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

Maritimes Region

Canadian Science Advisory Secretariat
Science Response 2013/004

MARITIMES RESEARCH VESSEL SURVEY TRENDS ON THE SCOTIAN SHELF AND BAY OF FUNDY

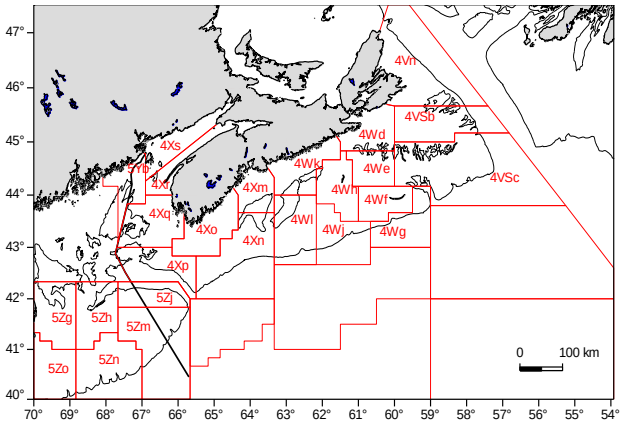

Figure 1. Northwest Atlantic Fisheries Organization (NAFO) Unit Areas.

Context

DFO has conducted summer research vessel (RV) surveys in the Maritimes Region, Northwest Atlantic Fisheries Organization (NAFO) subunits 4VWX and a small portion of 5Y, using a standardized protocol since 1970 (Figure 1). Results of these surveys provide information on trends in abundance for most groundfish species in the Maritimes Region. While these data reflect trends in biomass and abundance and are a critical part of science-based stock assessments, a full assessment, including other sources of data, would be required to evaluate the impacts of management measures on population status. Fisheries and Aquaculture Management (FAM) requested a review of the DFO RV survey information on the following list of fish stocks: 4X cod, 4VsW cod, 4Vn cod, 4X haddock, 4VW haddock, 4X white hake, 4VW white hake, 4VWX silver hake, 4VWX+5 pollock, Unit II redfish, Unit III redfish, 4VW flatfishes, and 4X flatfishes, 3NOPs4VWX+5 Atlantic halibut, Atlantic wolffish, monkfish, 4X and 4VW smooth skate, thorny skate, barndoor skate, winter skate, little skate, 4VWX spiny dogfish, and longhorn sculpin. The survey information will be used by FAM as background for discussions with various industry stakeholders on recommendations for management measures, and to determine which stocks should be reviewed in more detail in 2013/14.

This Science Response Report results from the Science Special Response Process of October 24, 2012, on the Review of Maritimes Research Vessel Survey Trends. Additional publications from this process will be posted as they become available on the Fisheries and Oceans Canada Science Advisory Schedule at www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

Background

The DFO summer research vessel (RV) survey of the Scotian Shelf and Bay of Fundy has been conducted annually since 1970. The surveys follow a stratified random sampling design, and include sampling of fish and invertebrates using a bottom otter trawl. These surveys are the primary data source for monitoring trends in species distribution, abundance, and biological condition within the region. The net and vessel conducting the survey were changed in 1982 and 1983, along with some changes in data collection protocols. These changes may affect the biomass trends for some species. For long-term averages, the most appropriate starting point has been selected for each species (for details see Clark and Emberley, 2011).

The bottom trawl surveys provide abundance trends for fish and invertebrates between depths of about 30 m to 400 m (Halliday and Kohler, 1971). Survey indices are expected to be proportional to abundance for most species described in this report. The distribution of some species, such as spiny dogfish, is not fully covered by the survey. Abundance trends for these species may only provide indication of direction of change over time.

Survey strata boundaries are shown in Figure 2 for the 4VWX5 area. NAFO area 4Vn includes strata 440-442, 4VsW includes strata 443-466, 4VW includes strata 440-466, and 4X includes strata 470-495. Sampling was conducted in all 4VWX strata and in the deeper strata of NAFO area 5Zjm. Catch distribution plots are provided for the entire area covered by the summer RV survey. Biomass index trends are shown for the area appropriate for each stock. Comparisons of 2011 and 2012 length composition from the survey catch to the long-term mean are also included, using data from the geographic areas that are used in assessments for those stocks.

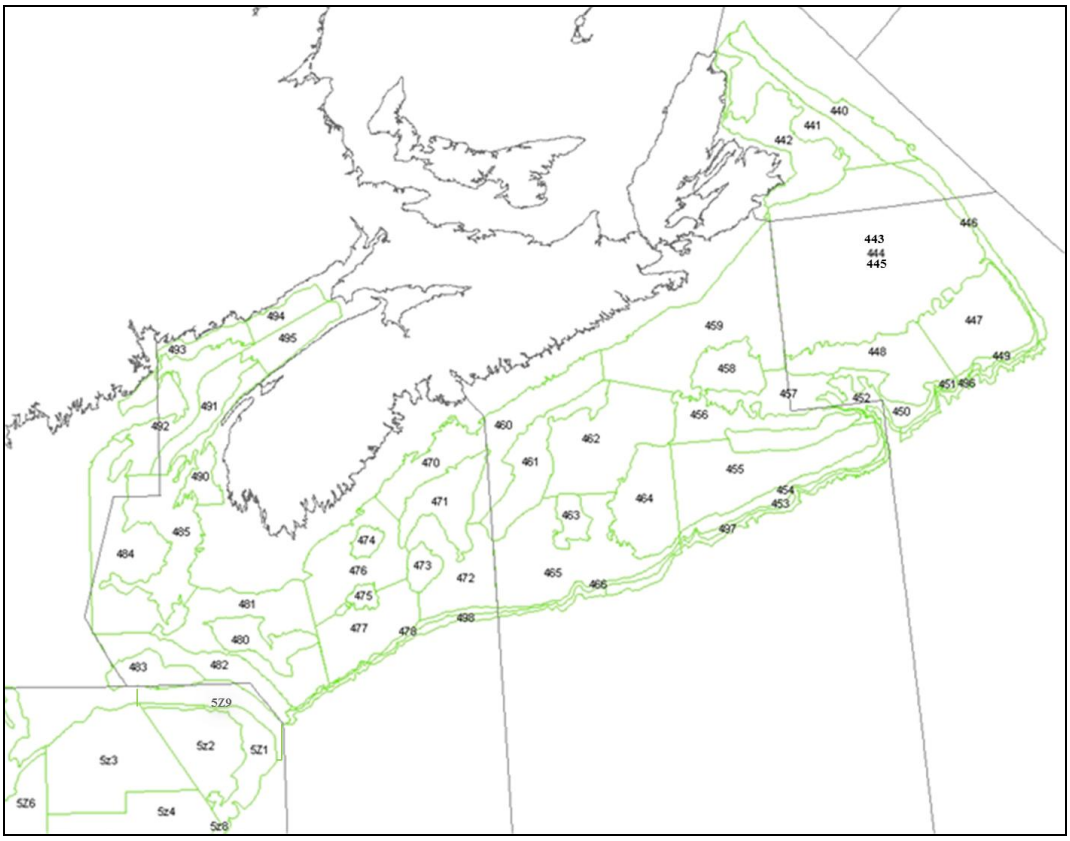

Figure 2. 2012 Summer Research Vessel survey strata.

Analysis

The time-series of survey biomass indices (not total biomass) are compared to averages for a series of time periods to provide historical context for biomass levels. The time periods used are a short-term 5 year average (2006-2010), a mid-term 15 year average (1996-2010), and the long-term survey average (1970-2010), unless otherwise noted. Length compositions from the 2011 and 2012 survey catch are also compared with the long-term survey mean (1987-2010). Information on the calculation of these indices is contained in Clark and Emberley (2011).

Atlantic cod

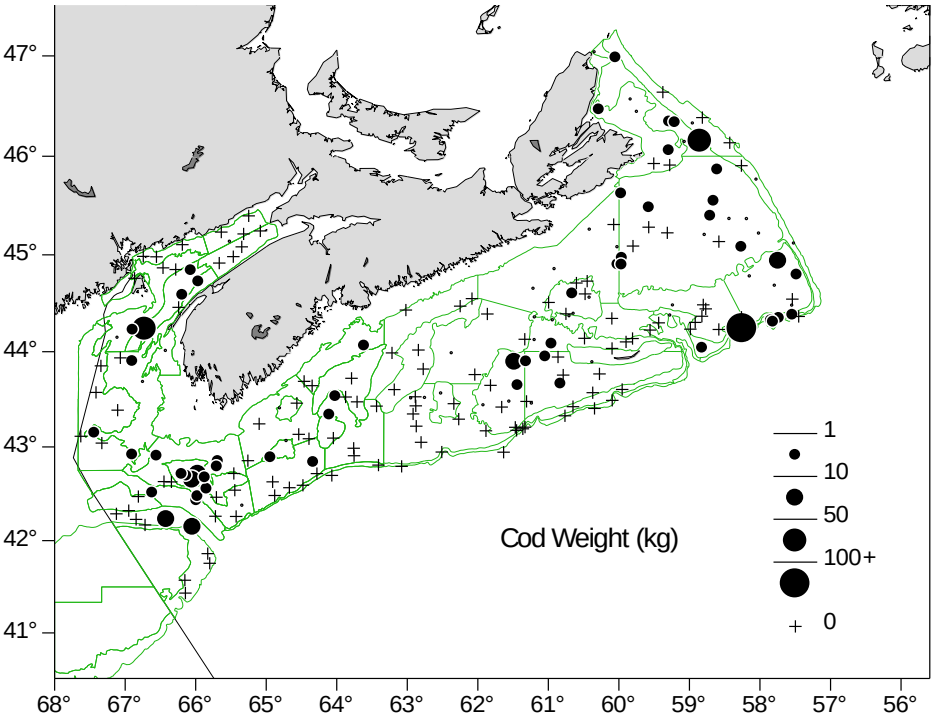

Figure 3a. Distribution and magnitude (weight/tow) of cod catches during the 2012 summer RV survey.

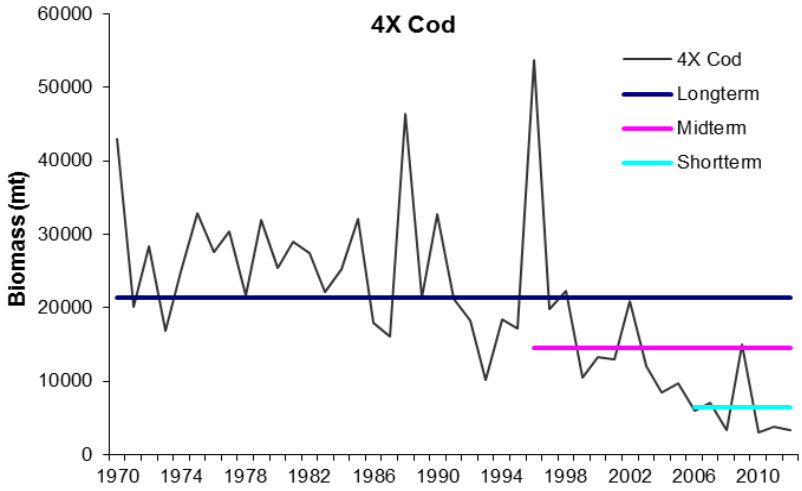

Figure 3b. Biomass indices for cod in 4X from the summer RV survey.

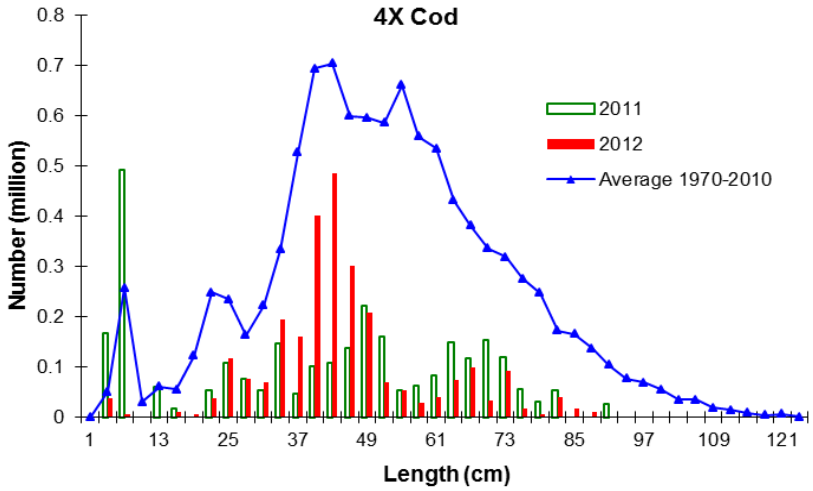

Figure 3c. Length composition for cod in 4X from the summer RV survey.

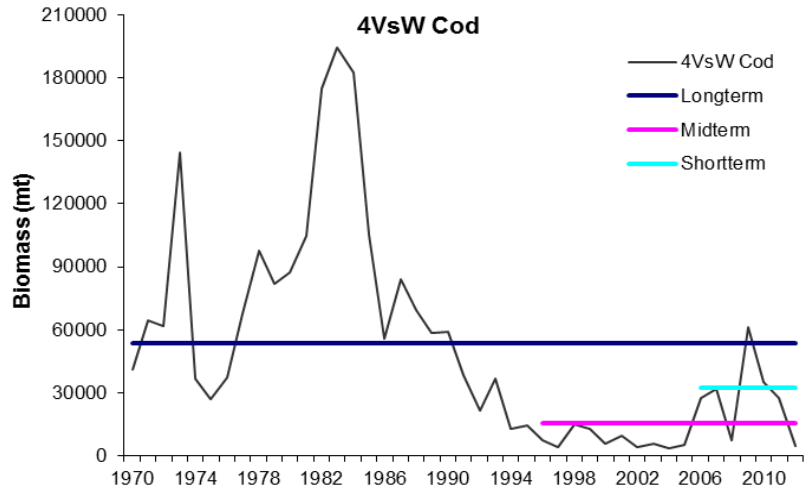

Figure 3d. Biomass indices for cod in 4VsW from the summer RV survey.

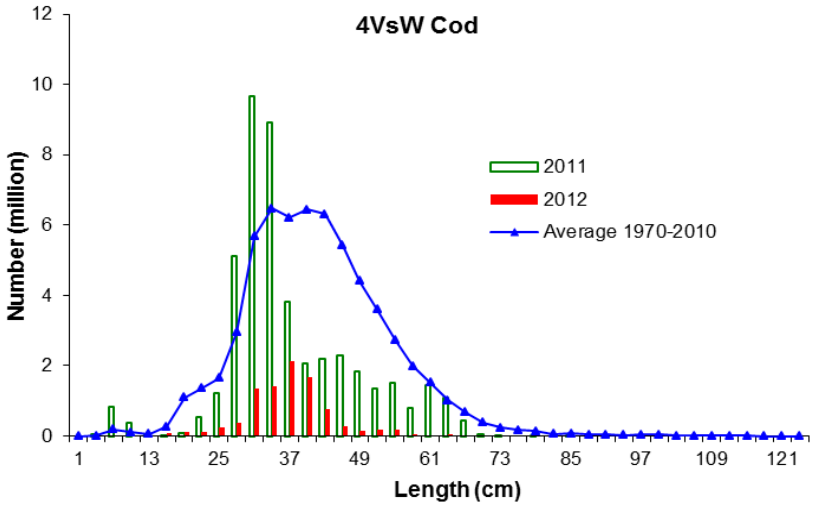

Figure 3e. Length composition for cod in 4VsW from the summer RV survey.

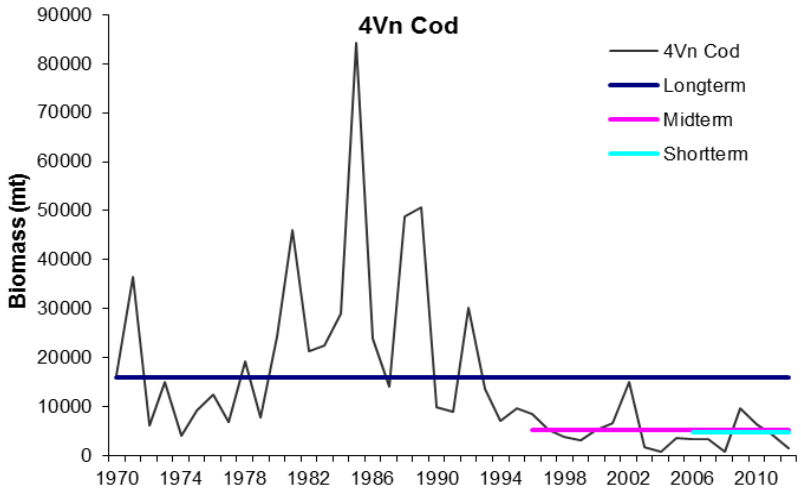

Figure 3f. Biomass indices for cod in 4Vn from the summer RV survey.

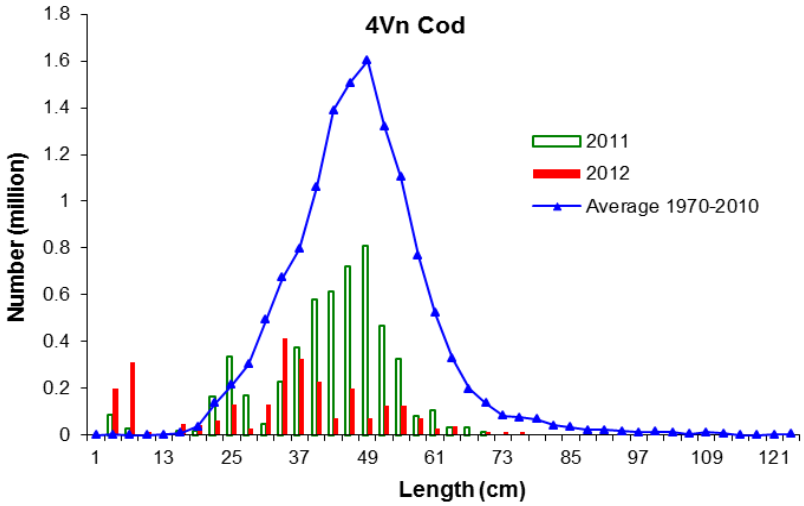

Figure 3g. Length composition for cod in 4Vn from the summer RV survey.

Haddock

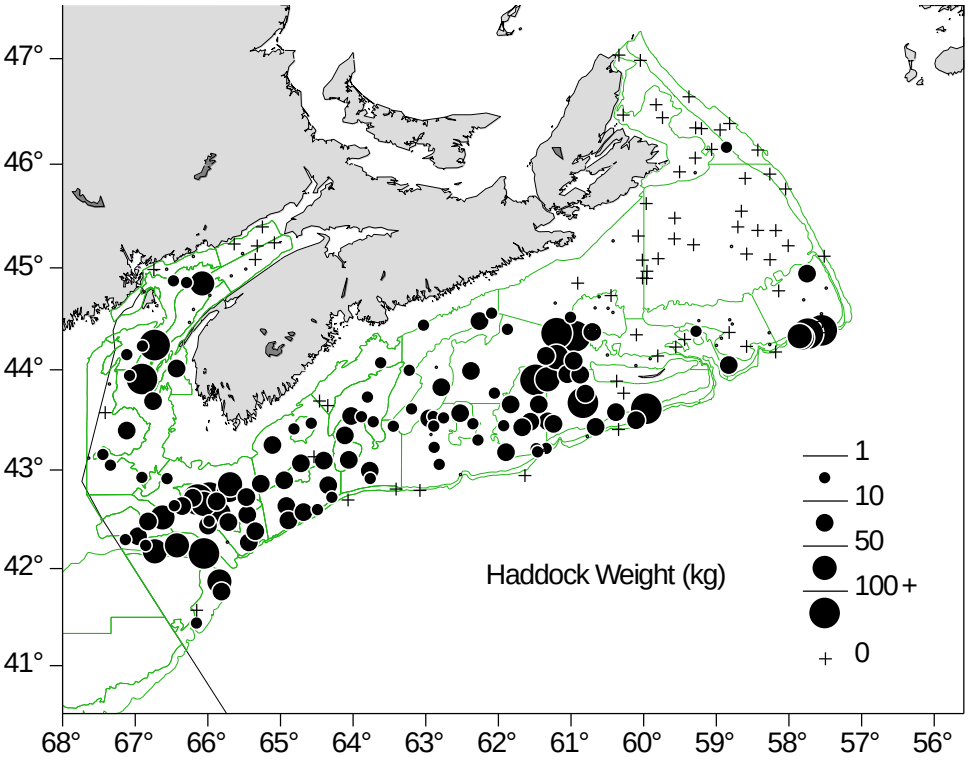

Figure 4a. Distribution and magnitude (weight/tow) of haddock catches during the 2012 summer RV survey.

