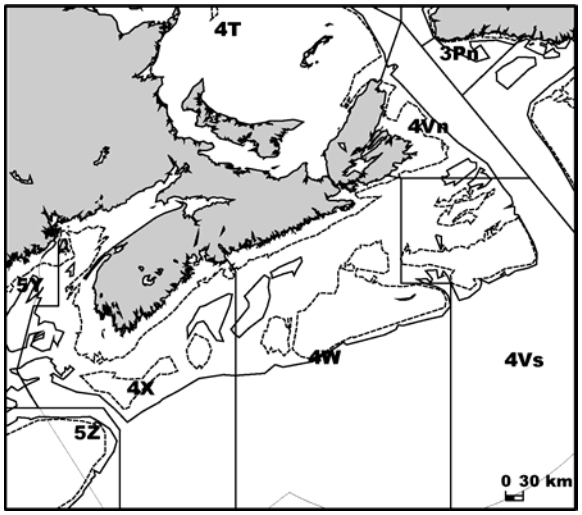
Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

Maritimes Region **Stock Status Report A3-30(2002)**



Monkfish on the Scotian Shelf and Northeast Georges Bank (4VWX and 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 at temperatures from 0-24°C, but in Canadian waters, appear most abundant between 3-9°C.

The monkfish 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 latitude. Females lay a nonadhesive, buoyant mucoid veil that can be as large as 12m long and 1.5m wide. Eggs hatch in 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 5Zc components of this stock. 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.

Summary

- Landings have averaged 1500t since 1980 and have been about 1000t annually in 2000-2002.
- Abundance of adult monkfish in **4X** remains at or below average. The proportion of large fish (>70cm) continues to decline and biomass remains low.
- There is evidence of improved immature abundance in **4X** since 1992 particularly in 1995 and 2000. This does not appear to be resulting in biomass increases.
- Indicators for monkfish in **4VW** show similar trends to those for 4X, although fishery removals have been much lower.
- Continuation of the recent cautious approach to harvesting is appropriate.

Canada

The Fishery

Landings (tonnes)

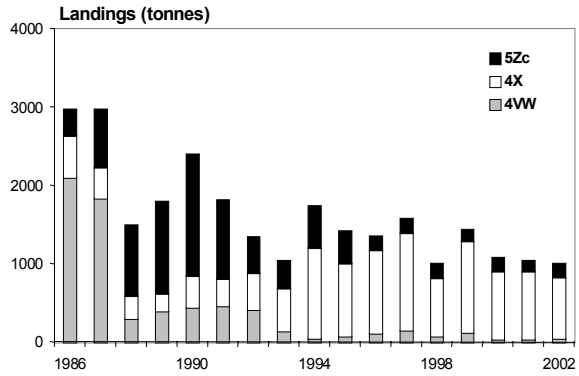
Year	1970-79 avg.	1980-89 avg.	1990-96 avg.	1997	1998	1999[2]	2000[3]	2001
Allocation	-	-	255[1]	310[1]	310[1]	310[1]	-	-
4VW	6005	557	236	144	68	118	38	33
4X	565	287	706	1249	748	1170	867	869
5Zc	-	793[4]	648	189	190	151	177	141
Total	6570	1637	1590	1582	1006	1432	1082	1043

1. Experimental directed monkfish fishery (beginning in 1995 at 200t, 1996-1999 at 310t)
2. Allocation and landings refer to the 15-month period from January 1, 1999, to March 31, 2000.
3. Commencing in 2000, fishing year and landings refer to the period April 1st of the current year to March 31st of the following year.
4. Average is from 1986 to 1989 as no 5Zc designation prior to 1986.

The 2002 **landings** to October 24th were 564t.

Prior to 1986, Canadian markets for monkfish were limited. Therefore, monkfish landings by the scallop and groundfish mobile gear fleets may not be reflective of actual catches for that time due to potential discarding. However, as new markets and higher prices in the early 1990s resulted in an increased number of trips targeting monkfish, landings since then are more likely to reflect the catches.

Since 1993, the majority of landings have come from 4X with 4VW landings at less than 150 tonnes. Increased effort on the resource was particularly evident by the mobile gear fleet less than 65ft in 4X. This fleet was restricted to a 20% bycatch early in 1995 in order to maintain historical catch and effort levels for the duration of a proposed exploratory fishery. A 5-year co-operative science/industry study to assess the abundance and distribution of monkfish and its potential as a developing fishery was conducted from 1995 to 1999. In 2000 monkfish underwent a full assessment review that included data from this study. The fishery continues on a bycatch basis only.



Large landings of monkfish by the offshore scallop fleet in 5Zc throughout the late 1980s and early 1990s have steadily dropped to a low of 56t. Landings by the inshore scallop fleet, predominantly in the Bay of Fundy area, increased through the 1990s to a high of 322 tonnes in 1997. By 2001, they had dropped to early 1990 levels of less than 150t. The amount of monkfish incidentally caught and discarded in the scallop fisheries is unknown but may be substantial.

