

## Effort Trends for Cod, Haddock and Pollock on the Scotian Shelf and Georges Bank

A suitable measure of effort can provide an indication of trends in fishing intensity if a complete census of all fishing activity is recorded. It is generally considered most desirable to use a measure of effort with the greatest resolution, e.g. hours fished for trawlers, # hooks-soak time for longliners, etc. or even days fished, but these quantities are not recorded faithfully. As we were seeking a complete census of effort and not a sampling to derive catch rates, only trips were considered further as a measure of effort. Trips were identified by unique Commercial Fishing Vessel-landed date entries.

Effort information from the commercial fisheries on the Scotian Shelf, Bay of Fundy and Georges Bank was available from 1987 to the present for vessels based in all regions. From 1977 to 1986, the information was available only for vessels based in Scotia-Fundy Region. We describe the trends in fishing effort on traditional groundfish, defined here as cod, haddock and pollock, since 1977 by the principle fishing fleets in each of three zones, the eastern Scotian Shelf (Div. 4VsW), the southwest Scotian Shelf/Bay of Fundy (Div. 4X) and Georges Bank (Subdiv. 5Ze).

Examination of the database revealed that over the time period 1977 to the present, there were inconsistencies in the recording of information for tonnage classes 0 and 1 vessels (< 24.9 GRT). Frequent occurrences arise where Commercial Fishing Vessel is not recorded and landings from several vessels and/or trips may be aggregated (Supplementary B slip data). Consequently, a summary of trip effort could only be conducted for tonnage classes 2 and greater (> 25 GRT). The principle gears employed to fish traditional groundfish in the Scotia-Fundy Region are otter trawl, longline, handline and gillnet. Since most of the handline and gillnet fisheries are conducted by tonnage classes 0 and 1 vessels, trip effort summaries were only produced for longline (LL) and otter trawl (OT).

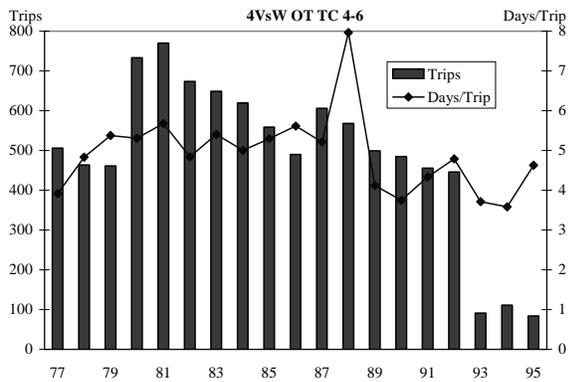
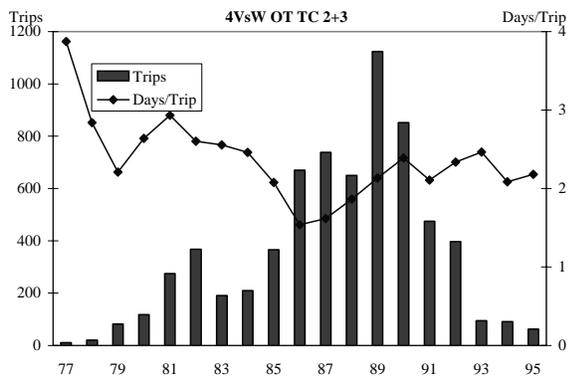
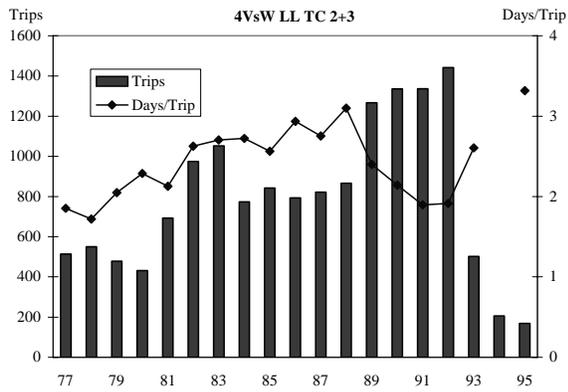
A trip was counted if any amount of cod, haddock or pollock were reported landed from the zone of interest. We have aggregated tonnage classes 2 (25 - 49.9 GRT) and 3 (50 - 149.9 GRT), commonly referred to as the "inshore", and tonnage classes 4 (150 - 499.9 GRT) and 5 (500 - 999.9 GRT), commonly referred to as the "offshore". There are few longliners greater than tonnage class 3, therefore these were not considered