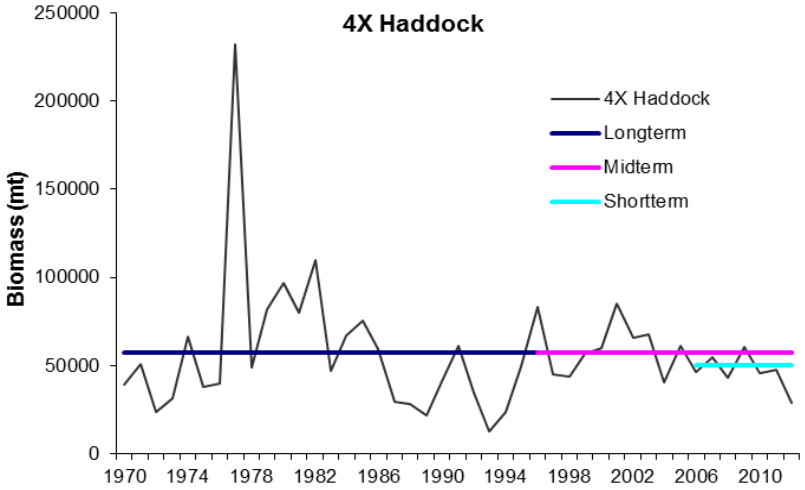

Figure 4b. Biomass indices for haddock in 4X from the summer RV survey.

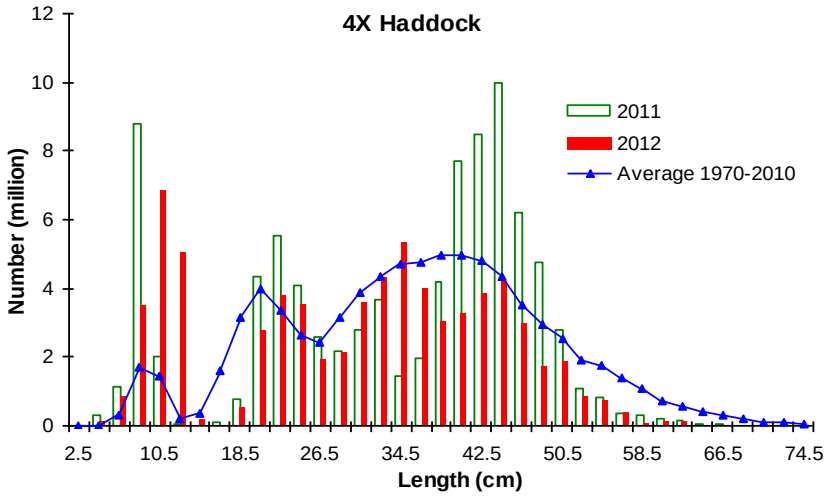

Figure 4c. Length composition for haddock in 4X from the summer RV survey.

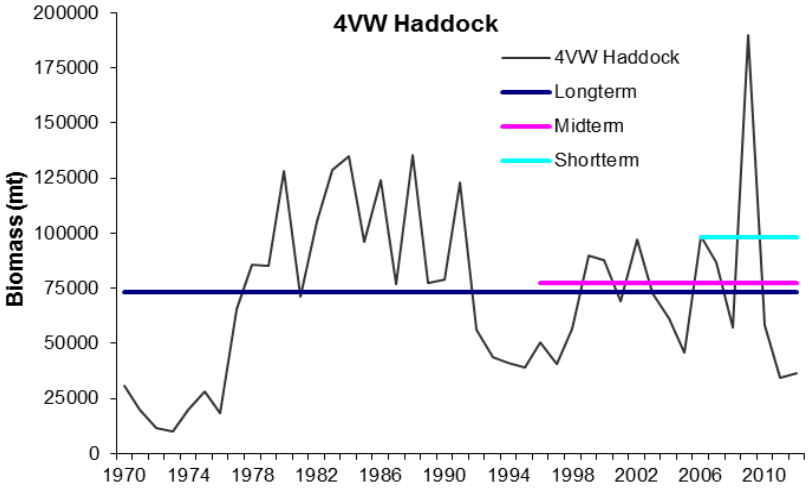

Figure 4d. Biomass indices for haddock in 4VW from the summer RV survey.

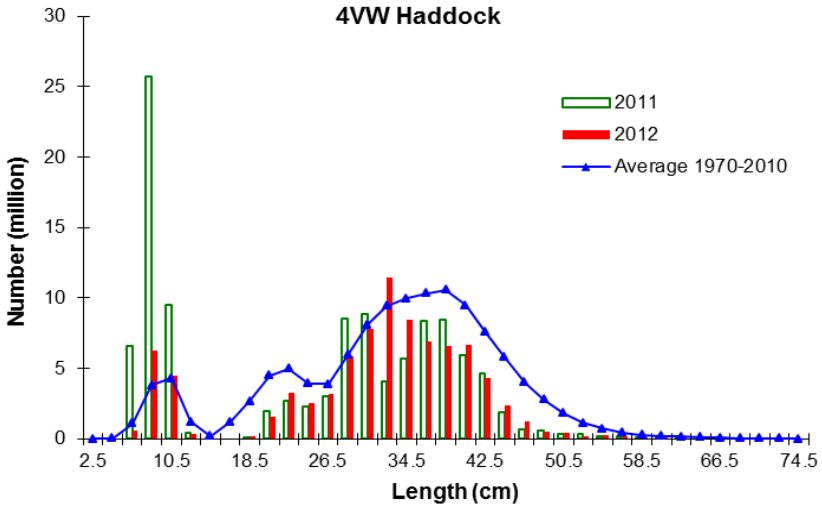

Figure 4e. Length composition for haddock in 4VW from the summer RV survey.

White hake

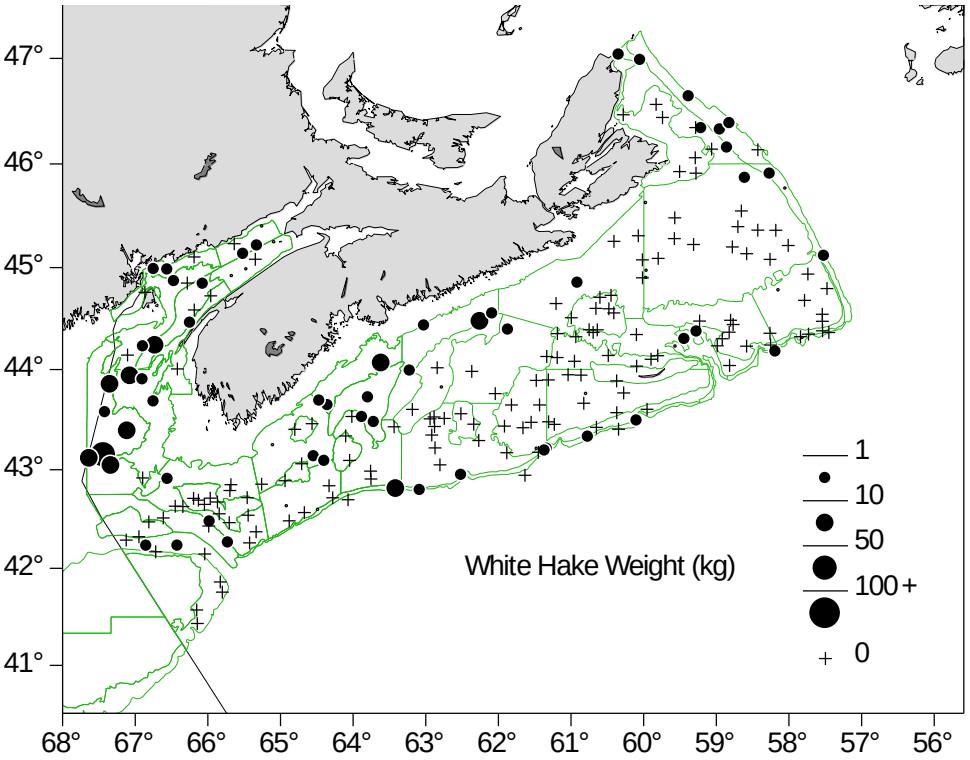

Figure 5a. Distribution and magnitude (weight/tow) of white hake catches during the 2012 summer RV survey.

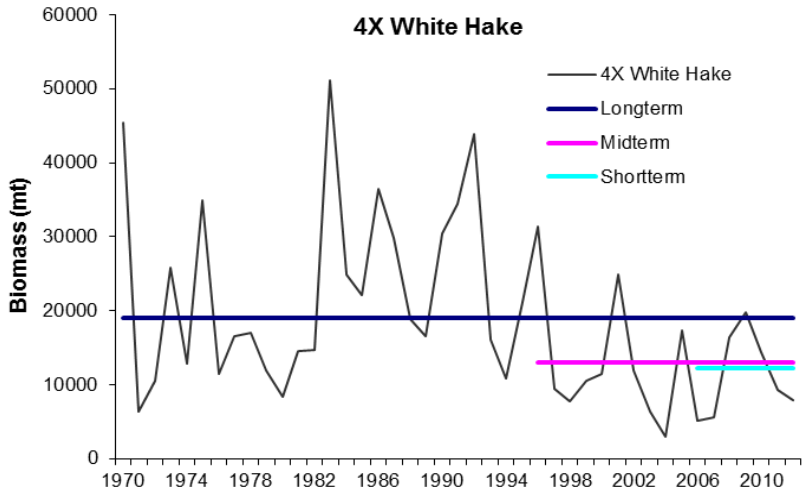

Figure 5b. Biomass indices for white hake in 4X from the summer RV survey.

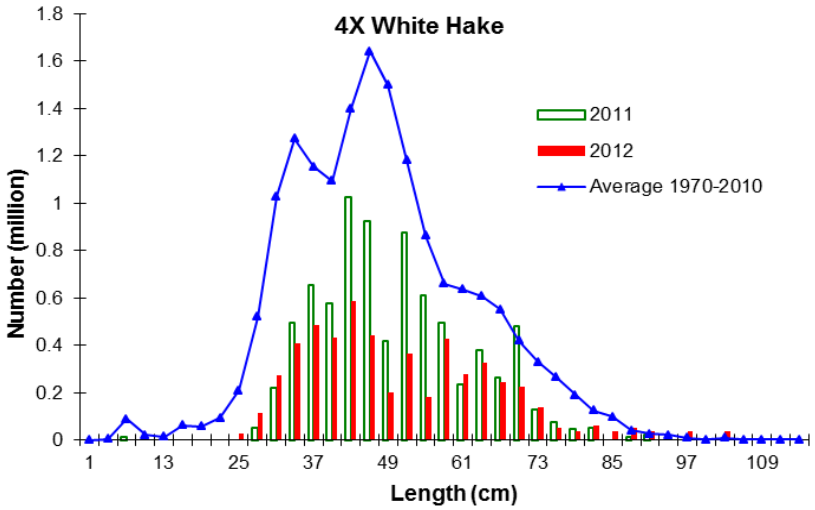

Figure 5c. Length composition for white hake in 4X from the summer RV survey.

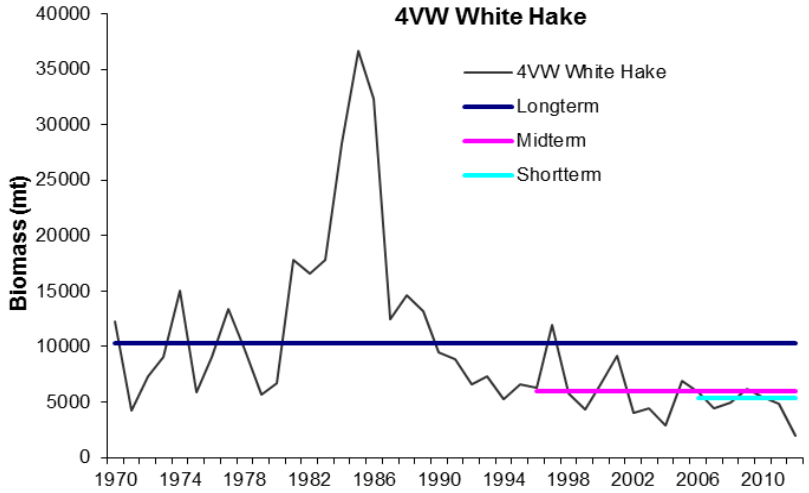

Figure 5d. Biomass indices for white hake in 4VW from the summer RV survey

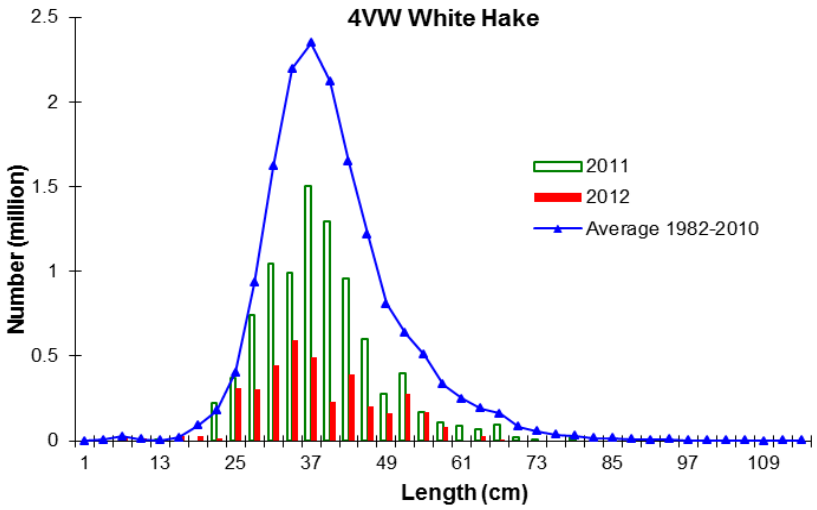

Figure 5e. Length composition for white hake in 4VW from the summer RV survey.

Silver hake

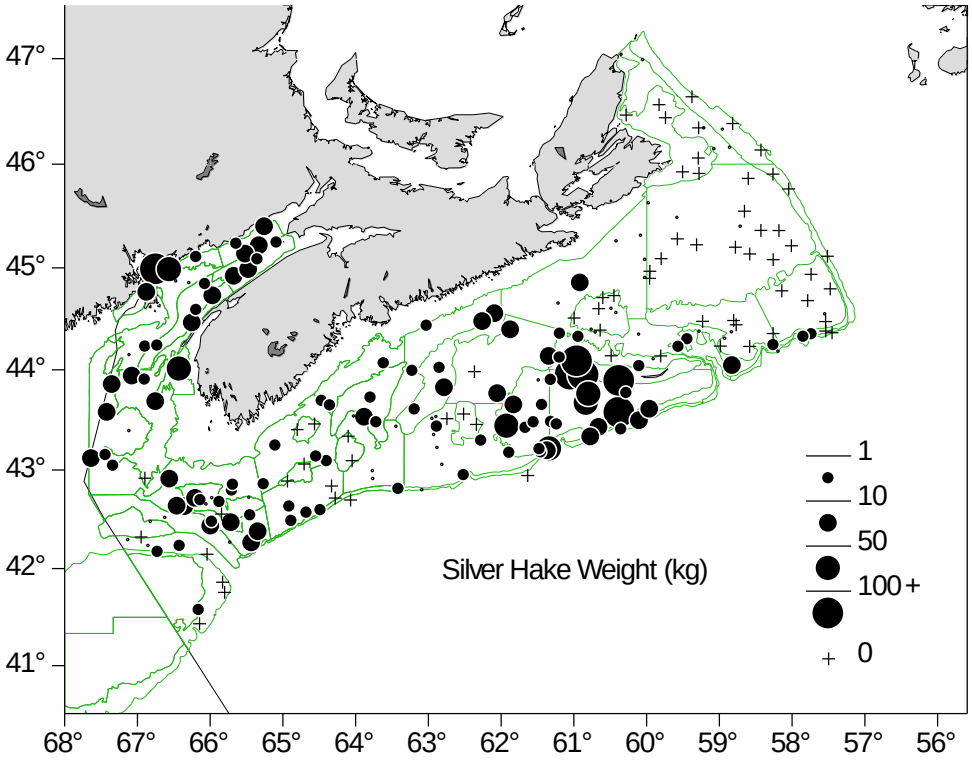

Figure 6a. Distribution and magnitude (weight/tow) of silver hake catches during the 2012 summer RV survey.

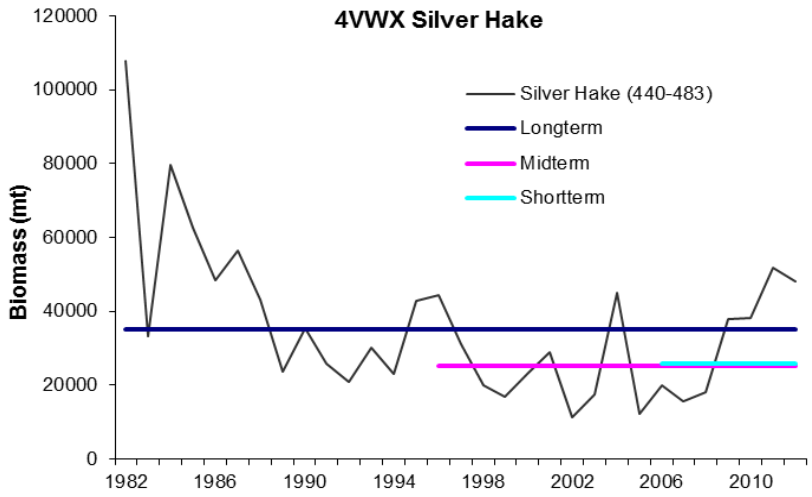

Figure 6b. Biomass indices for silver hake in 4VWX (strata 440-483) from the summer RV survey, 1982-present (for rationale see Clark and Emberley, 2011).

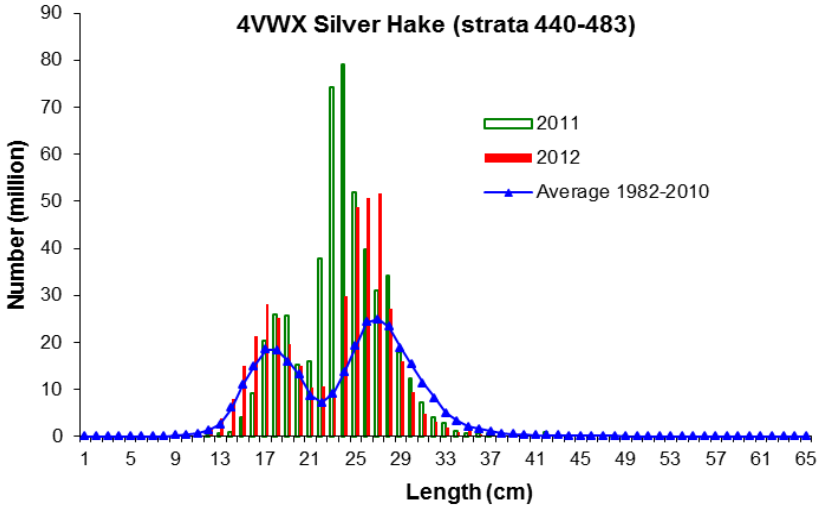

Figure 6c. Length composition for silver hake in 4VWX (strata 440-483) from the summer RV survey.

Pollock

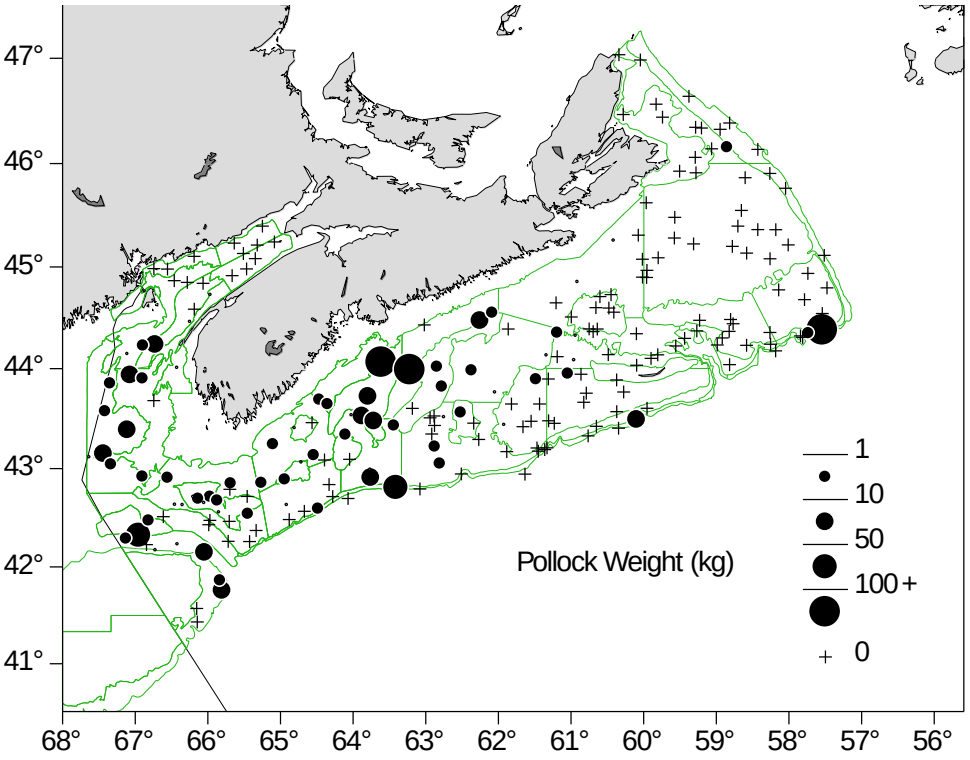

Figure 7a. Distribution and magnitude (weight/tow) of pollock catches during the 2012 summer RV survey.