The catch and effort data for otter trawlers tonnage classes 1-3 is confounded by the fact that through provisions in their CHP, this fleet is permitted to direct for their 20% bycatch and therefore does not represent a true incidental bycatch. For a more accurate reflection of catch rates in this fishery, further investigation is needed to extract this information on a set by set basis. Declines in effort by this fleet are strongly linked to availability of markets and prices.

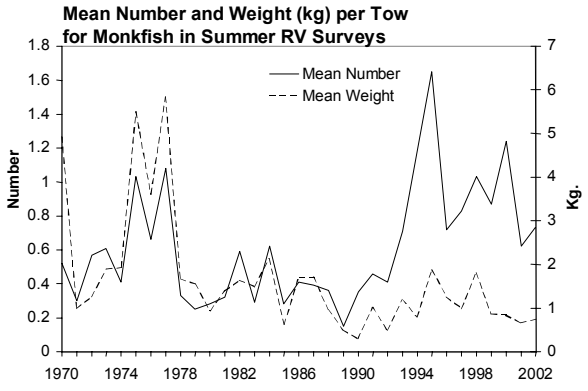
Resource Status

Annual spatial **distributions** and length frequencies from RV surveys are contained in Branton and Black (2002). Monkfish appear to be spread across the shelf with concentrations on the edges of the banks and in the basins. However, small fish (10 to 30 cm) were consistently found inshore of LaHave Basin.

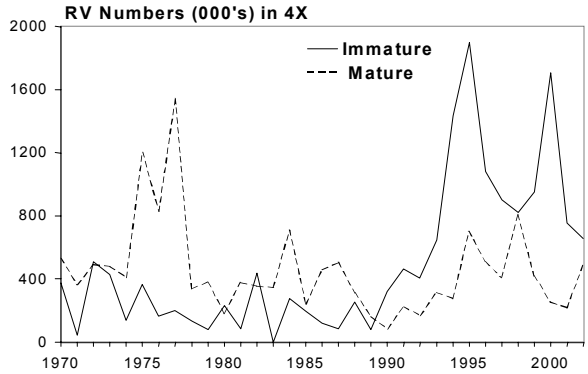
The current stock area includes all of 4VWX and 5Zc but the fishery has been conducted almost entirely in 4X and the bulk of the landings come from that area. The relationship between 4X and the balance of the stock area is unknown. Because of the current fishery distribution, 4X will be given primary focus

Monkfish in 4X

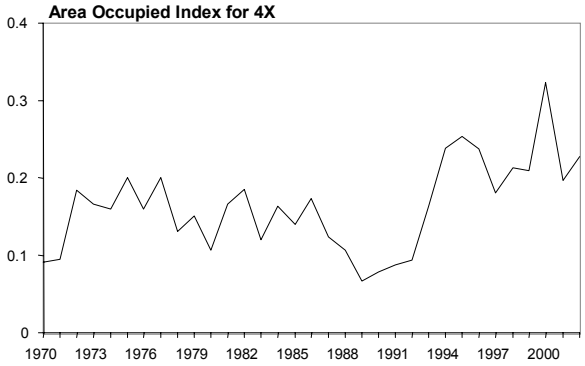
The **DFO summer research vessel (RV) survey** stratified mean **numbers per tow** have been increasing in 4X with the 1995 and 2000 values the highest in the series. Stratified mean **weights per tow** increased slightly through the late 1990s but dropped in 1999 and remain at a low level.



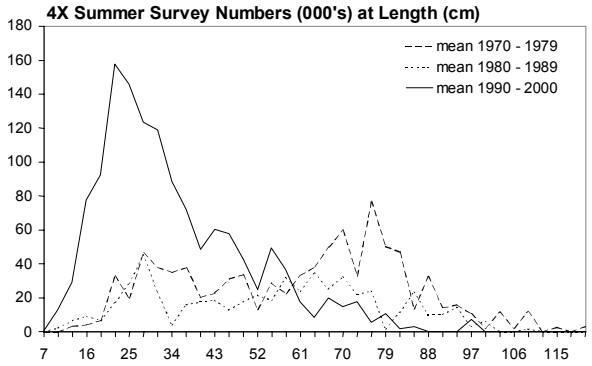
The summer RV survey numbers were separated into immature (<42cm) and mature (42+cm) sizes. Abundance of mature fish declined in the late 1980s before gradually increasing until 1998. The abundance of immature monkfish increased in the 1990s and has been high since then.