further. Past observations suggest that larger vessels obtain a higher catch per unit of effort fished under similar conditions. Differences in catch per unit of effort between tonnage classes 2 and 3 vessels are not known for either otter trawlers or longliners, therefore no adjustments were made. Results from Gavaris and Sinclair (1985) indicated that the catch per unit of effort for tonnage class 5 stern trawlers was about 1.5 times that for tonnage class 4 side trawlers in Div. 4VsW. This factor was used to adjust the tonnage class 4 otter trawl effort to tonnage class 5 stern trawler effort. The few tonnage class 6 vessels (1,000 - 1999.9 GRT) were included with the tonnage class 5 results as these vessels are near the boundary of the tonnage class 5 and 6 distinction. There were few tonnage class 7 vessels (> 2,000 GRT) and these were not considered.

As trip duration may vary, the days fished per trip for those trips where days fished was reported, were computed for examination. Note that days fished were not entered on the database for longliners in 1994, therefore it was not possible to evaluate days fished per trip in that year.

### 4VsW

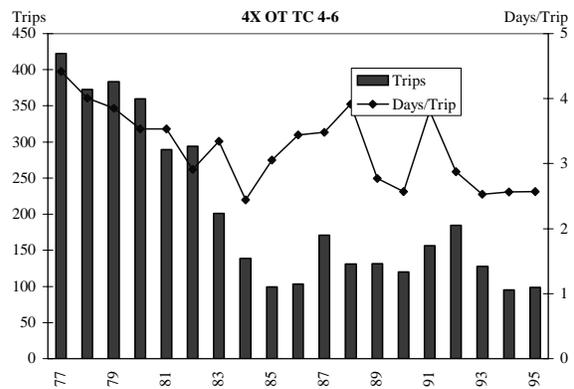
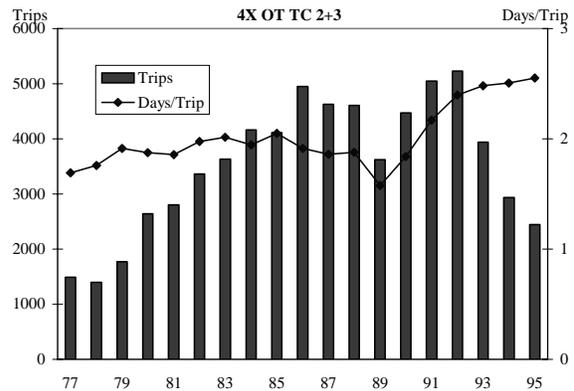
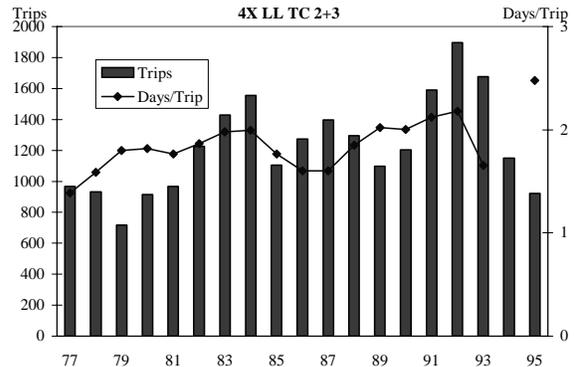
The number of trips and days per trip increased steadily for longline from 1977 to 1988. Between 1989 and 1992, while longline were permitted to fish in the nursery area which was closed to mobile gear, the number of trips increased substantially while trip duration decreased. The days per trip for otter trawl do not show persistent trends. The development of an "inshore" otter trawl fishery began in the late 1970s with number of trips increasing to a peak in the late 1980s and early 1990s. The very high "inshore" otter trawl effort in 1989 was probably associated with the early closures of the 4X and 5Z fisheries in that year. The number of trips for "offshore" otter trawl increased abruptly in 1980 and declined gradually by the early 1990s to roughly the same level as in 1977. The number of trips for all three sectors decreased substantially in 1993, under severely restrictive management measures, and has remained at this low level.