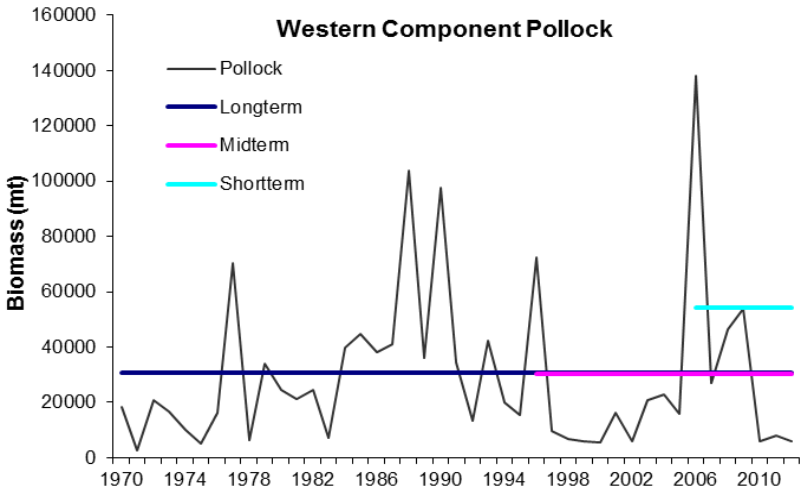

Figure 7b. Biomass indices for pollock in the Western component (4Xopqrs5) from the summer RV survey.

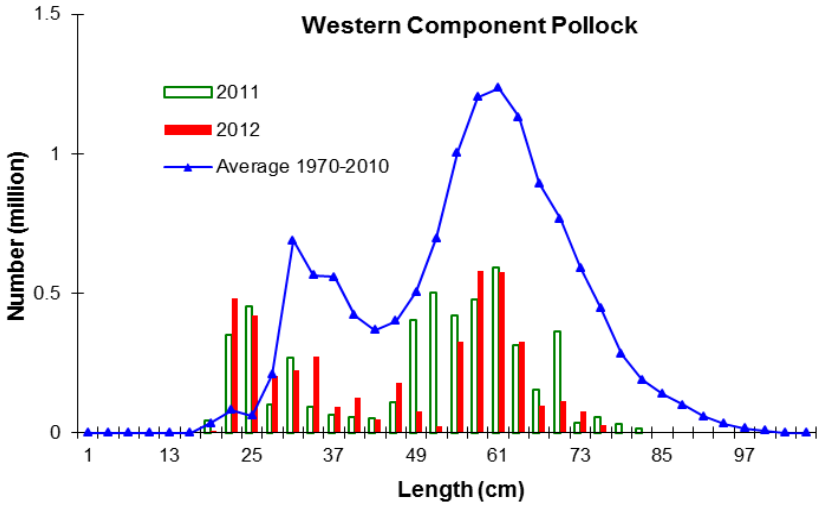

Figure 7c. Length composition for pollock in the Western component (4Xopqrs5) from the summer RV survey.

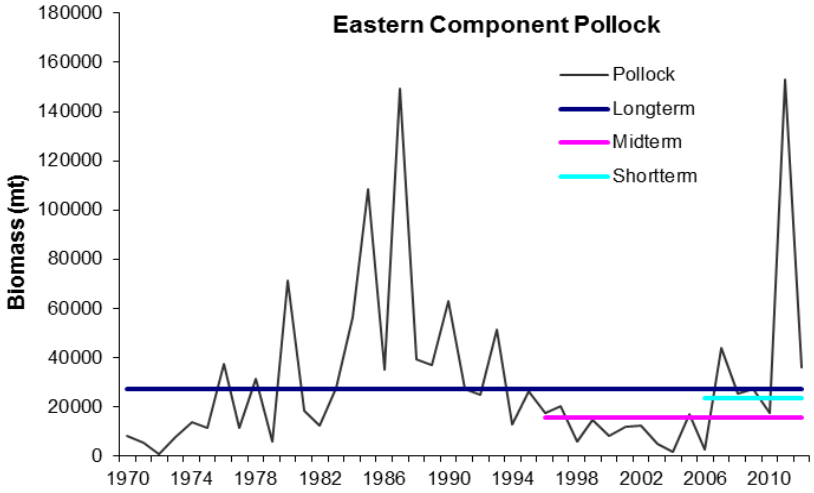

Figure 7d. Biomass indices for pollock in the Eastern component (4VWXmn) from the summer RV survey.

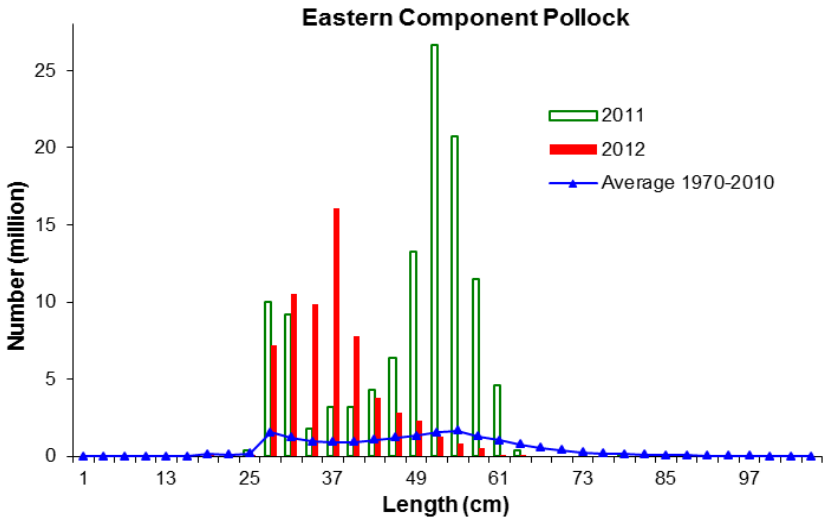

Figure 7e. Length composition for pollock in the Eastern component (4VWXmn) from the summer RV survey.

Redfish

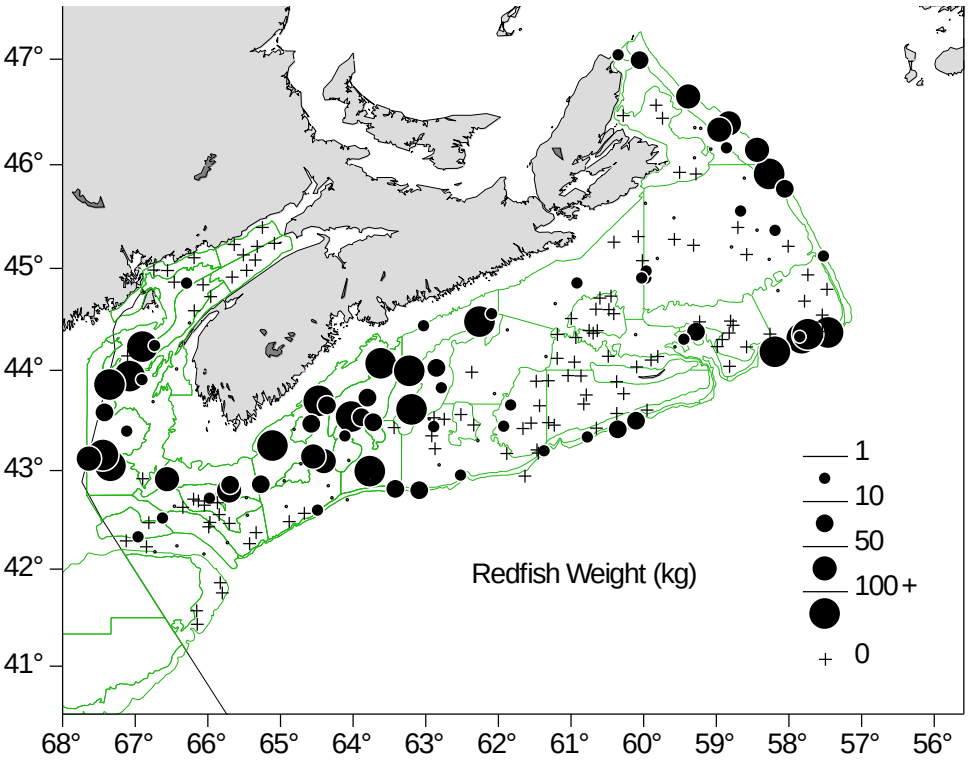

Figure 8a. Distribution and magnitude (weight/tow) of redfish catches during the 2012 summer RV survey.

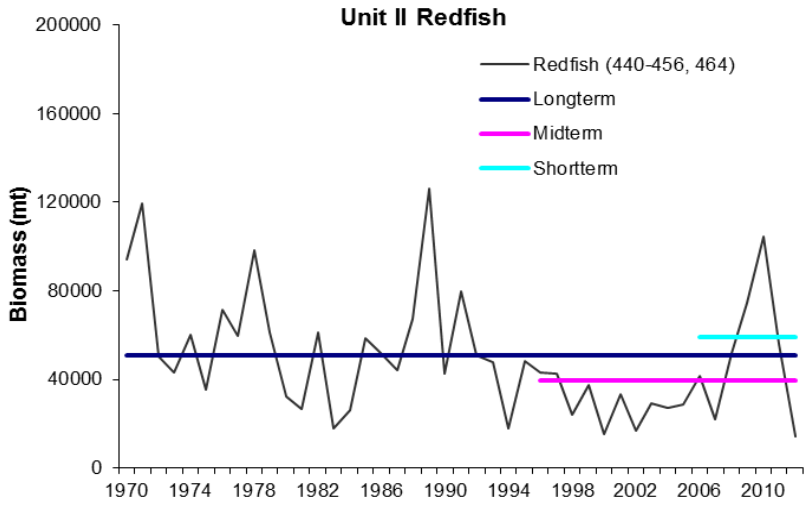

Figure 8b. Biomass indices for redfish in the portion of Unit II covered (strata 440-456,464) from the summer RV survey.

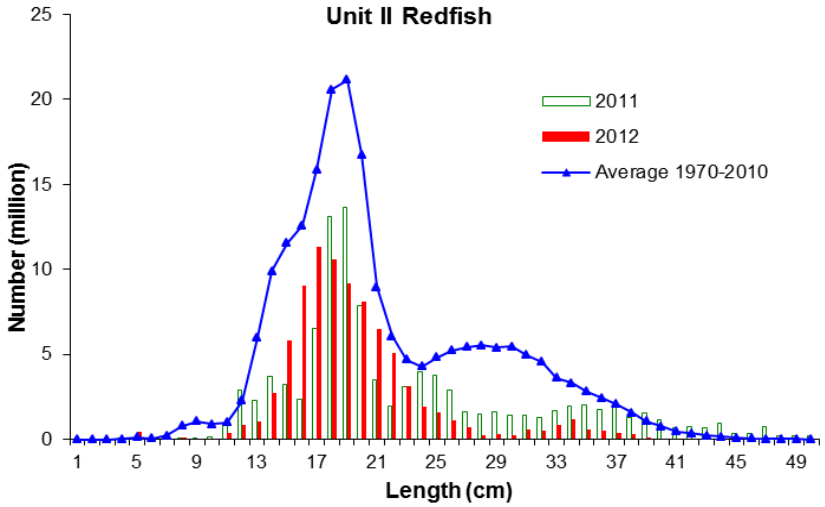

Figure 8c. Length composition for redfish in the portion of Unit II covered (strata 440-456,464) from the summer RV survey.

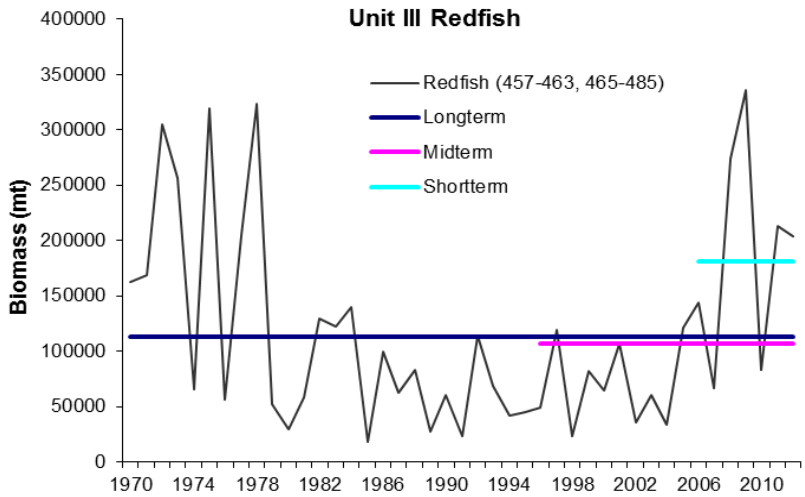

Figure 8d. Biomass indices for redfish in Unit III (strata 457-463,465-485) from the summer RV survey.

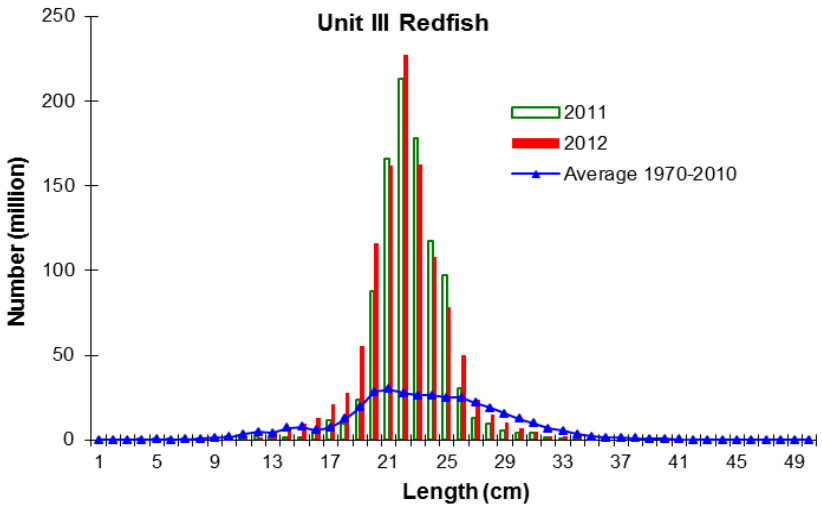

Figure 8e. Length composition for redfish in Unit III (strata 457-463,465-485) from the summer RV survey.

The three main species that constitute **4VW flatfishes** are American plaice, witch flounder, and yellowtail flounder. Winter flounder and witch flounder are the two main species that make up **4X flatfishes**, but this species group also includes American plaice and yellowtail flounder. Details on each individual species are presented below.

American plaice

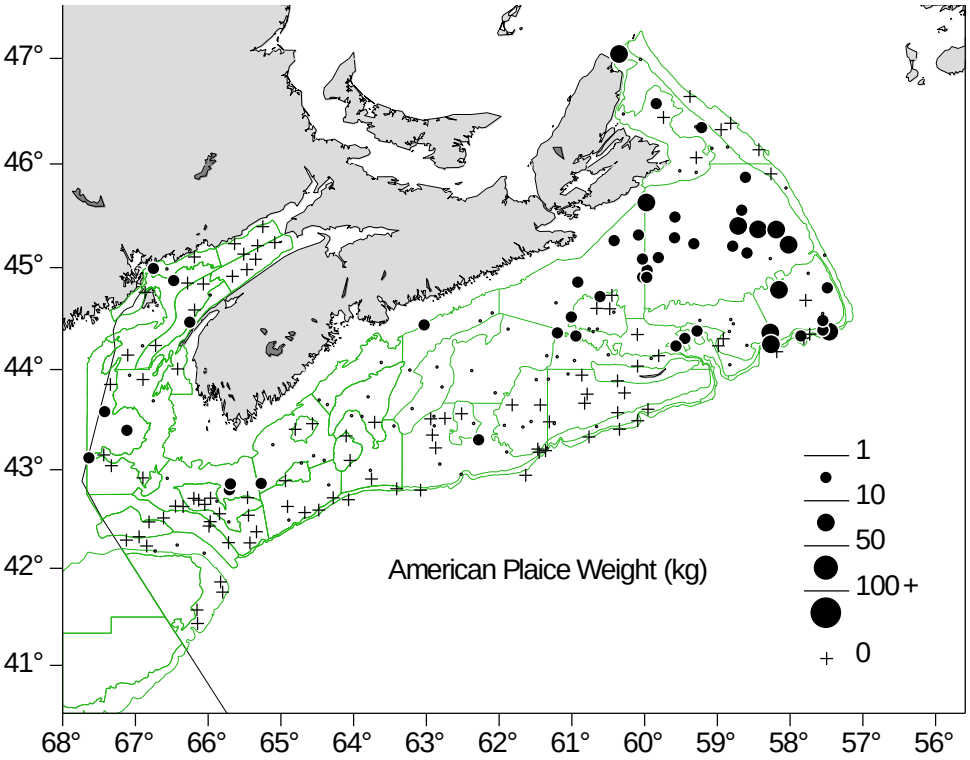

Figure 9a. Distribution and magnitude (weight/tow) of American plaice catches during the 2012 summer RV survey.

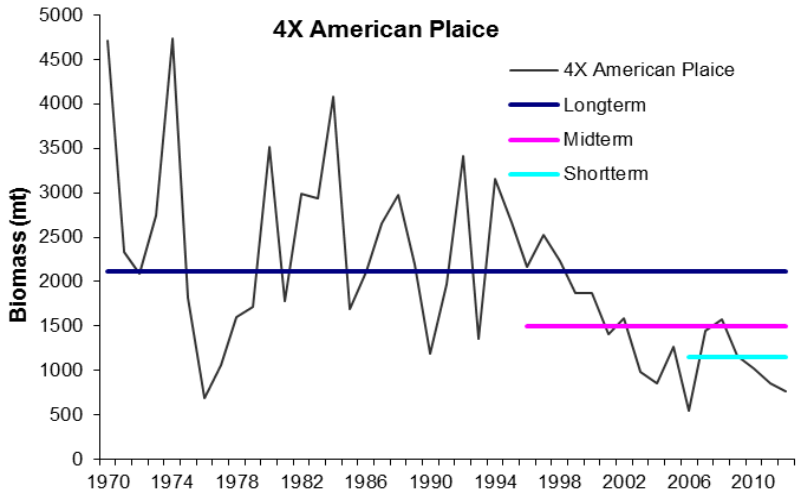

Figure 9b. Biomass indices for American plaice in 4X from the summer RV survey.

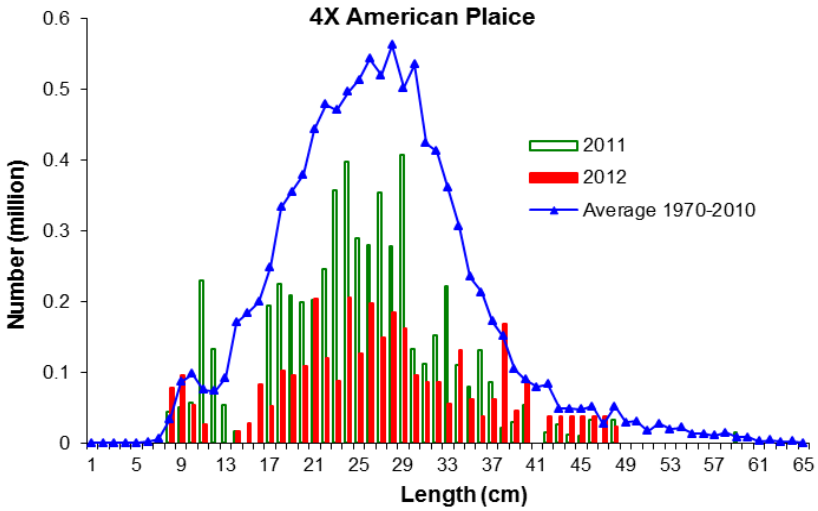

Figure 9c. Length composition for American plaice in 4X from the summer RV survey

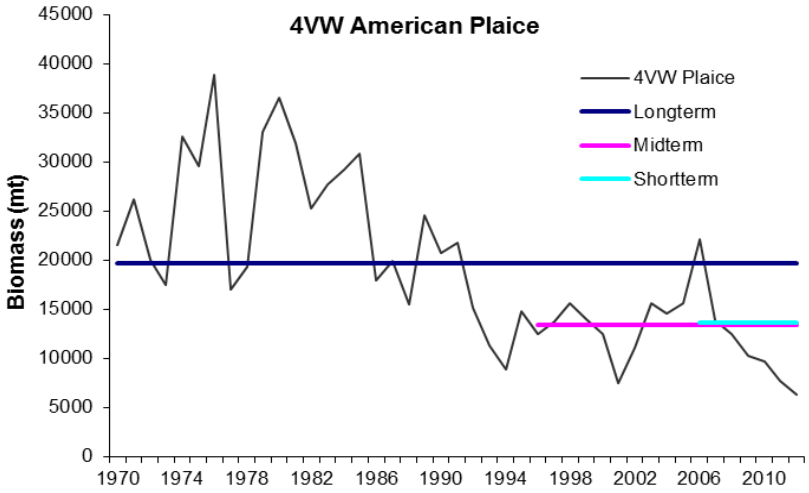

Figure 9d. Biomass indices for American plaice in 4VW from the summer RV survey.