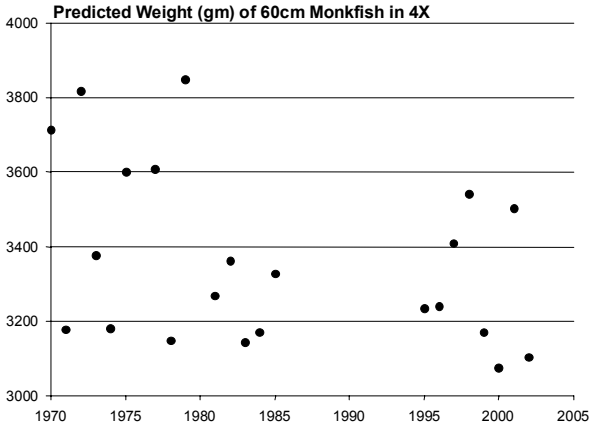
The proportion of the RV survey sets where monkfish occurs is a measure of **area occupied.** Area occupied has been relatively high since 1993 indicating that the resource is currently more widely distributed.



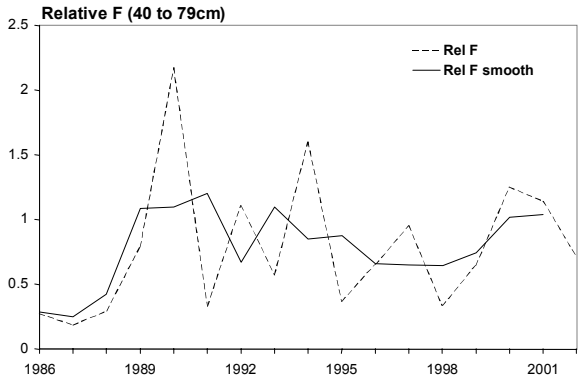
Size composition from stratified numbers at length indicates a major shift to small monkfish in recent years. Large monkfish (>70cm), that were prominent in the 1970s, have virtually disappeared. The cause for this disappearance has not been determined and it is worthy of note that it is also occurring in 4VW where there is no fishery.



Condition, the relative weight of a fish at a given length from the summer RV survey was used as an indicator of the health of the fish. The predicted weight of a 60 cm monkfish is more variable than for most other stocks because of small sample sizes and changes in the size composition.



Relative Fishing Mortality (F) was derived for 4X by dividing the catch by the RV survey biomass index for the corresponding size range (40 to 79cm) for 1986 to 2002. Catch data prior to 1986 were not used due to concerns over their accuracy. When smoothed, the results show a sharp increase in 1989 and have remained stable since.



Several options for estimating **total mortality (Z)** were examined. All indicate a strong increasing trend since the mid-1980s that is in keeping with the loss of large fish in the survey. The patterns of Z's available from catch curve analysis in 4X are based on the assumption of a stable age distribution. The recent strong abundance of young fish makes this assumption suspect and there will likely be biases associated with that. These total mortality estimates are difficult to interpret as they confound changes in mortality with changes in recruitment and growth and these are not considered further in this assessment.

<u>Monkfish in 4VW</u>

Available indicators for **monkfish in 4VW** show very similar trends to those for 4X, although fishery removals have been much lower.

<u>Monkfish on Georges Bank</u>

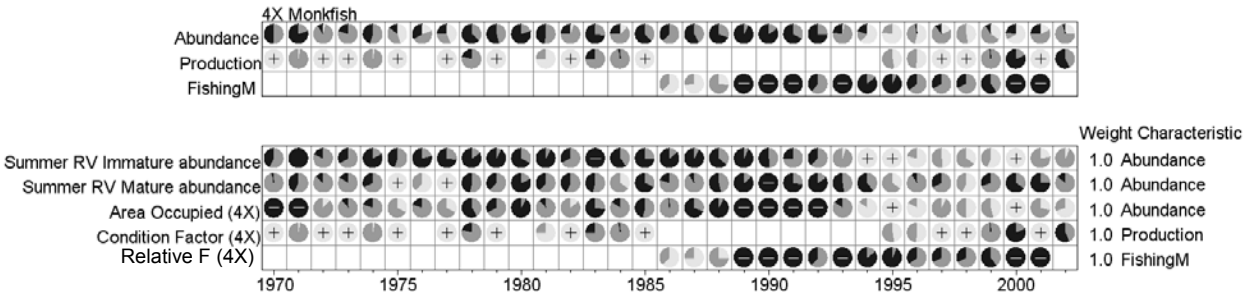
Georges Bank RV survey numbers at length are much more variable than in 4X and 4VW due to small numbers in the catch but the trends are relatively consistent.

Traffic Light Analysis

The **Traffic Light** table that follows summarizes the indicators of stock status for 4X shown above.

This table shows the annual values of each indicator as one of three lights depending on whether they are among the highest values observed for that indicator, among the lowest 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 are yellow ●.

The results for the indicators combined are shown in the characteristics above the array of individual indicators. If most indicators in a particular year are red then the summary light for that year will be red, if most are green the summary light will be green, and so on.



