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Assessment of (i) the State of the Eastern Scotian Shelf Ecosystem and (ii) the Northwest Atlantic Fisheries

by

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Abstract

Many features of the Eastern Scotian Shelf ecosystem have changed dramatically during the past thirty years. A major cooling event of the bottom waters occurred in the mid-1980s that persisted for a decade and recent intensive stratification in the surface layer has been apparent; both phenomena are associated with flow from upstream areas. The index of zooplankton abundance was low in the decade of the 1990s when phytoplankton levels were high and the opposite pattern was evident in 1960s/early-1970s. Major structural changes have occurred in the fish community. Groundfish have declined while small pelagic species and commercially exploited invertebrate species have increased. Range expansion of some species as well as the occurrence of species new to the area was evident and associated with changes in the physical environment. Reductions in average body size of groundfish have occurred and there are currently very few large fish – a situation likely to have never been witnessed in the past. Condition and growth of several groundfish species has remained low during the past decade contrary to expectations for improvement. It is not yet possible to predict how long the current situation will persist and whether or not the system will return to its previous groundfish-dominated state. The fishery is increasingly targeting species at lower levels in the food web because there now exists a lack of availability of groundfish at the higher trophic levels.

The state of the NW Atlantic fisheries was assessed by examining trends in survey and model-based estimates of recruitment (R), spawning stock biomass (SSB) and recruitment rate ($\ln R/SSB$). The species/stocks examined included cod, haddock, pollock, silver hake, skates (winter, smooth, thorny, little), redfish, flatfish (American plaice, yellowtail flounder, turbot), white hake, and mackerel. All data was expressed as standardized anomalies and were sorted using Principal Components Analysis with the first axis scores displayed to show generalized trends. In general, among those stocks where both survey and model based estimates of R and SSB were available, temporal trends were in close agreement. The analyses revealed species-specific differences particularly among cod, haddock, and herring stocks. Declining trends in both R and SSB were evident among most cod stocks while R/SSB was somewhat more variable. Herring recruitment was variable among stocks with recent positive SSB anomalies evident on the Scotian Shelf and Georges Bank. R/SSB anomalies were mainly positive among most herring stocks in the recent past suggesting future increases in SSB are to be expected. Recent R and R/SSB anomalies were positive among all haddock stocks and SSB has exhibited a striking transition from strong negative anomalies to moderately positive during the recent past decade. Among flatfish species/stocks, recent R and SSB anomalies were positive in the south while R/SSB anomalies were negative among all stocks in the past few years that were preceded by strong positive anomalies. Generalizations of the trends among all species based on the first axis scores of the principal components analysis revealed relative stability in R from the 1950s to the mid-1980s followed by a sharp transition to the early-1990s. The first axis for R can be considered representative of a groundfish versus pelagic gradient. Similarly, SSB was stable until a transition in late-1970s, possibly due to a density dependent effect and by the early-1990s a strong divergence was evident. R/SSB was stable until the mid-1960s and then began to oscillate with increasing amplitude.