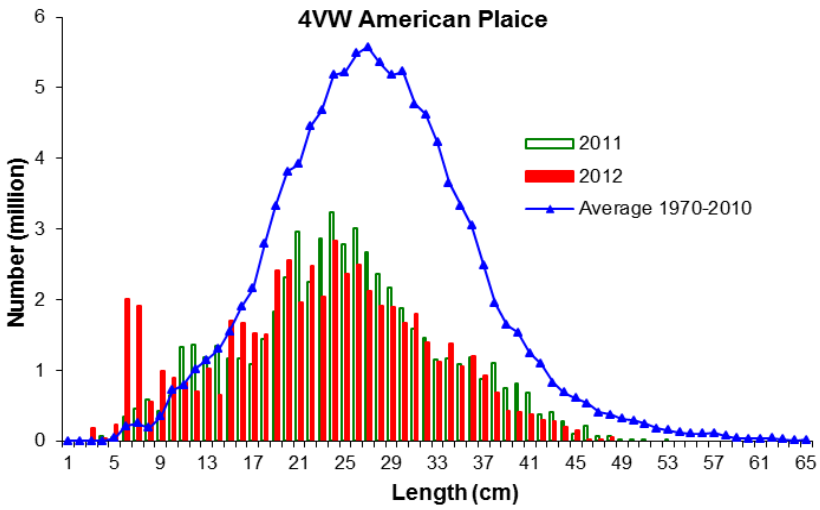

Figure 9e. Length composition for American plaice in 4VW from the summer RV survey.

Witch flounder

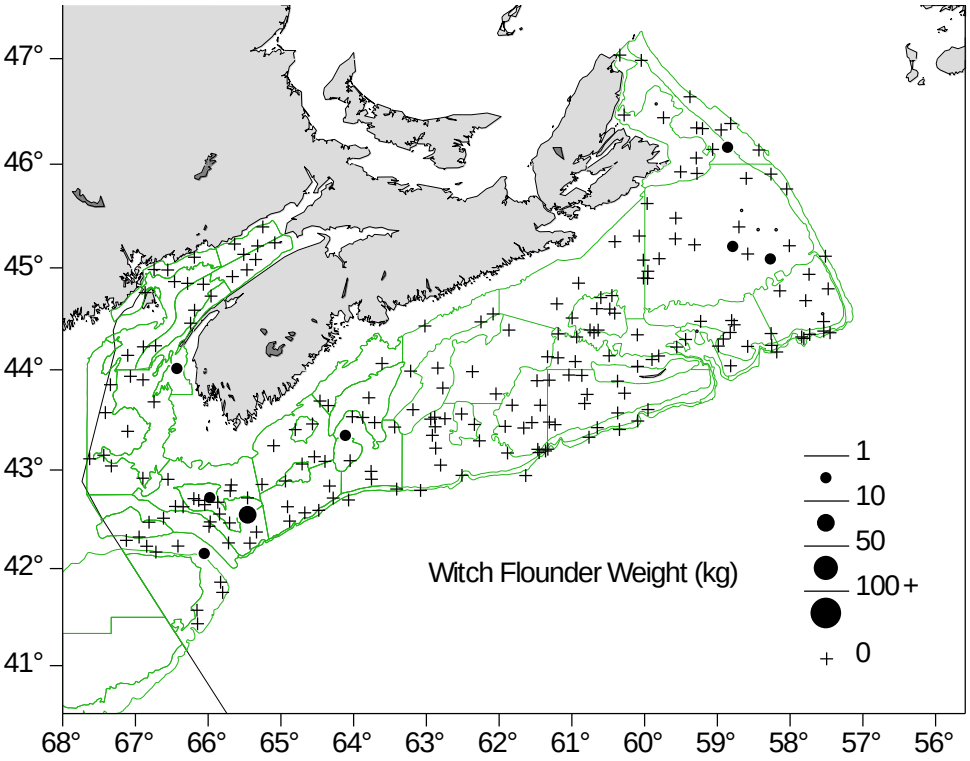

Figure 10a. Distribution and magnitude (weight/tow) of witch flounder catches during the 2012 summer RV survey.

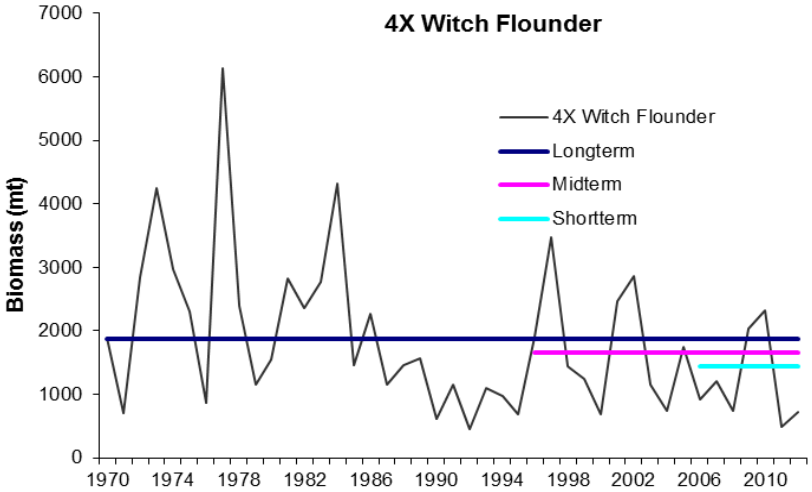

Figure 10b. Biomass indices for witch flounder in 4X from the summer RV survey.

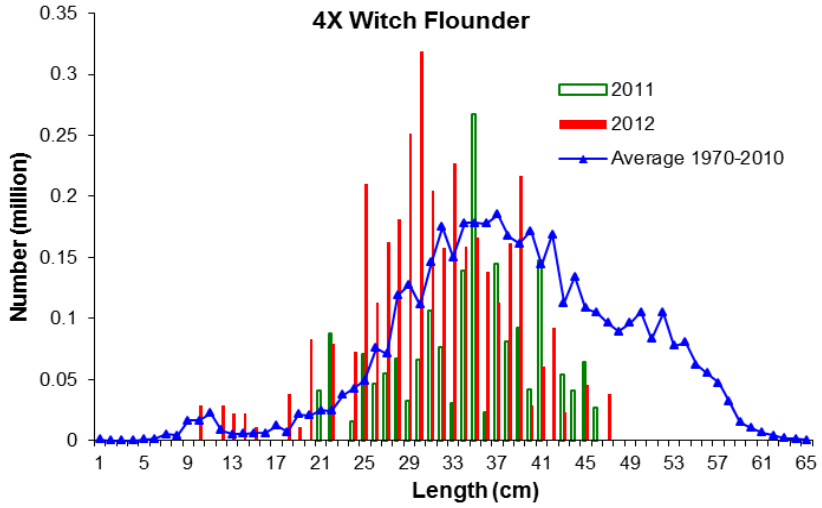

Figure 10c. Length composition for witch flounder in 4X from the summer RV survey.

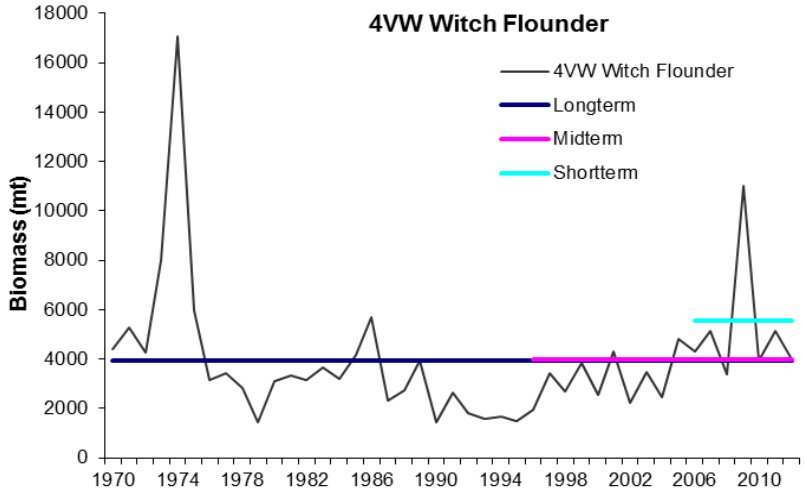

Figure 10d. Biomass indices for witch flounder in 4VW from the summer RV survey.

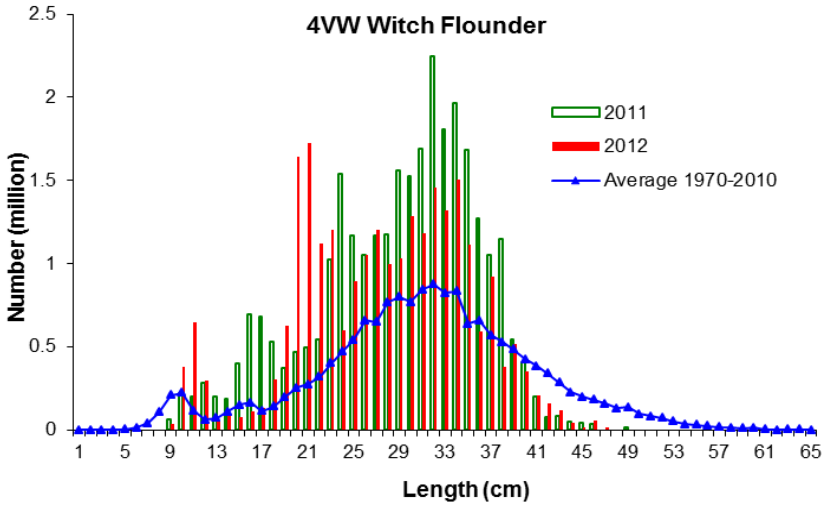

Figure 10e. Length composition for witch flounder in 4VW from the summer RV survey.

Yellowtail flounder

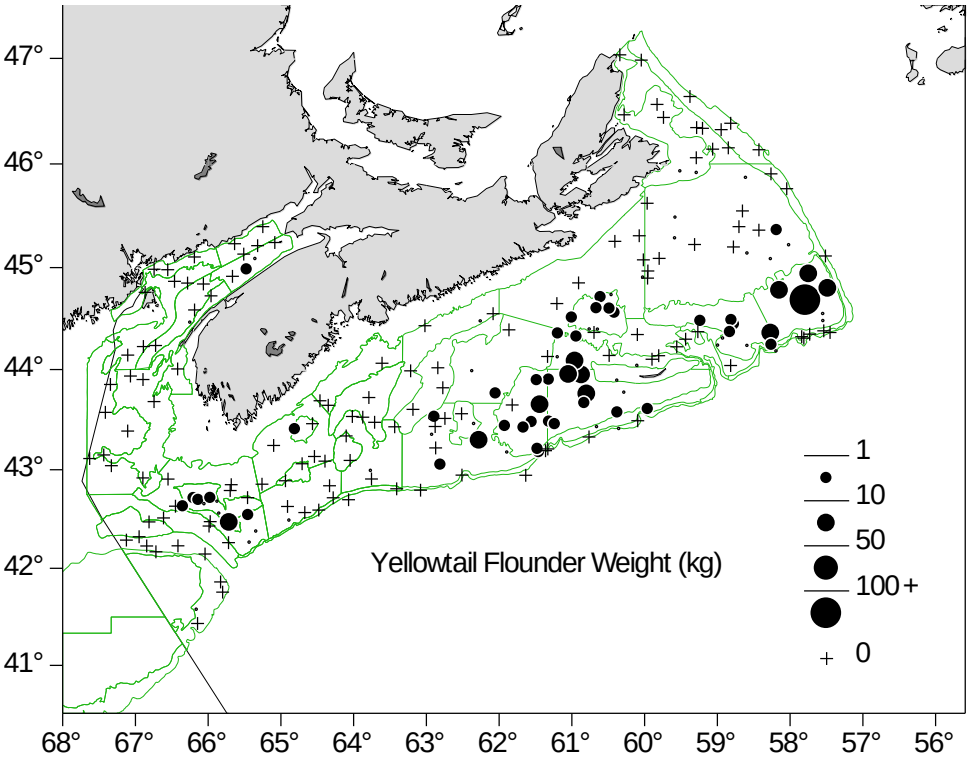

Figure 11a. Distribution and magnitude (weight/tow) of yellowtail flounder catches during the 2012 summer RV survey.

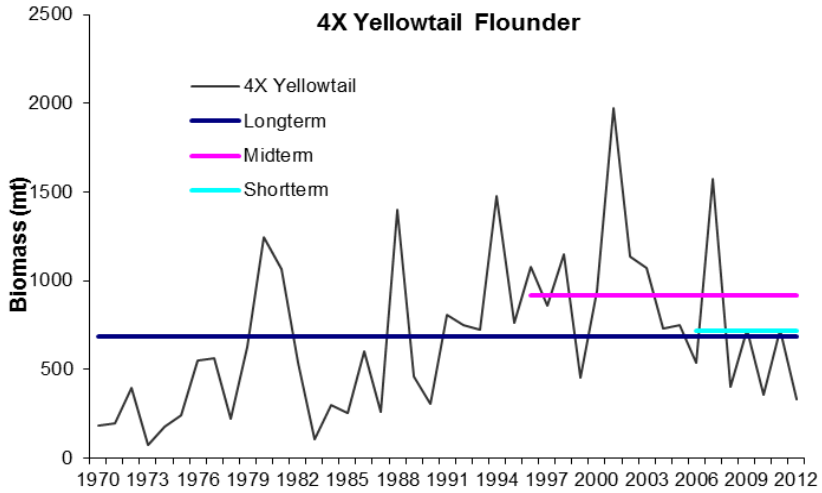

Figure 11b. Biomass indices for yellowtail flounder in 4X from the summer RV survey.

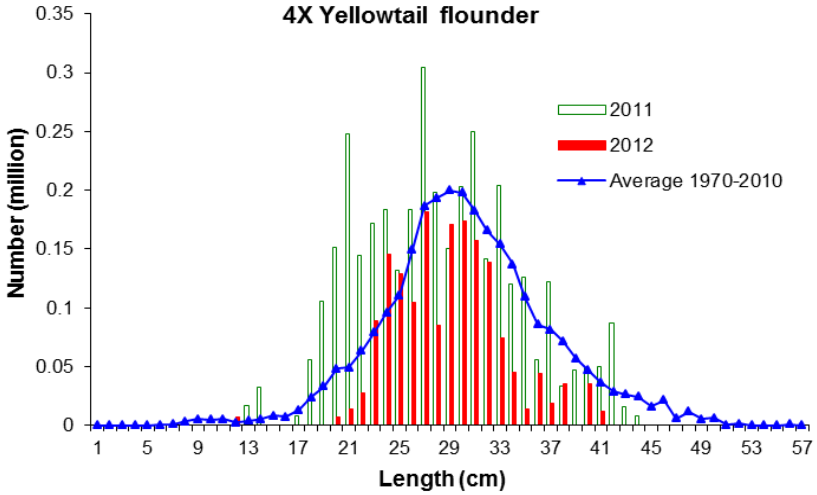

Figure 11c. Length composition for yellowtail flounder in 4X from the summer RV survey.

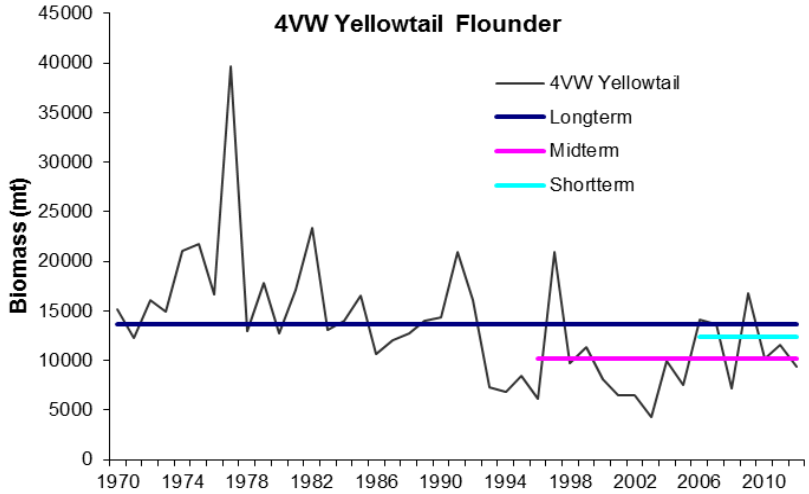

Figure 11d. Biomass indices for yellowtail flounder in 4VW from the summer RV survey.

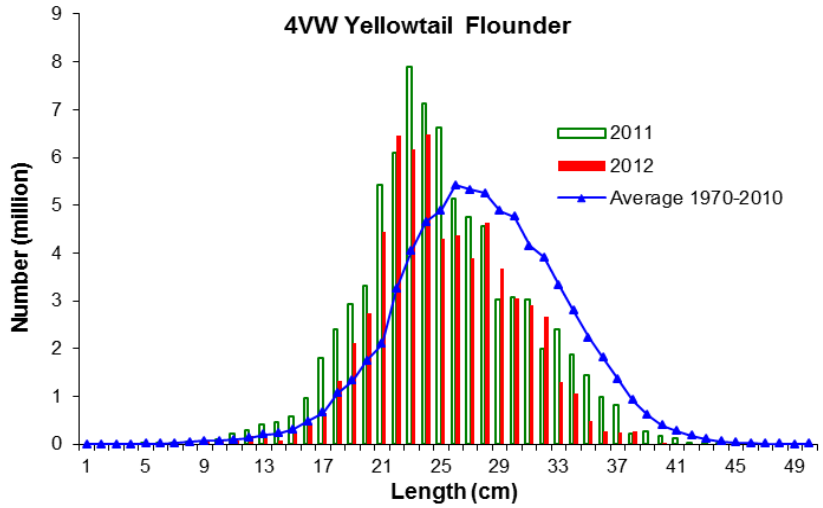

Figure 11e. Length composition for yellowtail flounder in 4VW from the summer RV survey.

Winter flounder

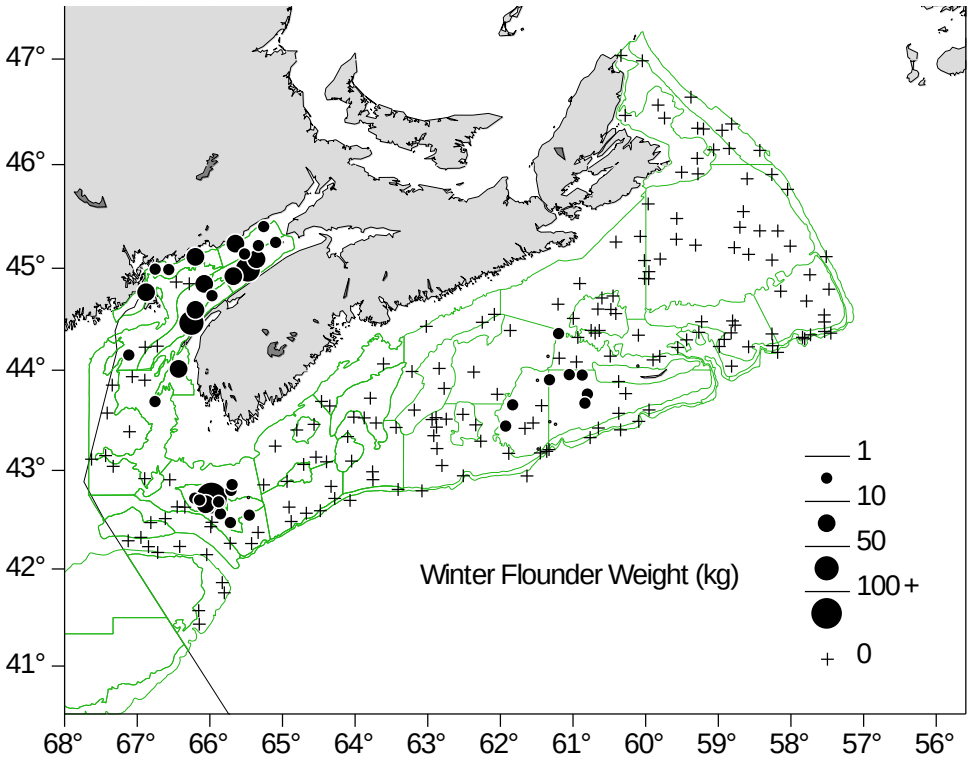

Figure 12a. Distribution and magnitude (weight/tow) of winter flounder catches during the 2012 summer RV survey.