**4X**

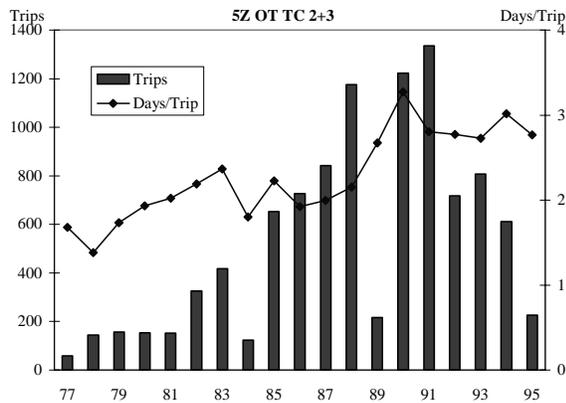
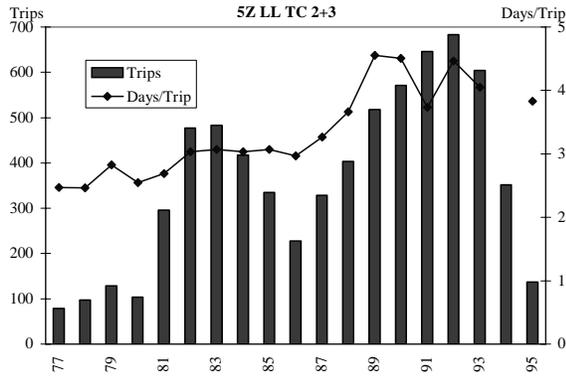
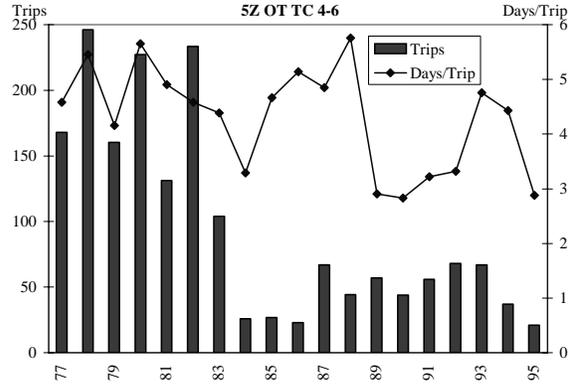
There was a moderate increase in days per trip for longline while number of trips gradually but steadily increased from 1977 to the highest level in 1992. Days per trip for "inshore" otter trawl was fairly constant through 1990 but increase considerably until 1993, during the period when Individual Quotas were introduced. The number of trips for "inshore" otter trawl increased rapidly during the early 1980s and fluctuated around that level through the early 1990s. The reduced effort by "inshore" otter trawlers in 1989

was due to an early closure of the fishery. The days per trip and number of trips for "offshore" otter trawl decreased substantially between 1977 and the mid 1980s, remaining relatively stable thereafter. Number of trips for all three sectors, especially longline and "inshore" otter trawl, shows a marked declining trend since 1992.