* See Appendix 1 for description of traffic light indicators, boundary points, weights and rationale.

Outlook

Abundance for the adult monkfish population in 4X remains at or below average. The proportion of large fish (> 60 cm) continues to decline and biomass remains low. However, there is evidence of improvement in immature abundance since 1992 particularly in 1995 and 2000. The area occupied has been high since 1993.

The indicator of **production** is inconclusive because condition factor is not well determined.

Relative **fishing mortality** (Relative F) was higher since 1989 and has remained stable since then.

In summary, the population appears to have gone through a period of low abundance in the late 1980s to early 1990s. Recruitment has improved since the early 1990s and immature abundance is high. This has not translated into improved biomass. There are very few fish over 70cm now while in the 1970s the modal length in the survey was over 75cm. It is not possible to tell if the absence of large fish is due to poor growth or higher mortality.

Continuation of the recent cautious approach to harvesting is appropriate until the recent improvements in immature abundance translate into increases in mature biomass.

Available indicators for **monkfish in 4VW** show very similar trends to those for 4X, although fishery removals have been much lower. This suggests that a cautious approach to exploitation should continue in the 4VW area. It also suggests that many of the changes observed in both areas may have been driven by changes in environmental conditions.

Management Considerations

The reported landings of monkfish by the scallop fleets have decreased substantially over the last 2 years. These fleets operate under an unrestricted bycatch and catches could increase again.

For More Information

Contact:

Diane Beanlands
Marine Fish Division
Bedford Institute of Oceanography
Box 1006, Dartmouth
Nova Scotia, B2Y 4A2

TEL: (902) 426-3515
FAX: (902) 426-1506
E-mail: dbeanlands@mar.dfo-mpo.gc.ca

References

Beanlands, D., R. Branton, and R. Mohn. 2000. Status of Monkfish in 4VWX5Zc. DFO. Can. Stock Assess. Sec. Res. Doc. 2000/143.

Bigelow, H.B., and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. U.S. Fish Wildlife Ser. Bull. 74, Vol. 53: 577p.

Branton, R. and G. Black. 2002. 2002 Summer Groundfish Survey Update for Selected Scotia-Fundy Groundfish Stocks. DFO Can. Stock Assess. Sec. Res. Doc. 2002/089.

Scott, W.B. and M.G. Scott. 1988. Atlantic Fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219: 731p.

This report is available from the:

Maritime Provinces
Regional Advisory Process
Department of Fisheries and Oceans
P.O. Box 1006, Stn. B203
Dartmouth, Nova Scotia
Canada B2Y 4A2
Phone number: 902-426-7070
Fax number: 902-426-5435
e-mail address: myrav@mar.dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1480-4913

La version française est disponible à l'adresse ci-dessus.

Correct citation for this publication:

DFO, 2002. Monkfish on the Scotian Shelf and Northeast Georges Bank (Div. 4VWX and 5Zc). DFO Sci. Stock Status Report A3-30(2002).

Appendix 1. Rationale table of indicators, their boundaries, characteristics and weighting factors that went into the traffic light tables for 4X monkfish.

The traffic light approach provides a framework that allows us to incorporate multiple indices of stock status and other relevant indicators. Colour boundaries corresponding to good and bad periods can be established qualitatively for some indicators, but remain problematic for others. For most indicators, the history of the index is short relative to the ecological and evolutionary history of the fish populations or of the ecosystems within which they occur. In the absence of quantitative information to specify colour boundaries they have been established by a process of deliberation, where the weight of expert opinion is used to determine the most reasonable estimates. These represent the best available estimates; however all are subject to improvement through ongoing research.

Abundance for monkfish improved throughout the1990's from low levels in the late 1980's. This was largely driven by immature abundance which peaked in 1995 and 2000. Mature abundance improved to near the long term average in 1998 but the proportion of fish >60 cm has declined and biomass remains low. Levels have been set to indicate these trends.

Indicator	Green (+) Boundary	Red (-) Boundary	Characteristic	Weighting
Summer RV Immature abundance (4X)	1200 – consistent with high abundance in the mid 1990s	40 – consistent with low abundance in the mid 1970s	Abundance	1
Summer RV Mature abundance (4X)	1000 – consistent with high abundance in the mid 1990s	100 – consistent with low abundance in the mid 1970s	Abundance	1
Area Occupied (4X)	.25 – consistent with second highest value in abundance	.1 – consistent with low abundance values in the 1970s	Abundance	1
Condition Factor (4X)	3300 – slightly below the long term mean (3365)	3050 – consistent with lowest value in 2000	Production	1
Relative F (4X, 40-79cm smooth)	.15 – consistent with lowest value in mid 1980s, values highly variable	.9 – consistent with highest value in 1994, values highly variable	Fishing M	1