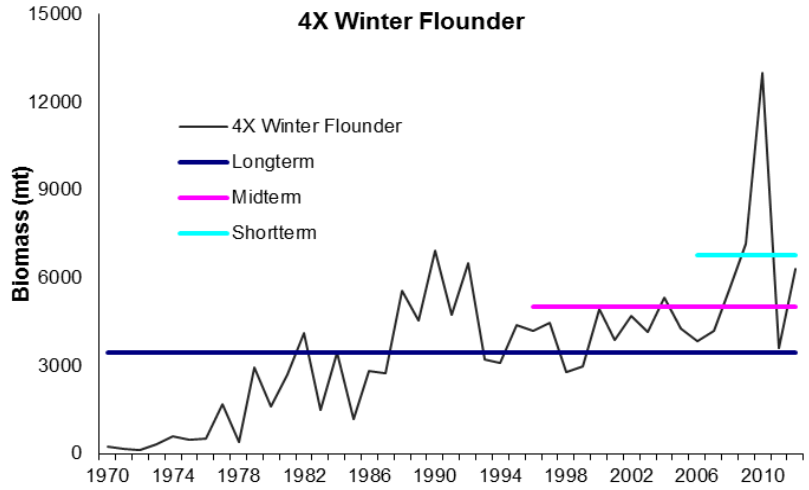

Figure 12b. Biomass indices for winter flounder in 4X from the summer RV survey.

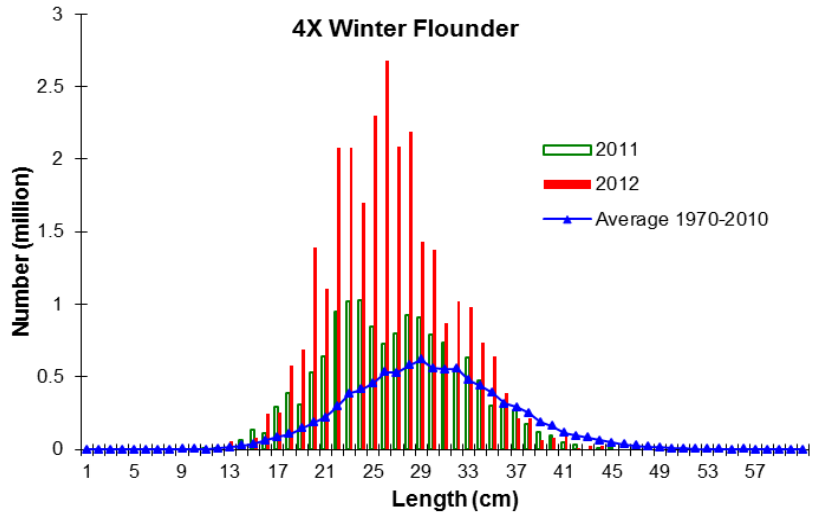

Figure 12c. Length composition for winter flounder in 4X from the summer RV survey.

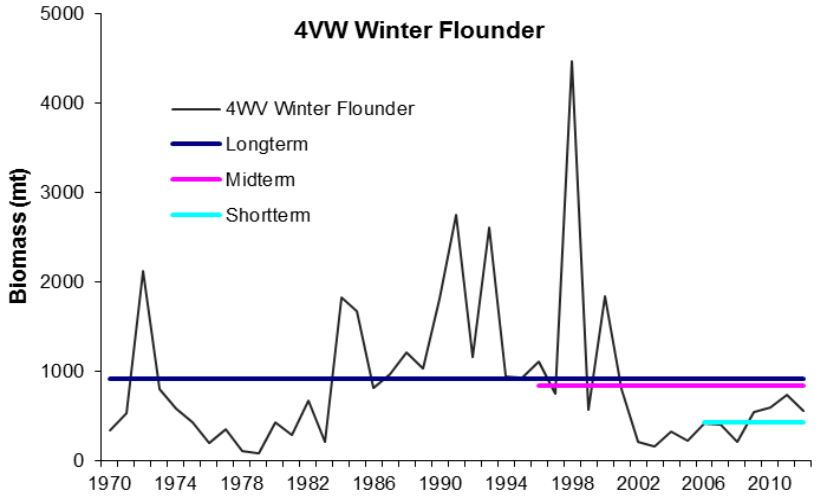

Figure 12d. Biomass indices for winter flounder in 4VW from the summer RV survey.

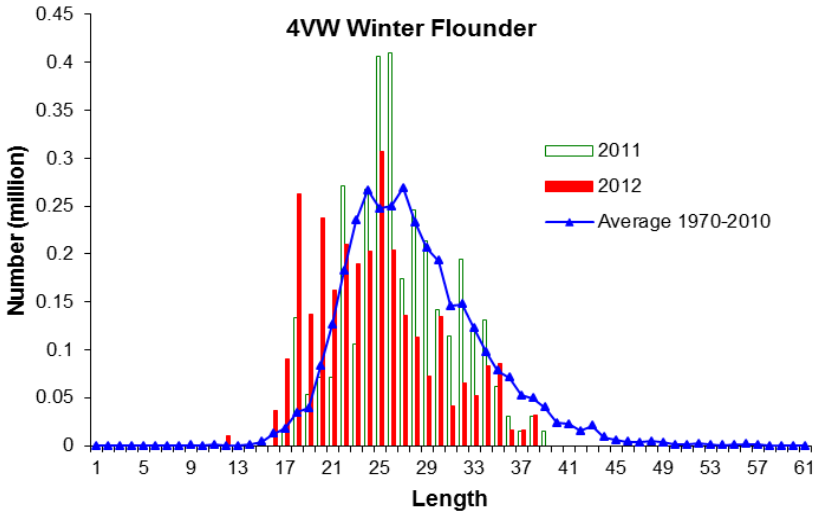

Figure 12e. Length composition for winter flounder in 4VW from the summer RV survey.

Atlantic halibut

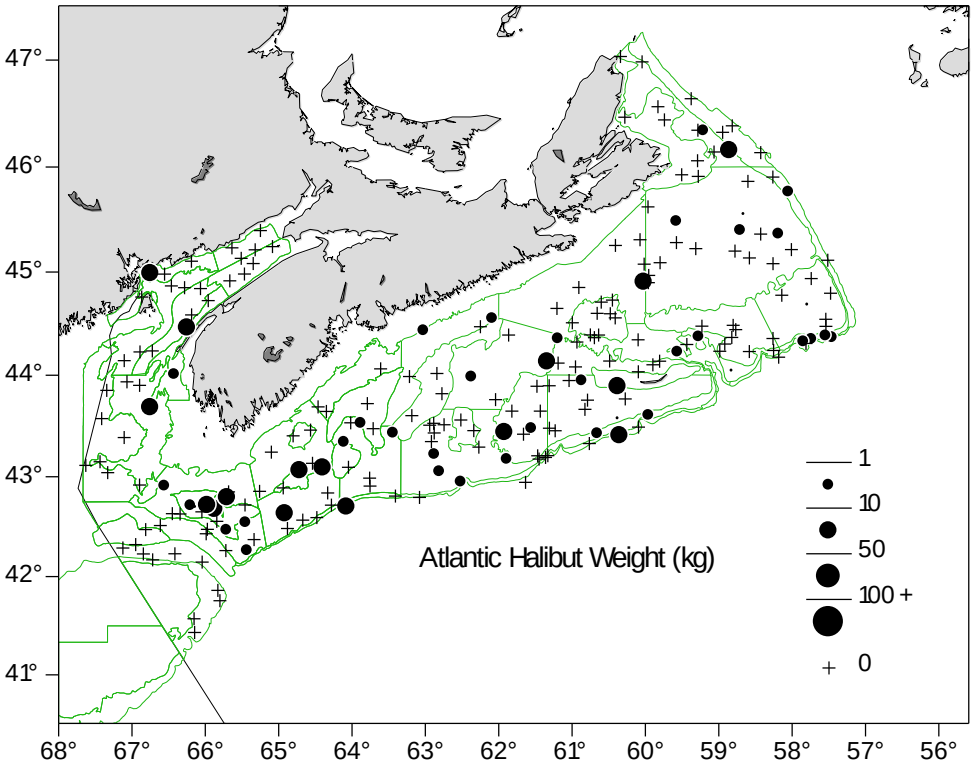

Figure 13a. Distribution and magnitude (weight/tow) of Atlantic halibut catches during the 2012 summer RV survey.

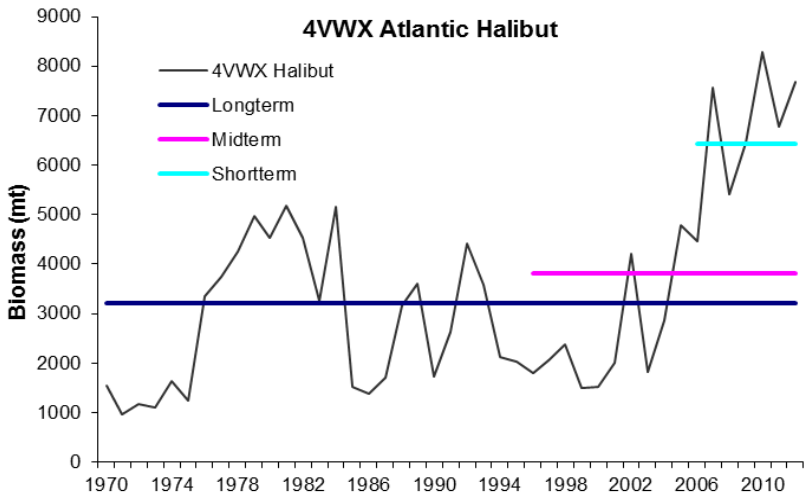

Figure 13b. Biomass indices for Atlantic halibut in the portion of 3NOPs4VWX+5 covered (4VWX5) from the summer RV survey.

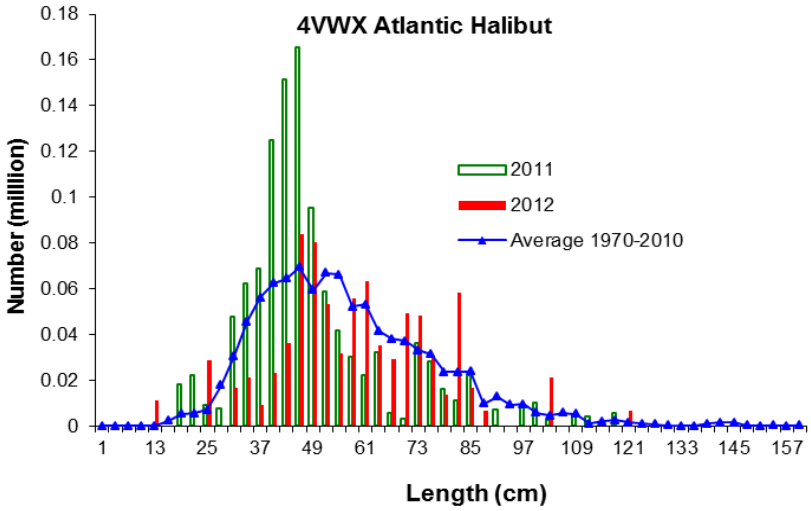

Figure 13c. Length composition for Atlantic halibut in the portion of 3NOPs4VWX+5 covered (4VWX5) from the summer RV survey.

Atlantic wolffish

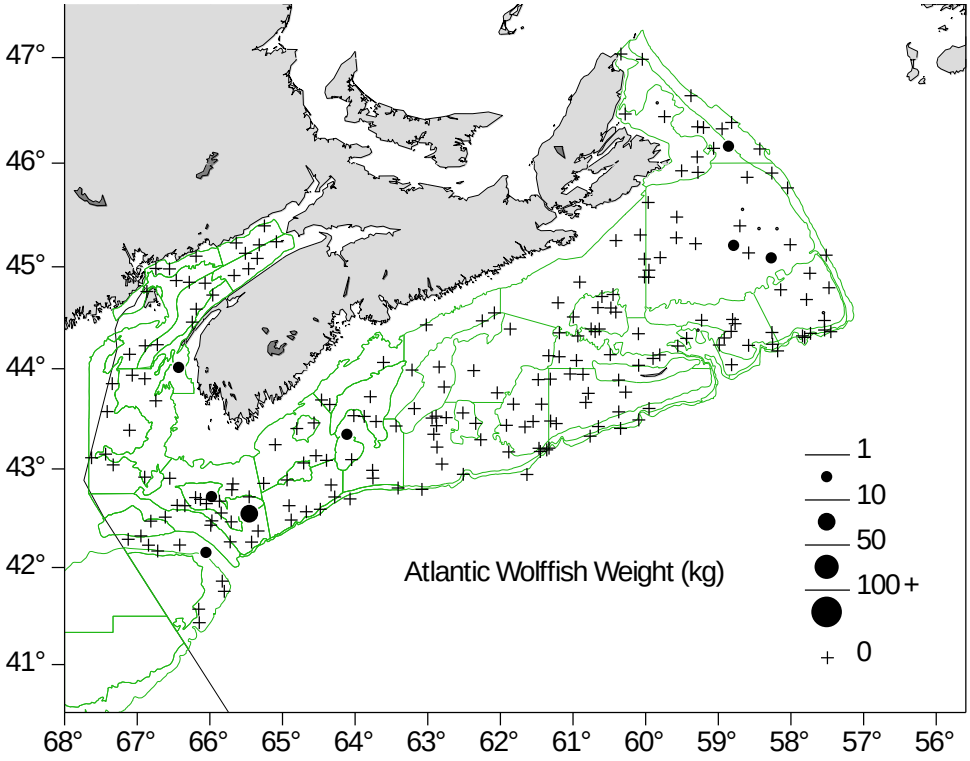

Figure 14a. Distribution and magnitude (weight/tow) of Atlantic wolffish catches during the 2012 summer RV survey.

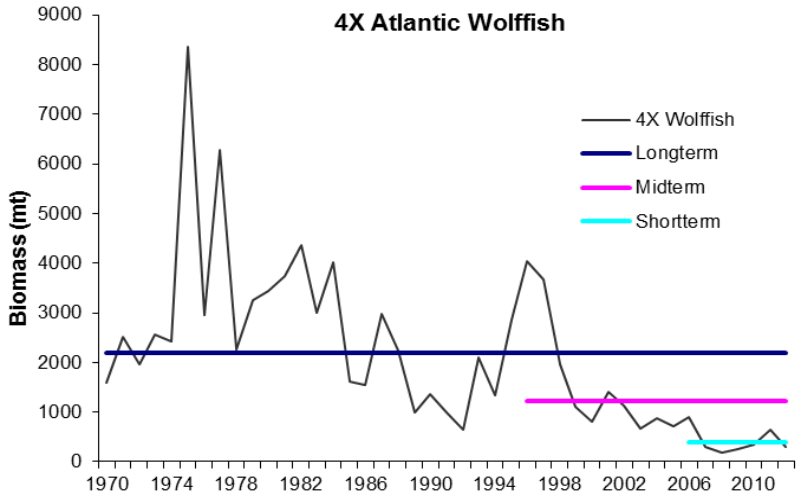

Figure 14b. Biomass indices for Atlantic wolffish in 4X from the summer RV survey.

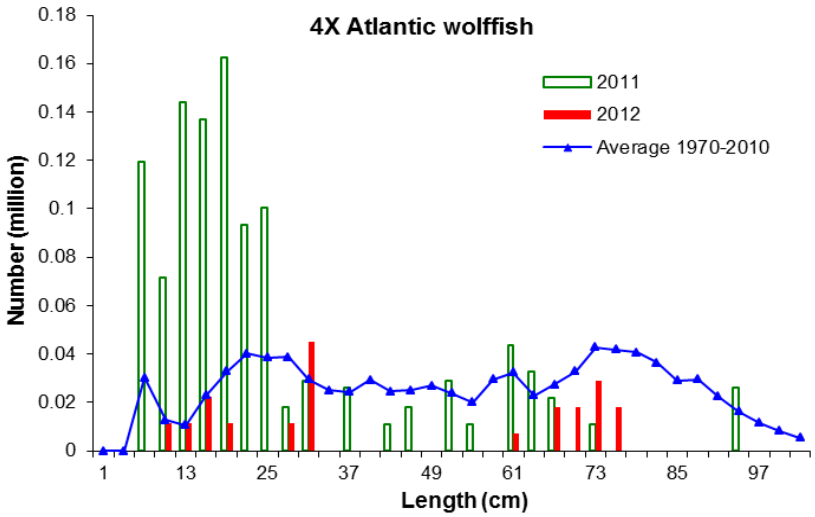

Figure 14c. Length composition for Atlantic wolffish in 4X from the summer RV survey.

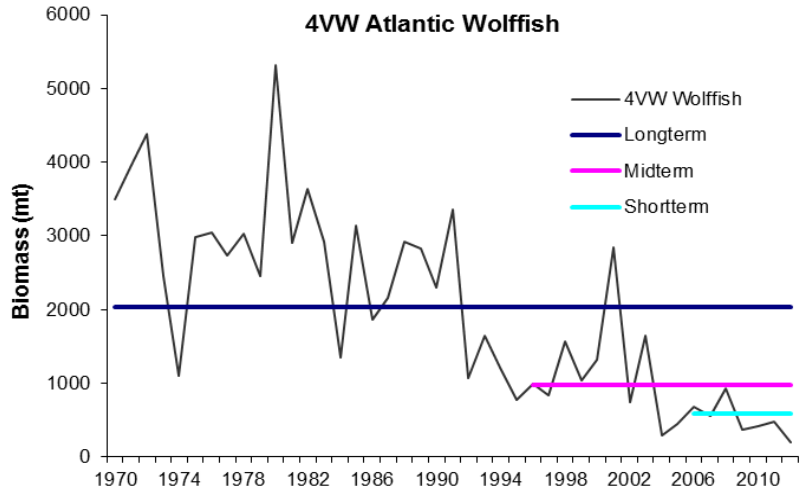

Figure 14d. Biomass indices for Atlantic wolffish in 4VW from the summer RV survey

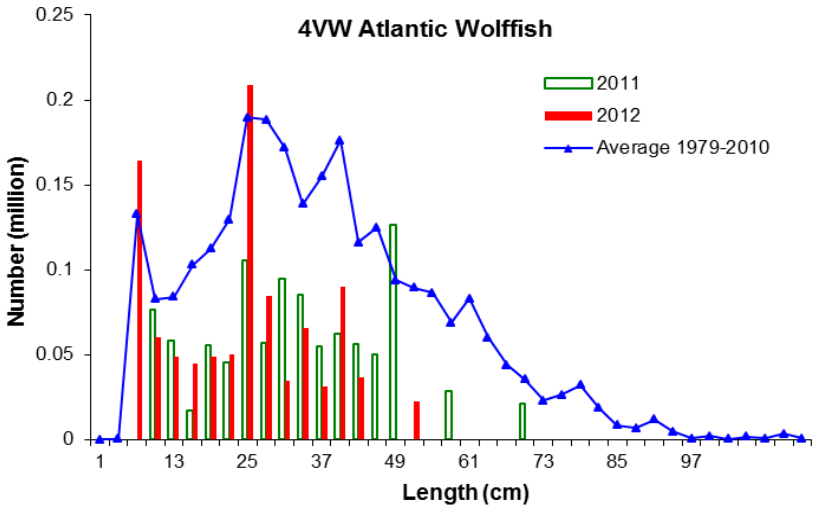

Figure 14e. Length composition for Atlantic wolffish in 4VW from the summer RV survey.

Monkfish

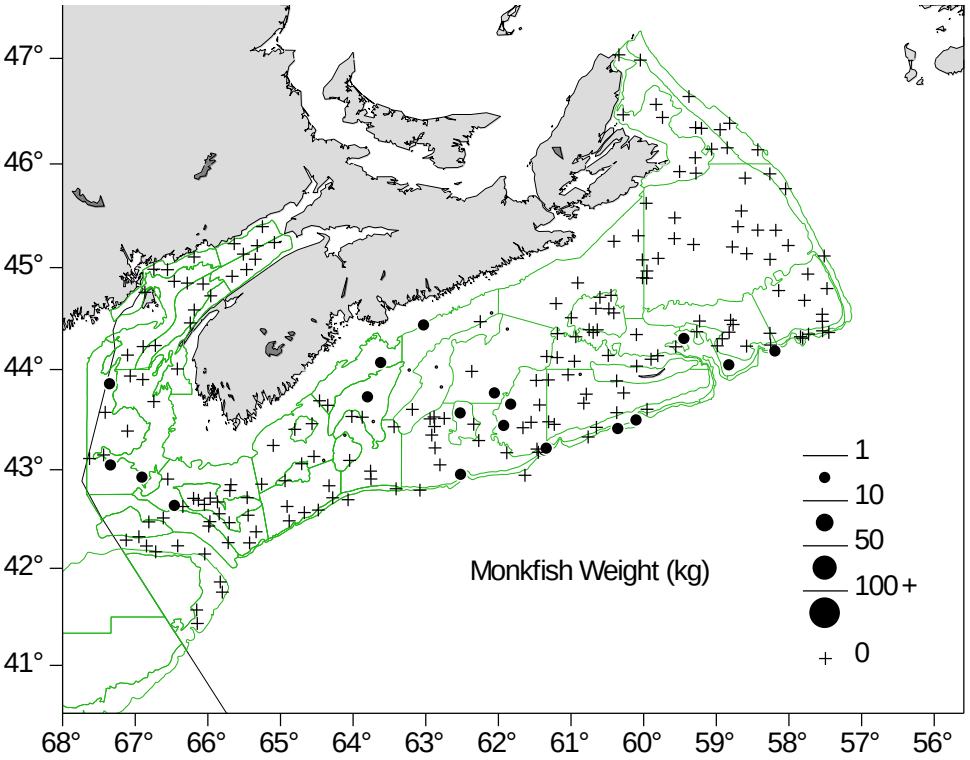

Figure 15a. Distribution and magnitude (weight/tow) of monkfish catches during the 2012 summer RV survey.