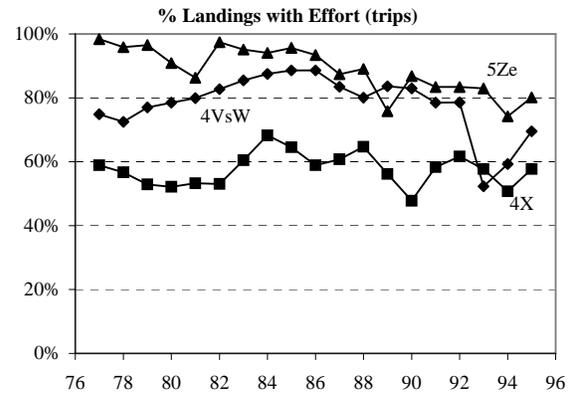
5Ze

Days per trip for longline was relatively stable through the mid 1980s while number of trips increased substantially in 1981 and again in 1982, followed by a decline to 1986. Both days per trip and number of trips for longline subsequently increased rapidly, reaching a peak in 1992. While days per trip increased gradually, the number of trips show a rapid progressive increase for "inshore" otter trawl from 1977 to the highest level in 1991. The very low number of trips in 1989 by "inshore" otter trawlers was due to a closure after only about 2 weeks of fishing when the quota was caught. Days per trip do not display any persistent patterns for "offshore" otter trawl and the number of trips declined considerably during the early 1980s and remained relatively stable thereafter. The number of trips by all three sectors show a substantial declining trend since 1991 and 1992.



Discussion

Since a complete census of all fishery activity was not possible, due to the complications indicated above, the proportion of the total landings represented by the enumerated trips was investigated. Landings represented by the enumerated trips in Divs. 4VsW accounted for about 80% of total landings from 1977 to 1992, declined to about 50% in 1993 and increased again to about 70% by 1995. This trend suggests that the decline in effort since 1992 indicated by this analysis is exaggerated. Landings represented by the enumerated trips in Div. 4X accounted for about 60% of total landings throughout the entire time period, therefore the effort trends indicated by this analysis should be reflective of overall effort. Landings represented by the enumerated trips in Subdiv. 5Ze accounted for about 90% of total landings from 1977 to the mid 1980s and then declined to about 80%. This pattern suggests that the increase in effort since the mid 1980s was even greater than was indicated in this analysis.



The derived measures of effort do not account for changes in seasonal distribution or spatial distribution of fishing activity which are known to affect

catchability. Also, over this period, the nature of the fishery has changed considerably. For example, in recent years, the tonnage classes 2 and 3 otter trawlers have been placed on an Individual Quota program and the degree of targeting or directing for cod, haddock and pollock has changed. It may be useful to develop a meaningful way to display the degree of targeting using species composition of the catch. Further, over this time period, there have been numerous innovations and technological advances in fishing practices. This analysis does not attempt to adjust for any such gains in efficiency.

In this analysis, trips which span more than one of the defined zones will result in a trip being counted in each zone. A better but more complicated way would be to count trip fractions based on the portion of fishing days in each zone, when fishing days are reported. Alternatively, the trip fraction could be based on the portion of the landings from each fishing zone. The inclusion of trips where very small amounts of incidental catch are reported, as perhaps might happen in a redfish fishery, could also distort this analysis. Examination of the frequency distribution of % traditional groundfish may be useful in identifying a threshold level for inclusion of trips.

Despite these limitations, the available information is considered suitable to obtain reliable coarse measures of trends in effort. The broad patterns suggest a general increase in effort in all areas from 1977 to their highest level by 1992, followed by a marked decline since then. It is clear that the steady increase in effort, particularly in the longline and “inshore” otter trawl sectors was only brought under control by management measures introduced in 1992.

The  $F_{0.1}$  strategy adopted by Canada in 1977 should have generated constant levels of annual fishing effort. This analysis indicates that implementation of quota management between 1977 and the early 1990s did not achieve the objective of constant annual effective effort. The growth in effort between 1977 and the early 1990s placed correspondingly increasing pressure on the stocks, and it was desirable to reduce effective effort levels. The measures introduced since 1993 have succeeded in causing effort to be reduced in all three zones.

### *For More Information*

Contact:

Stratis Gavaris  
St. Andrews Biological Station  
St. Andrews, New Brunswick  
E0G 2X0

Tel: (506) 529-8854  
Fax: (506) 529-5862  
E-Mail: sgavaris@sta.dfo.ca

### *References*

Gavaris, S., and A. Sinclair. 1985. Abundance indices of 4VsW cod. CAFSAC Res. Doc. 85/39.