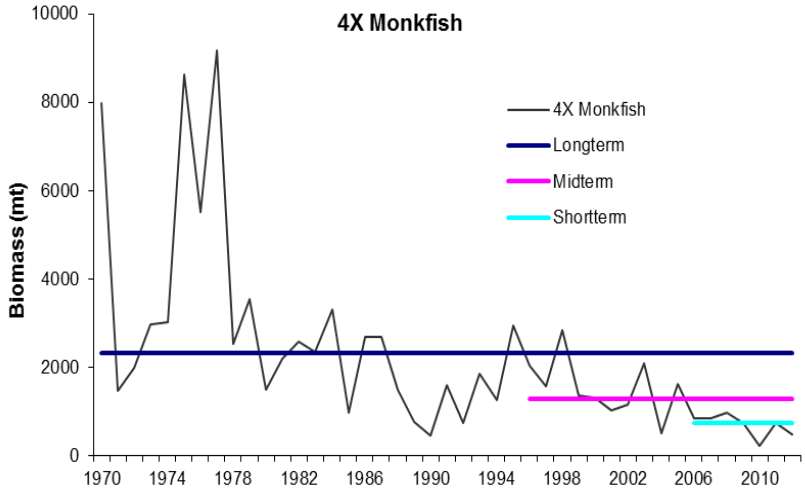

Figure 15b. Biomass indices for monkfish in 4X from the summer RV survey.

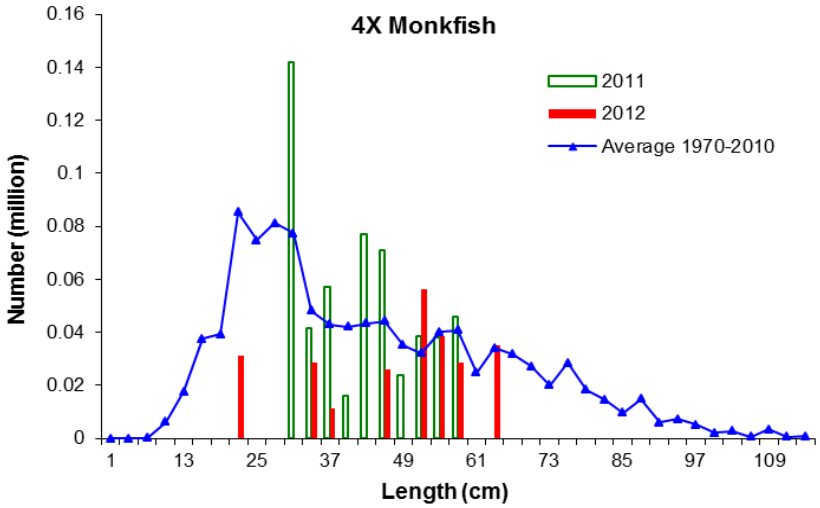

Figure 15c. Length composition for monkfish in 4X from the summer RV survey.

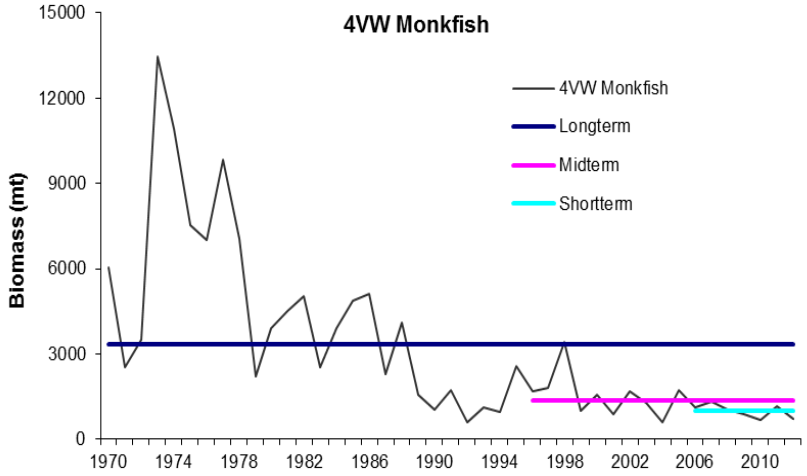

Figure 15d. Biomass indices for monkfish in 4VW from the summer RV survey.

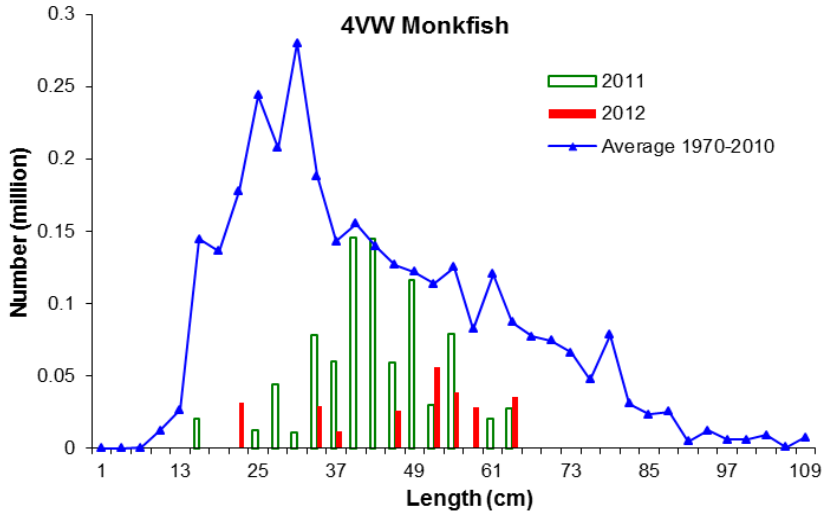

Figure 15e. Length composition for monkfish in 4VW from the summer RV survey.

Smooth skate

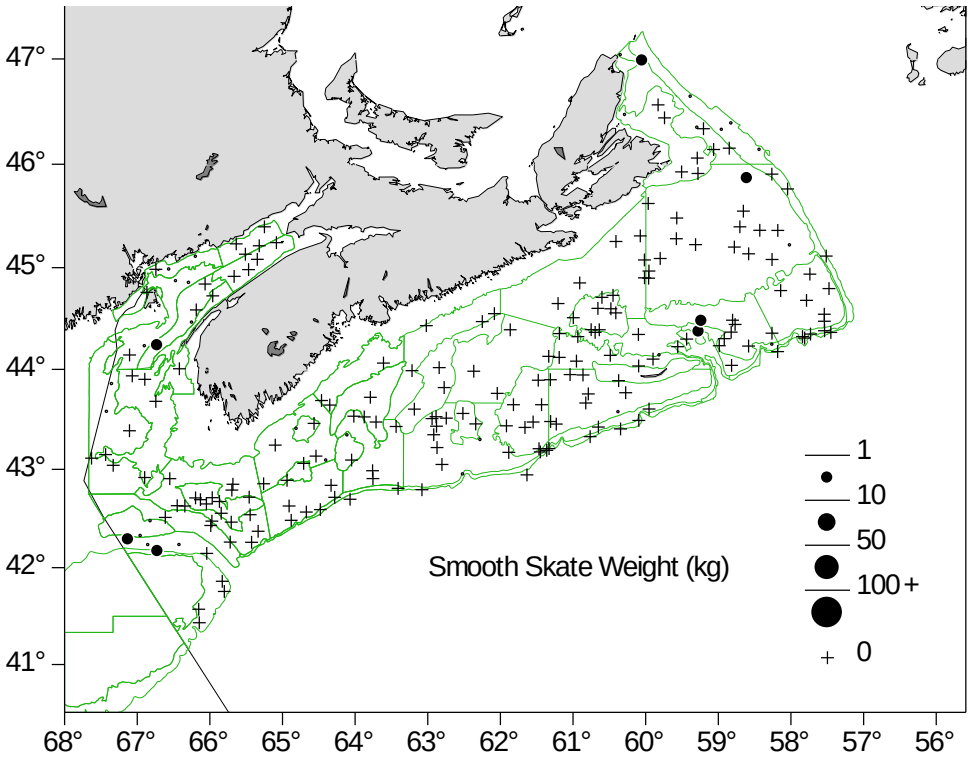

Figure 16a. Distribution and magnitude (weight/tow) of smooth skate catches during the 2012 summer RV survey.

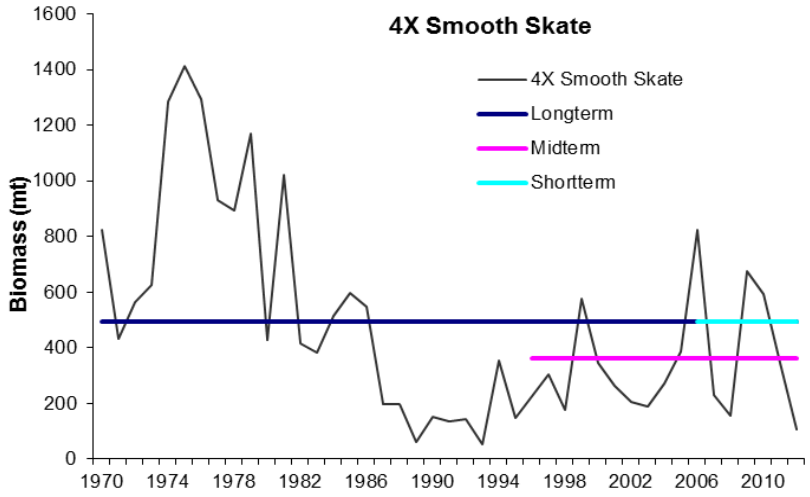

Figure 16b. Biomass indices for smooth skate in 4X from the summer RV survey.

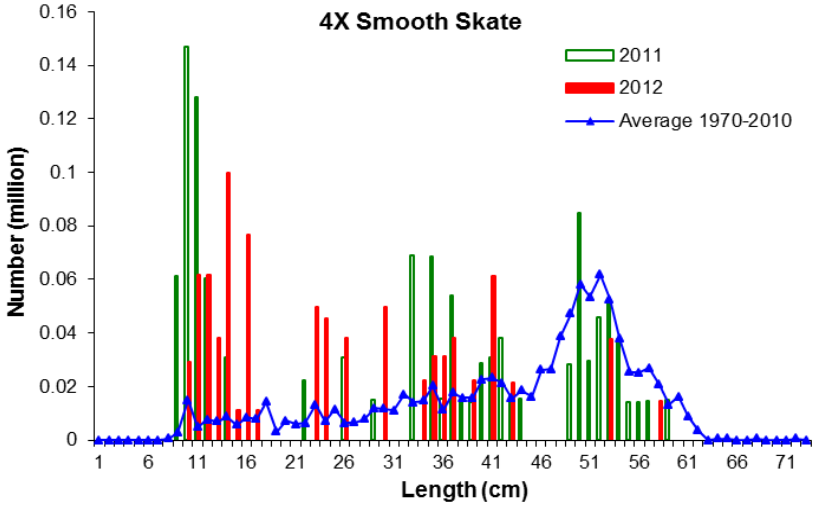

Figure 16c. Length composition for smooth skate in 4X from the summer RV survey.

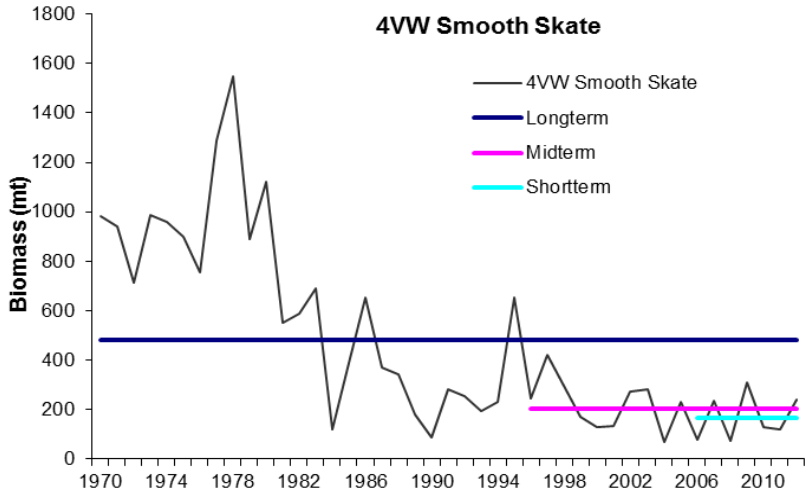

Figure 16d. Biomass indices for smooth skate in 4VW from the summer RV survey.

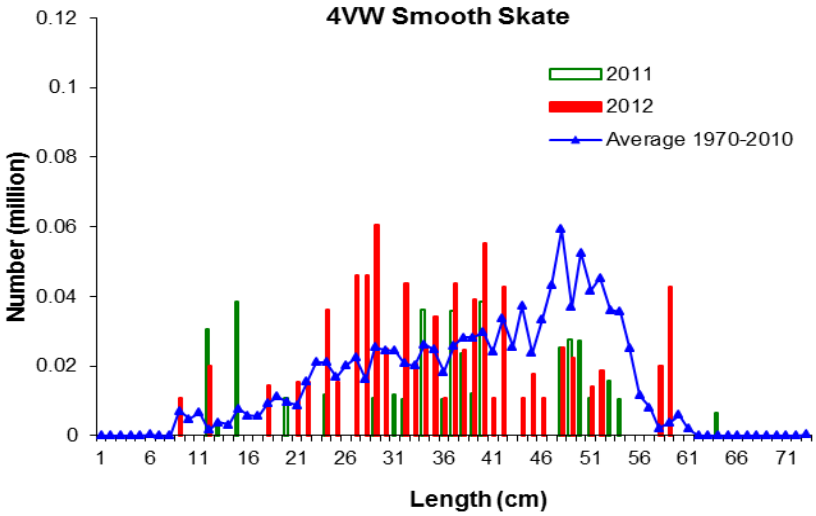

Figure 16e. Length composition for smooth skate in 4VW from the summer RV survey.

Thorny skate

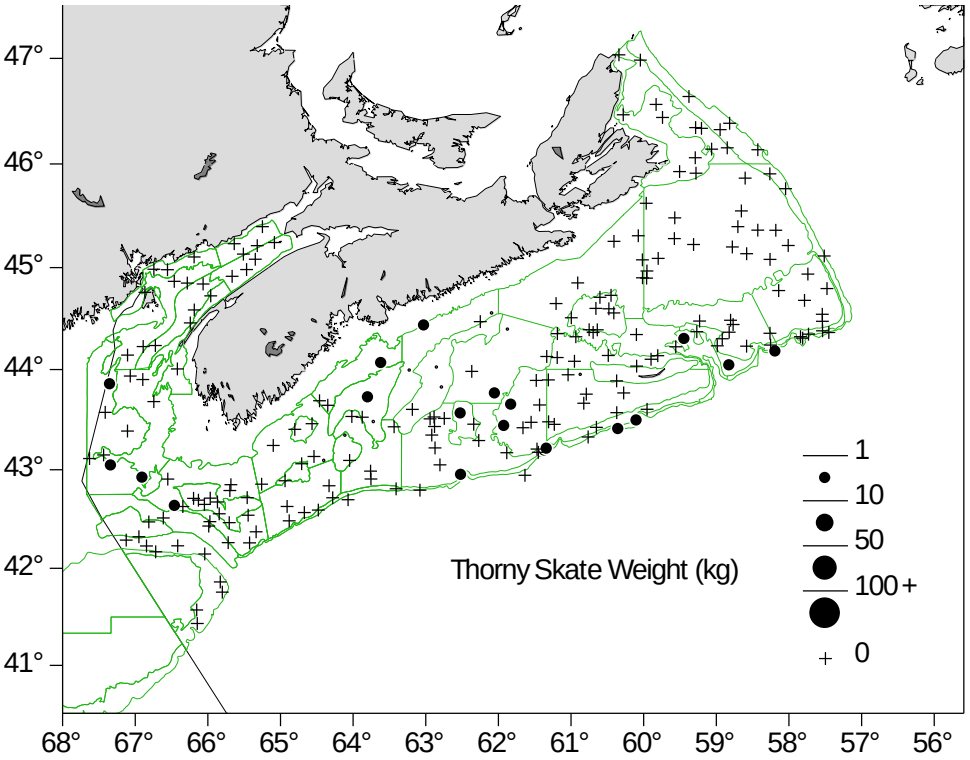

Figure 17a. Distribution and magnitude (weight/tow) of thorny skate catches during the 2012 summer RV survey.

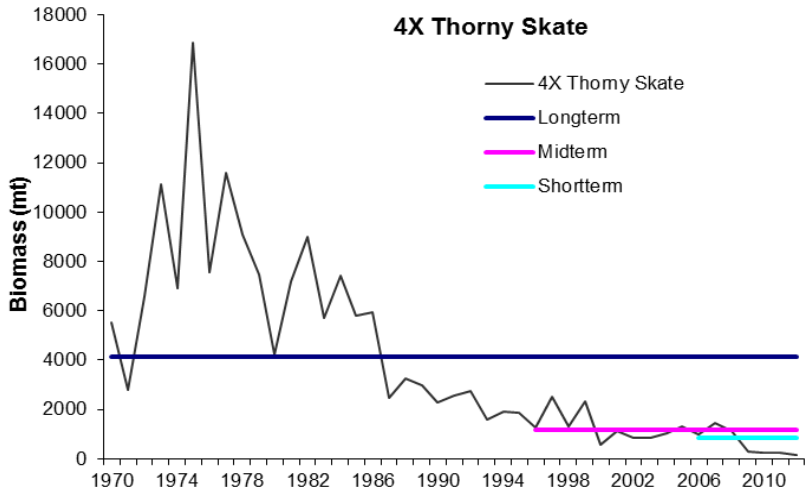

Figure 17b. Biomass indices for thorny skate in 4X from the summer RV survey.

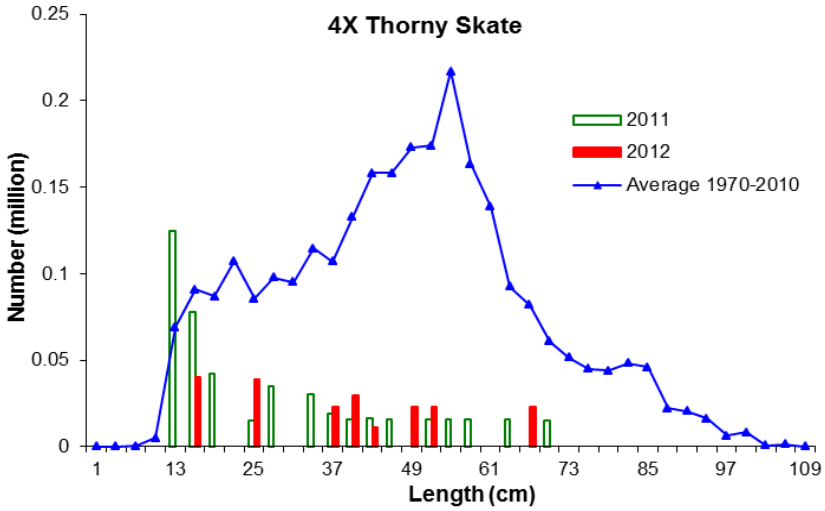

Figure 17c. Length composition for thorny skate in 4X from the summer RV survey.

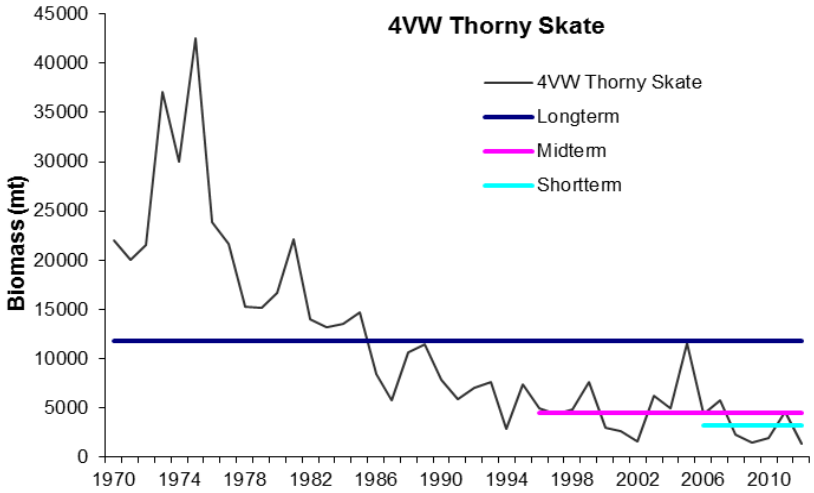

Figure 17d. Biomass indices for thorny skate in 4VW from the summer RV survey.

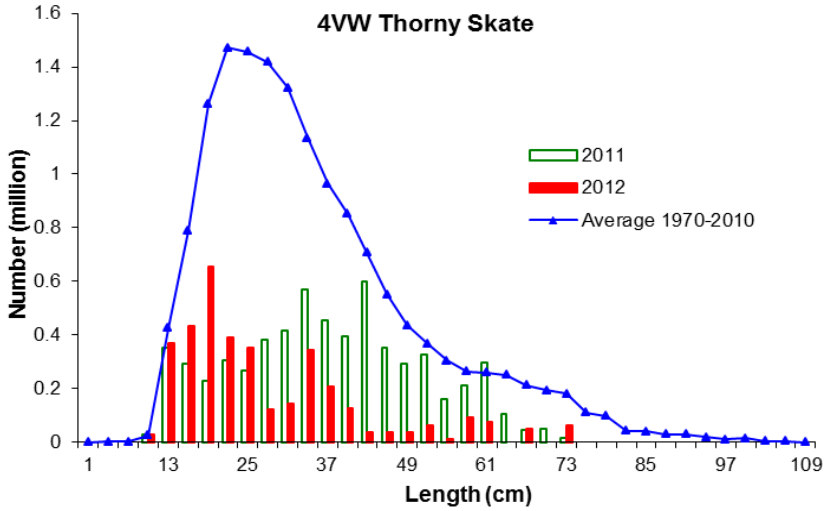

Figure 17e. Length composition for thorny skate in 4VW from the summer RV survey.

Barndoor skate

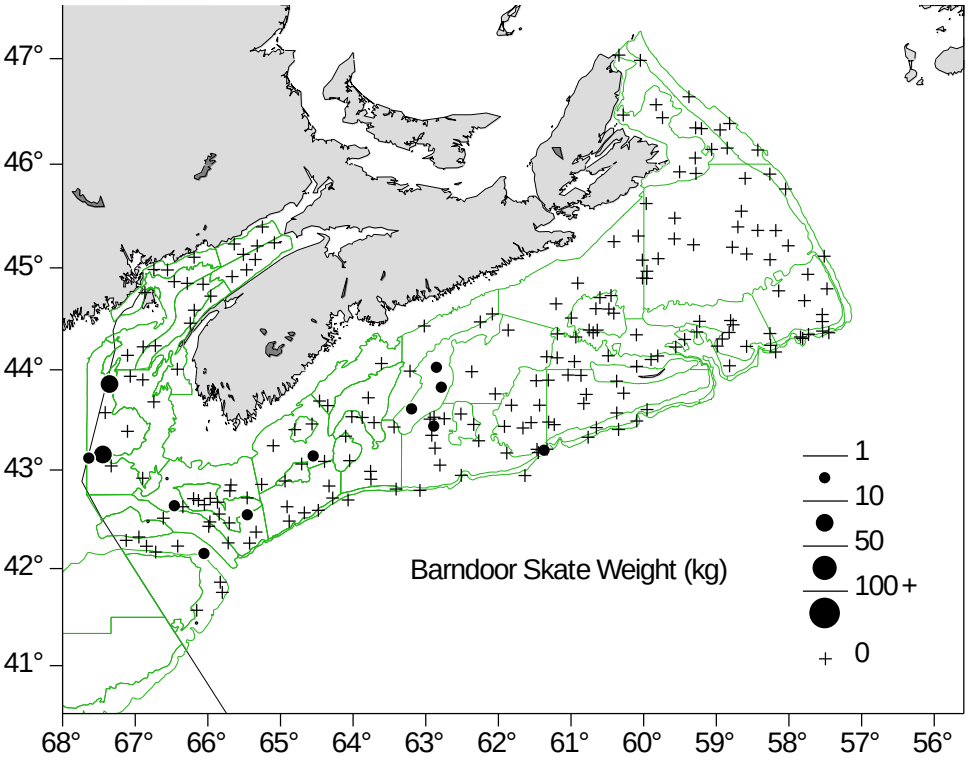

Figure 18a. Distribution and magnitude (weight/tow) of barndoor skate catches during the 2012 summer RV survey.

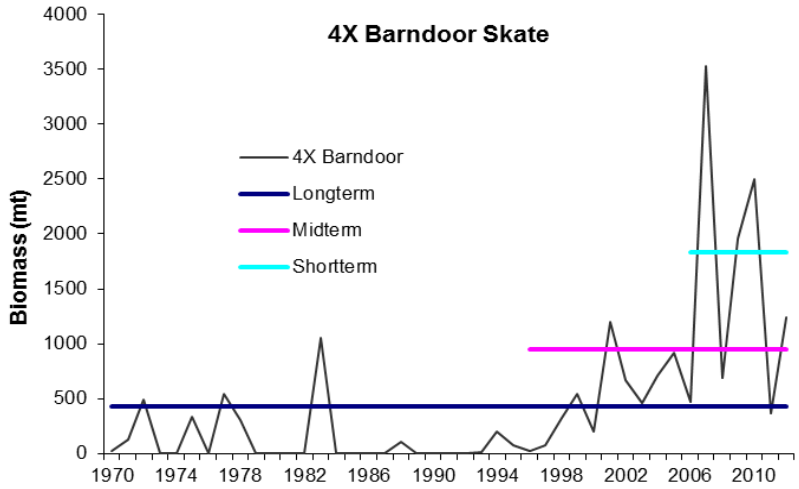

Figure 18b. Biomass indices for barndoor skate in 4X from the summer RV survey.

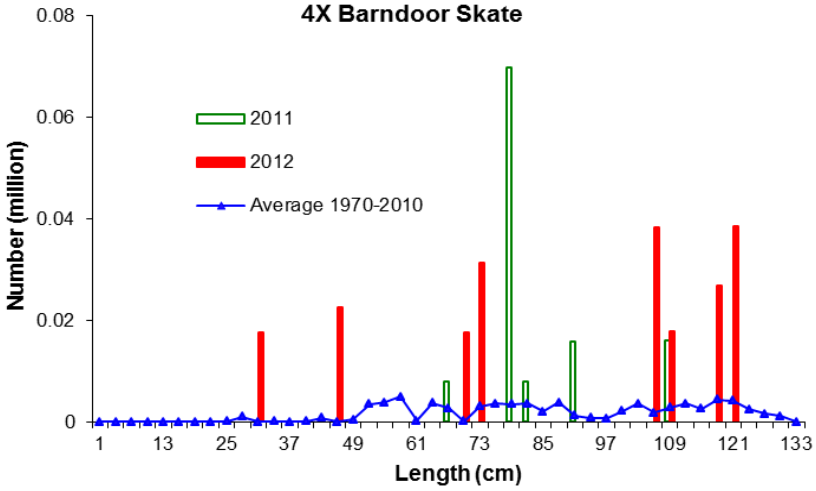

Figure 18c. Length composition for barndoor skate in 4X from the summer RV survey.

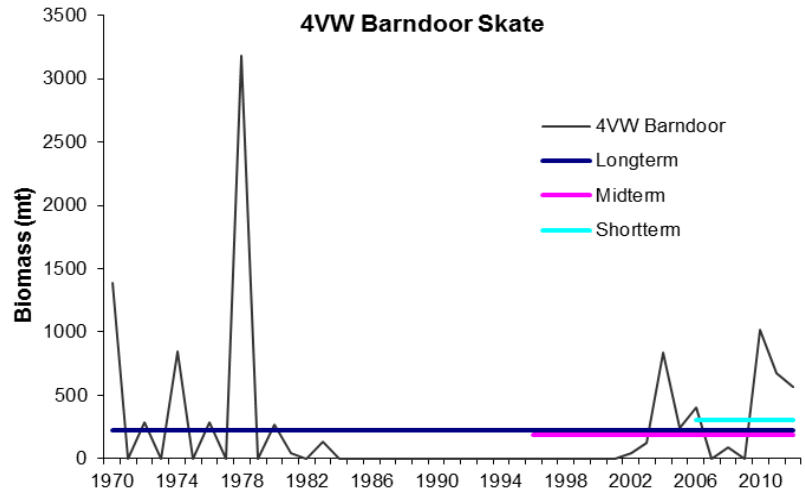

Figure 18d. Biomass indices for barndoor skate in 4VW from the summer RV survey.

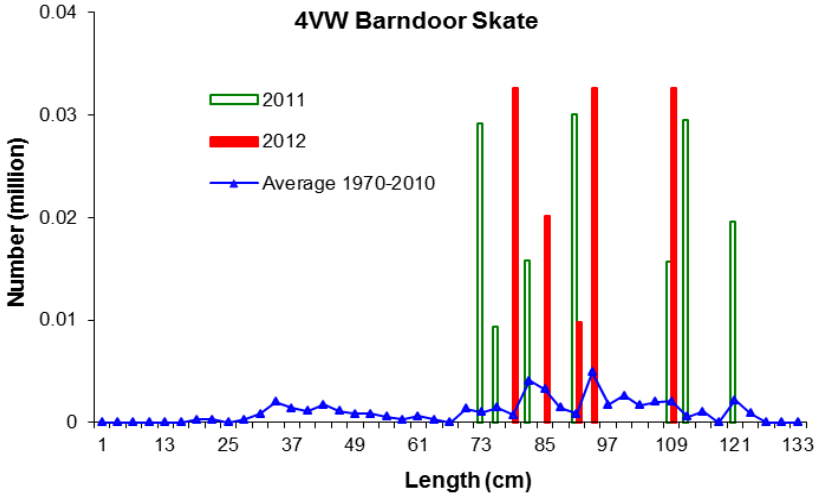

Figure 18e. Length composition for barndoor skate in 4VW from the summer RV survey.

Winter skate and **little skate** cannot be reliably distinguished at lengths less than about 35 cm. Given that the majority of the winter and little skates captured in the surveys are in this length range, the biomass trends are influenced by the contribution of fish for which identification is uncertain (for more information see McEachran and Musick, 1973).

Winter skate

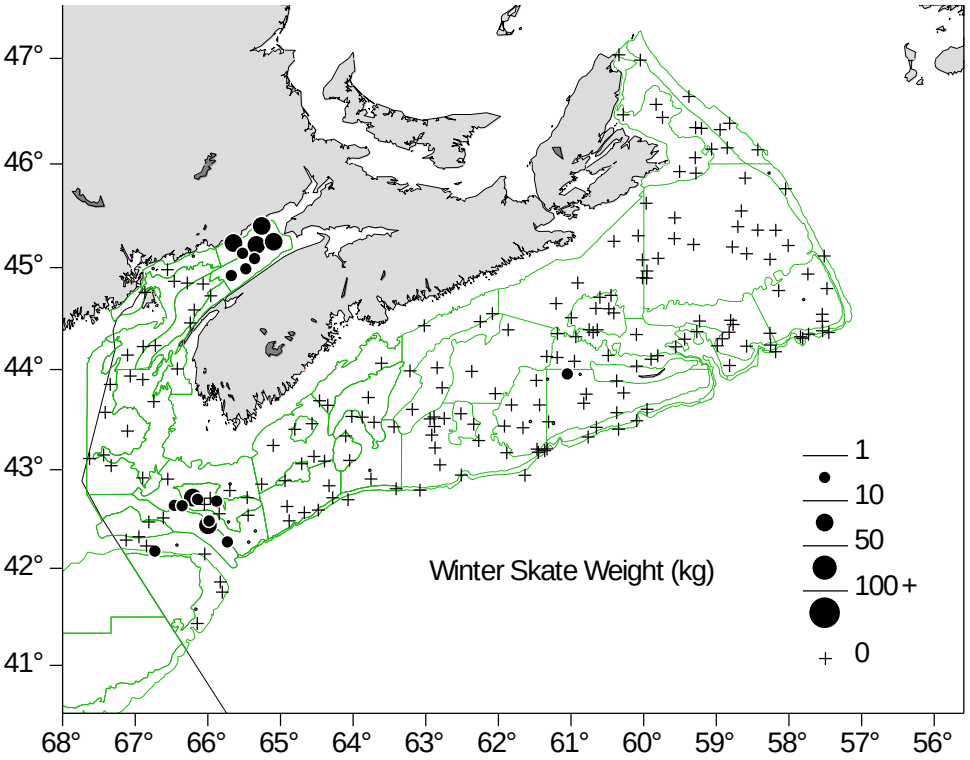

Figure 19a. Distribution and magnitude (weight/tow) of winter skate catches during the 2012 summer RV survey.

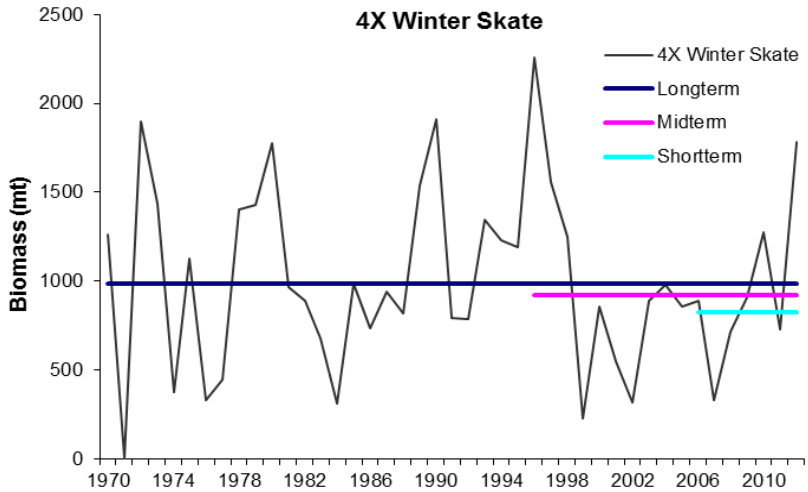

Figure 19b. Biomass indices for winter skate in 4X from the summer RV survey.

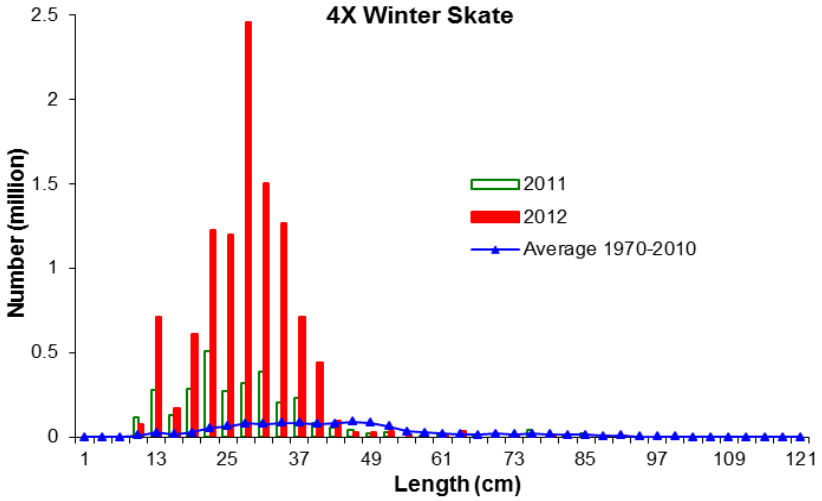

Figure 19c. Length composition for winter skate in 4X from the summer RV survey.

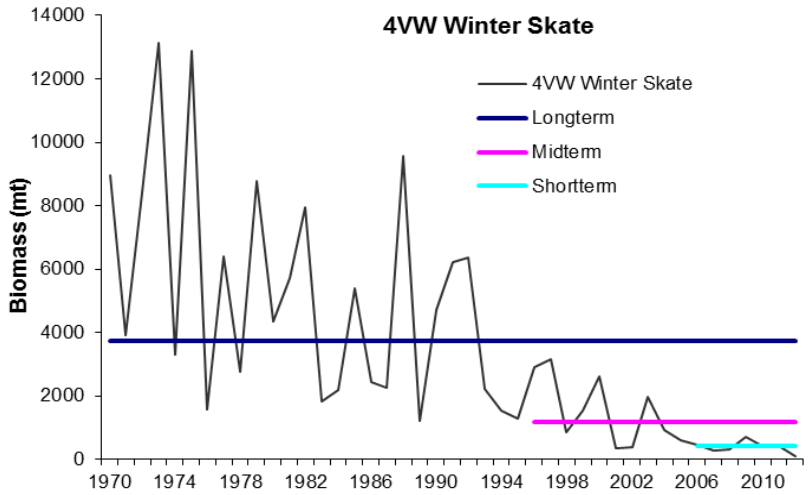

Figure 19d. Biomass indices for winter skate in 4VW from the summer RV survey.

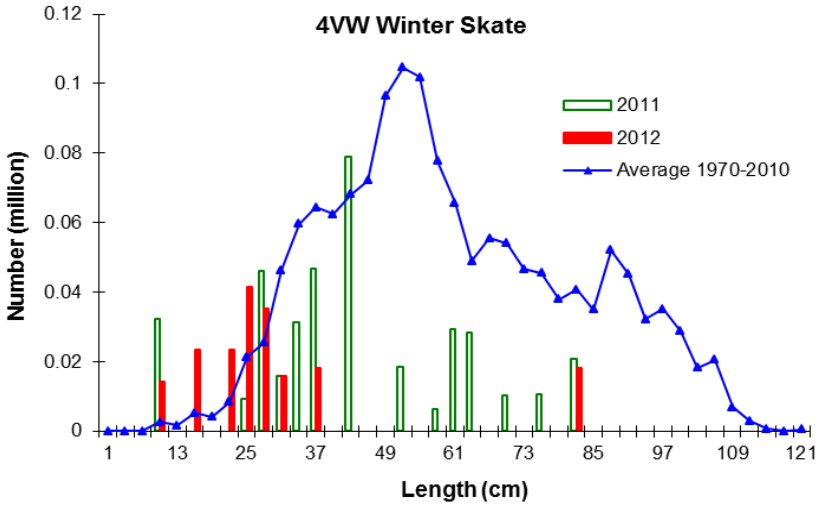

Figure 19e. Length composition for winter skate in 4VW from the summer RV survey.

Little skate

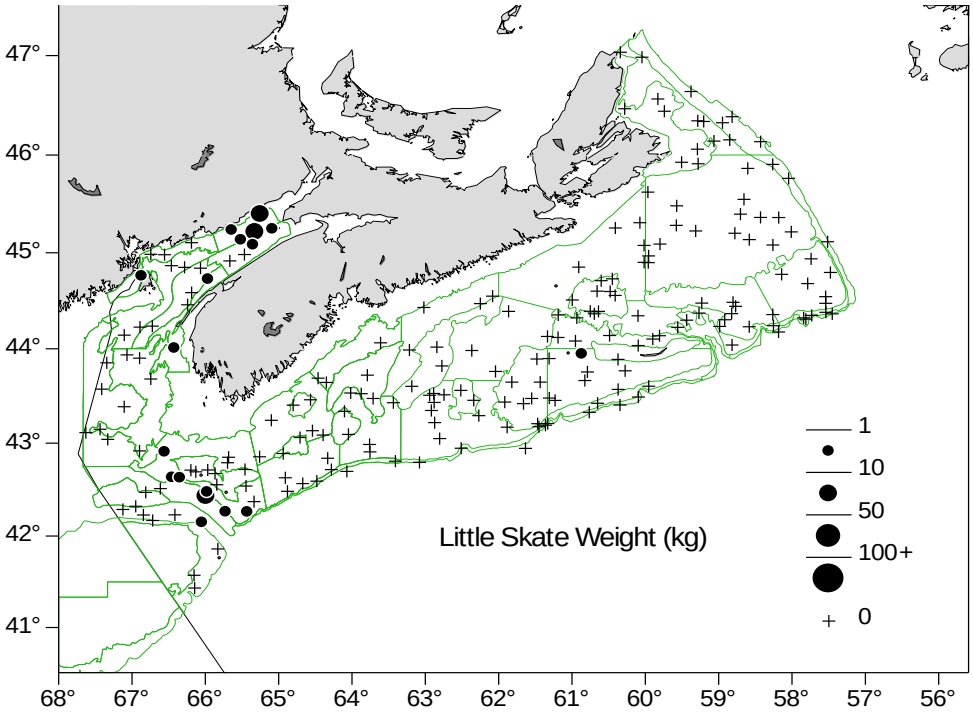

Figure 20a. Distribution and magnitude (weight/tow) of little skate catches during the 2012 summer RV survey.

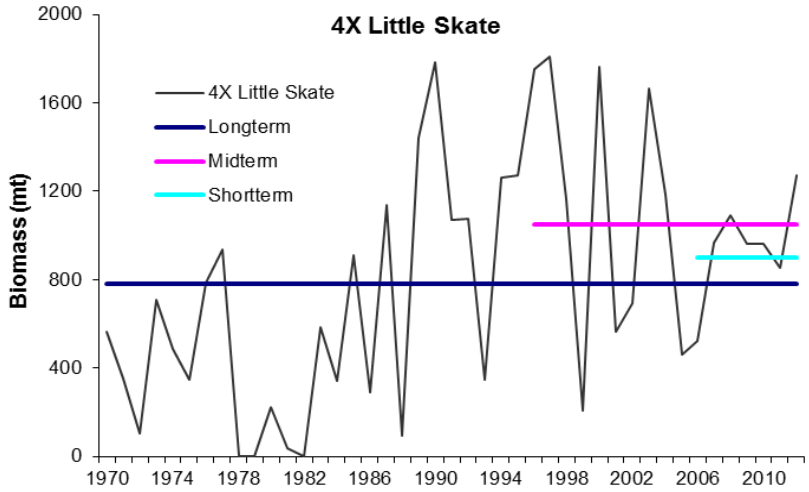

Figure 20b. Biomass indices for little skate in 4X from the summer RV survey.

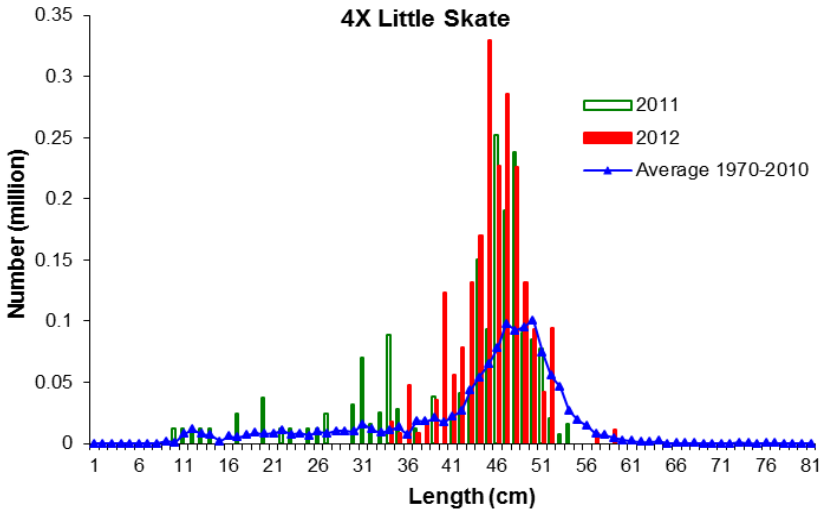

Figure 20c. Length composition for little skate in 4X from the summer RV survey.

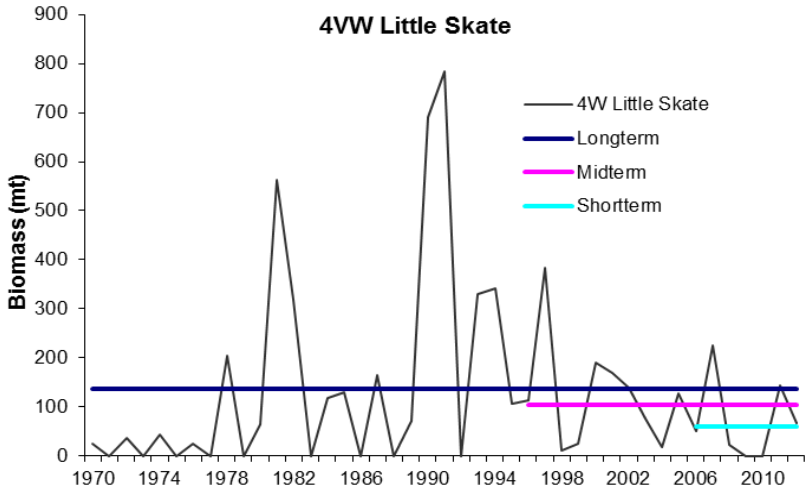

Figure 20d. Biomass indices for little skate in 4VW from the summer RV survey.

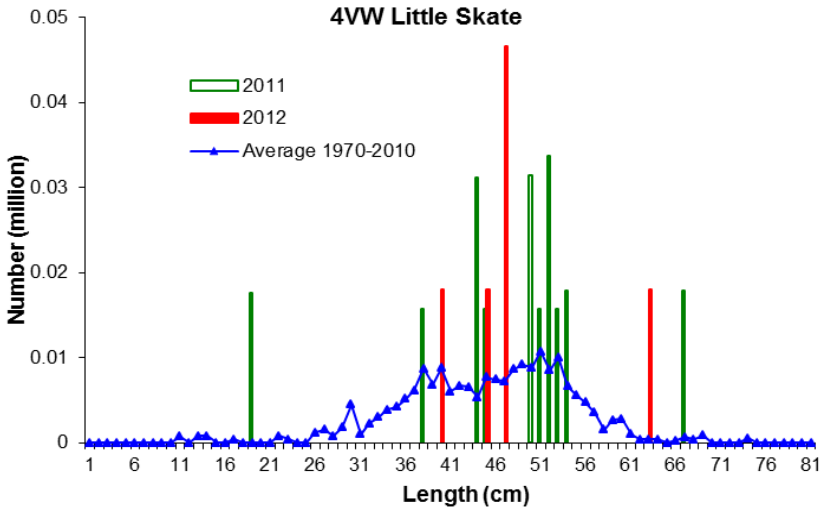

Figure 20e. Length composition for little skate in 4VW from the summer RV survey.

Spiny dogfish

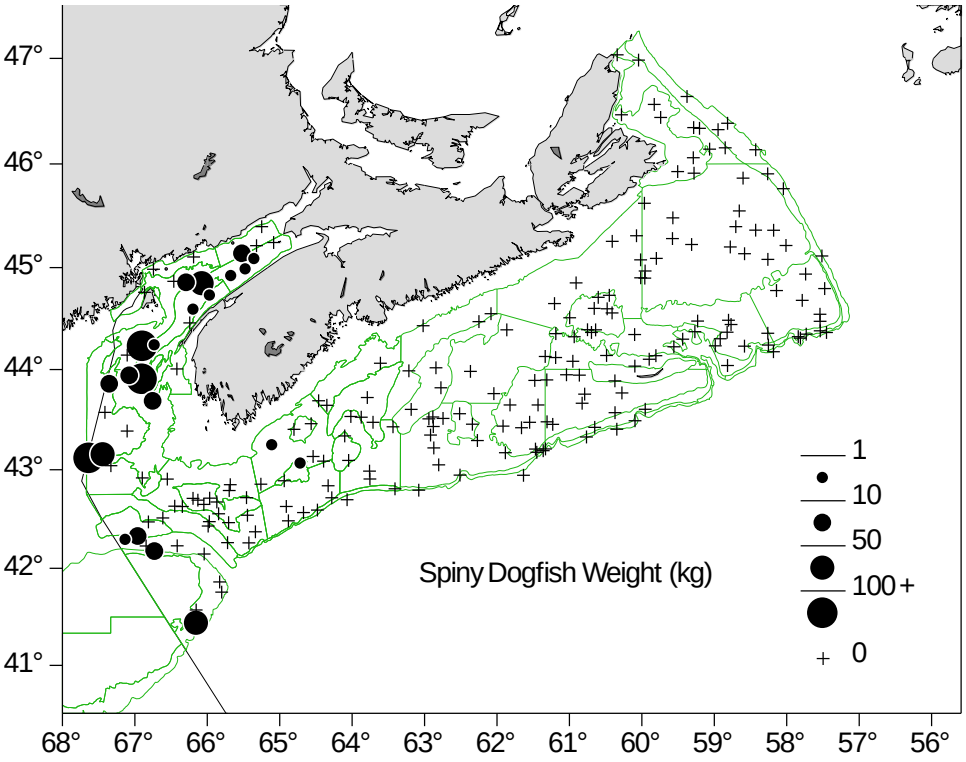

Figure 21a. Distribution and magnitude (weight/tow) of spiny dogfish catches during the 2012 summer RV survey.

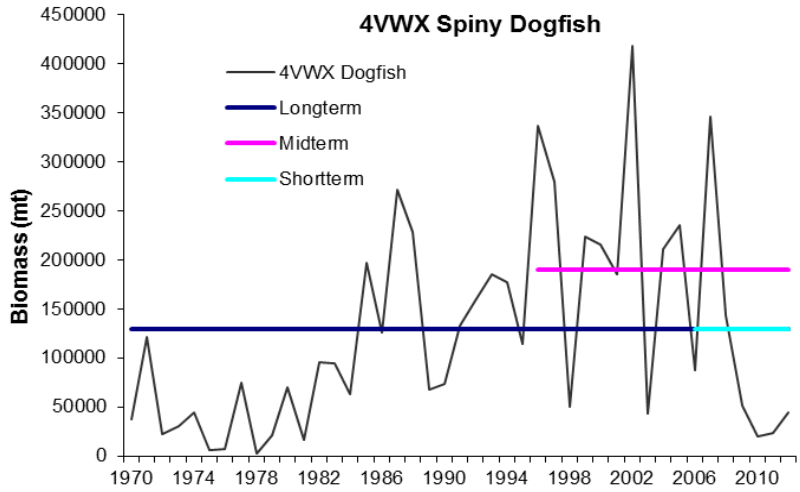

Figure 21b. Biomass indices for spiny dogfish in 4VWX from the summer RV survey.

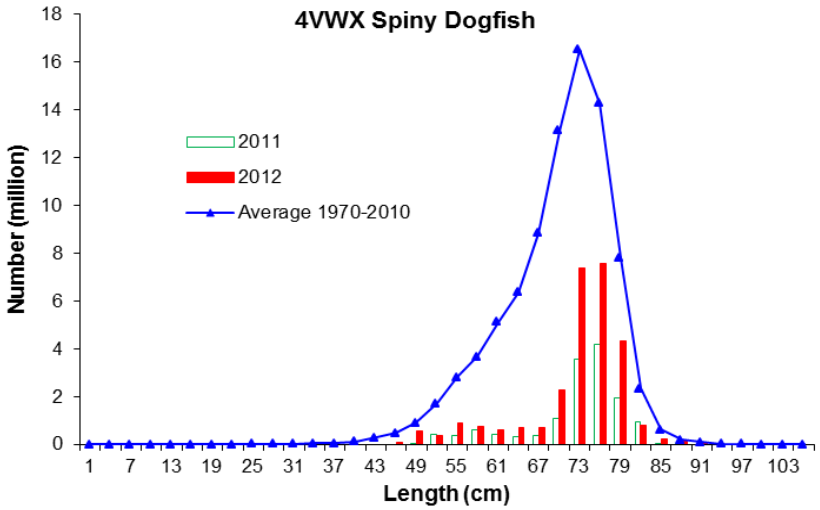

Figure 21c. Length composition for spiny dogfish in 4VWX from the summer RV survey.

Longhorn sculpin

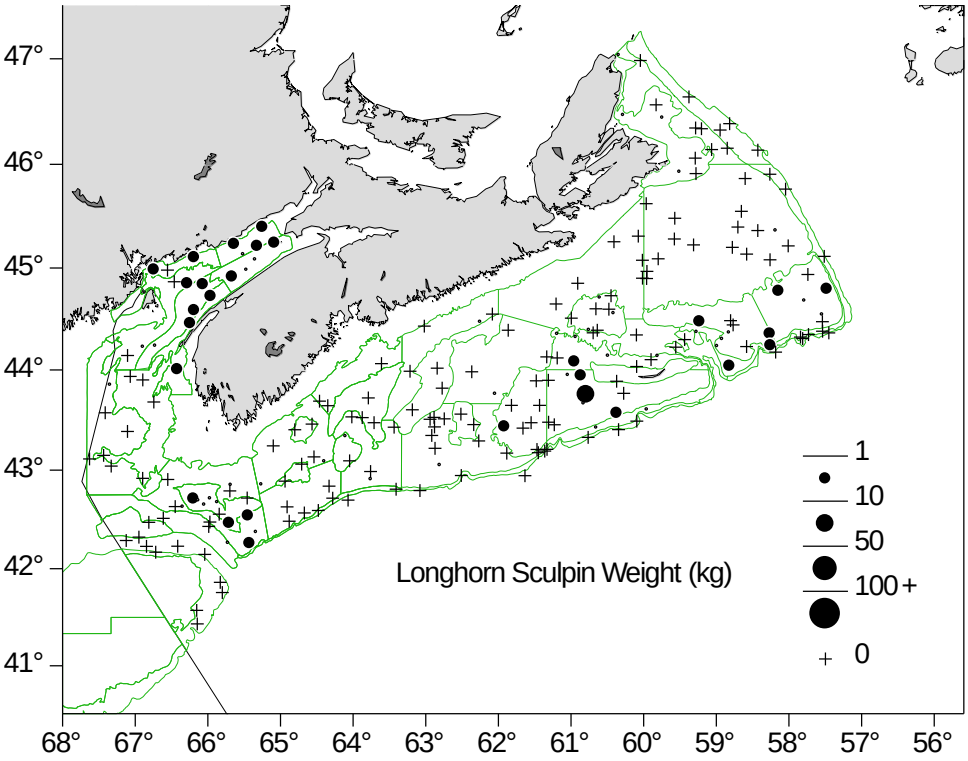

Figure 22a. Distribution and magnitude (weight/tow) of longhorn sculpin catches during the 2012 summer RV survey.

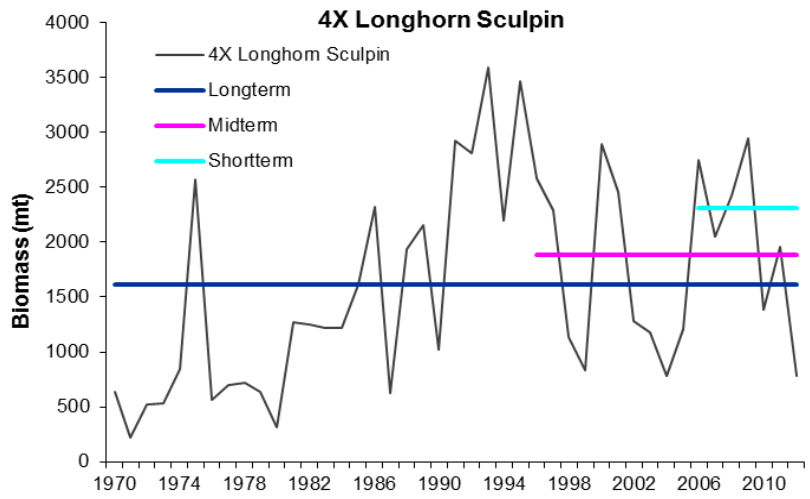

Figure 22b. Biomass indices for longhorn sculpin in 4X from the summer RV survey.

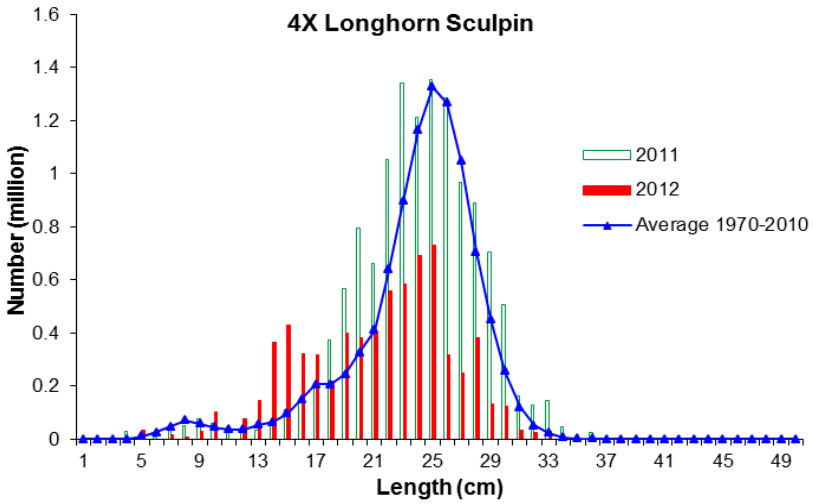

Figure 22c. Length composition for longhorn sculpin in 4X from the summer RV survey.

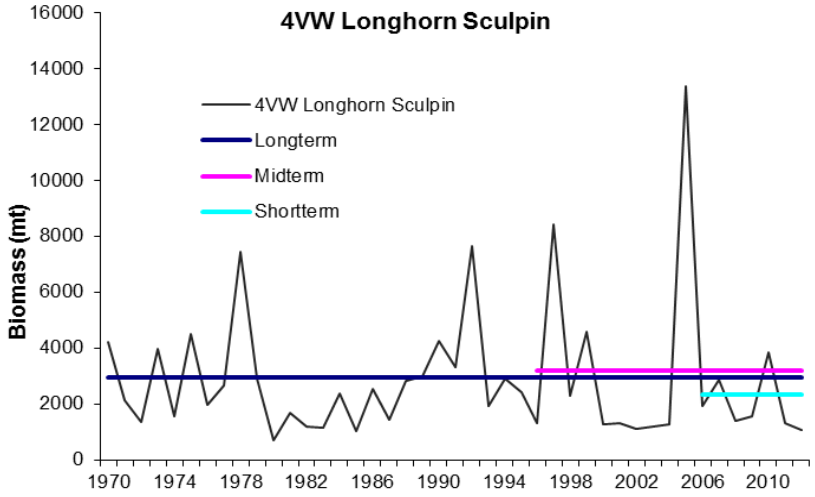

Figure 22d. Biomass indices for longhorn sculpin in 4VW from the summer RV survey.

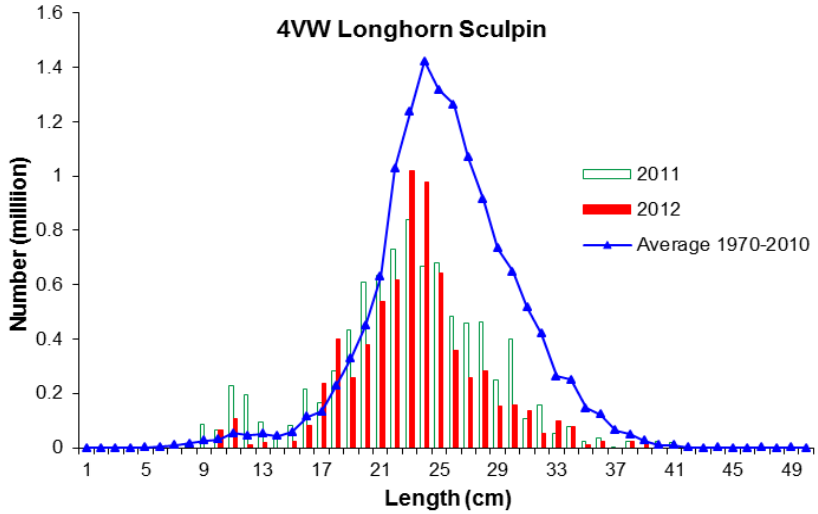

Figure 22e. Length composition for longhorn sculpin in 4VW from the summer RV survey.

Conclusions

Biomass indices are compared with the short-term (2006-2010), mid-term (1996-2010) and long-term (1970-2010) averages over 3 time periods; short-term being most recent 5 year average, mid-term being most recent 15 year average and long-term being since the beginning of the survey series, or the period deemed appropriate for that particular species.

Contributors

Donald Clark	DFO Maritimes Science, St. Andrews Biological Station
Peter Comeau	DFO Maritimes Science, Bedford Institute of Oceanography
Adam Cook	DFO Maritimes Science, Bedford Institute of Oceanography
Verna Docherty	DFO Maritimes Resource Management, Marine House
Jamie Emberley	DFO Maritimes Science, St. Andrews Biological Station
Mark Fowler	DFO Maritimes Science, Bedford Institute of Oceanography
Peter Hurley	DFO Maritimes Science, Bedford Institute of Oceanography
Jim Simon	DFO Maritimes Science, Bedford Institute of Oceanography
Heath Stone	DFO Maritimes Science, St. Andrews Biological Station
Daphne Themelis	DFO Maritimes Science, Bedford Institute of Oceanography
Jerry Young	DFO Maritimes Science, Bedford Institute of Oceanography
Tana Worcester	DFO Maritimes Science, Bedford Institute of Oceanography

Approved by

Alain Vézina
Regional Director of Science, DFO Maritimes Region
Dartmouth, Nova Scotia

Ph. 902-426-3490
Date: December 18, 2012

Sources of Information

This Science Response Report results from the Science Special Response Process of October 24, 2012 on the Review of Maritimes Research Vessel Survey Trends. Additional publications from this process will be posted as they become available on the Fisheries and Oceans Canada Science Advisory Schedule at www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

Clark, D.S. and Emberley, J. 2011. Update of the 2010 summer Scotian Shelf and Bay of Fundy research vessel survey. Can. Data Rep. Fish. Aquat. Sci. 1238.

Halliday, R.G. and Kohler, A.C. 1971. Groundfish survey programmes of the St. Andrews Biological Station, Fisheries Research Board of Canada – Objectives and characteristics. ICNAF Res. Doc. 71/35.

McEachran, J.D. and J.A. Musick. 1973. Characters for distinguishing between immature specimens of the sibling species, *Raja erinacea* and *Raja ocellata* (Pisces: Rajidae). Copeia 1973: 238-250.

This Report is Available from the:

Center for Science Advice (CSA)
Maritimes Region
Fisheries and Oceans Canada
PO Box 1006, Station B203
Dartmouth, Nova Scotia Canada B2Y 4A2

Telephone: 902-426-7070
E-Mail: XMARMRAP@mar.dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

ISSN 1919-3769

Correct Citation for this Publication:

DFO. 2013. Maritimes research vessel survey trends on the Scotian Shelf and Bay of Fundy. DFO Can. Sci. Advis. Sec. Sci. Resp. 2013/004.