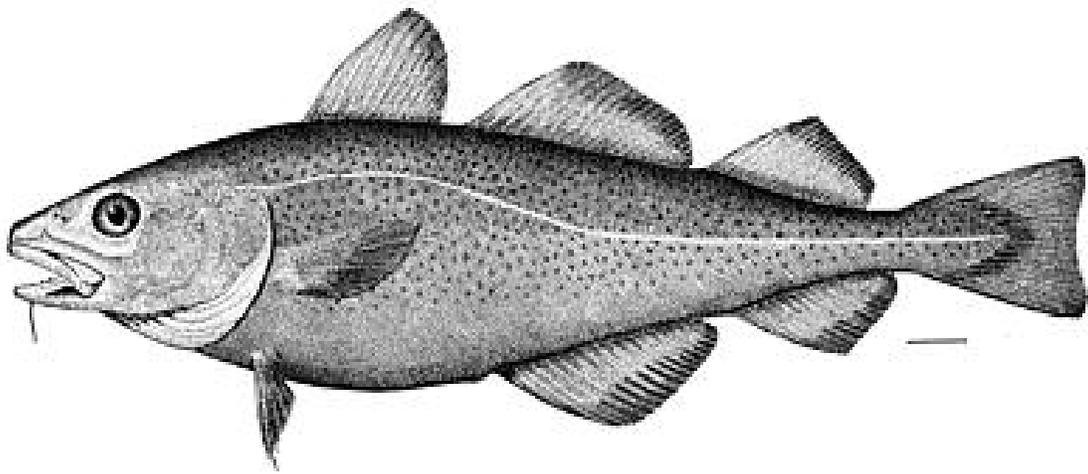


The Gulf of Maine stock of Atlantic cod



Commercial Statistical Areas Used to Define the Stocks of Atlantic Cod

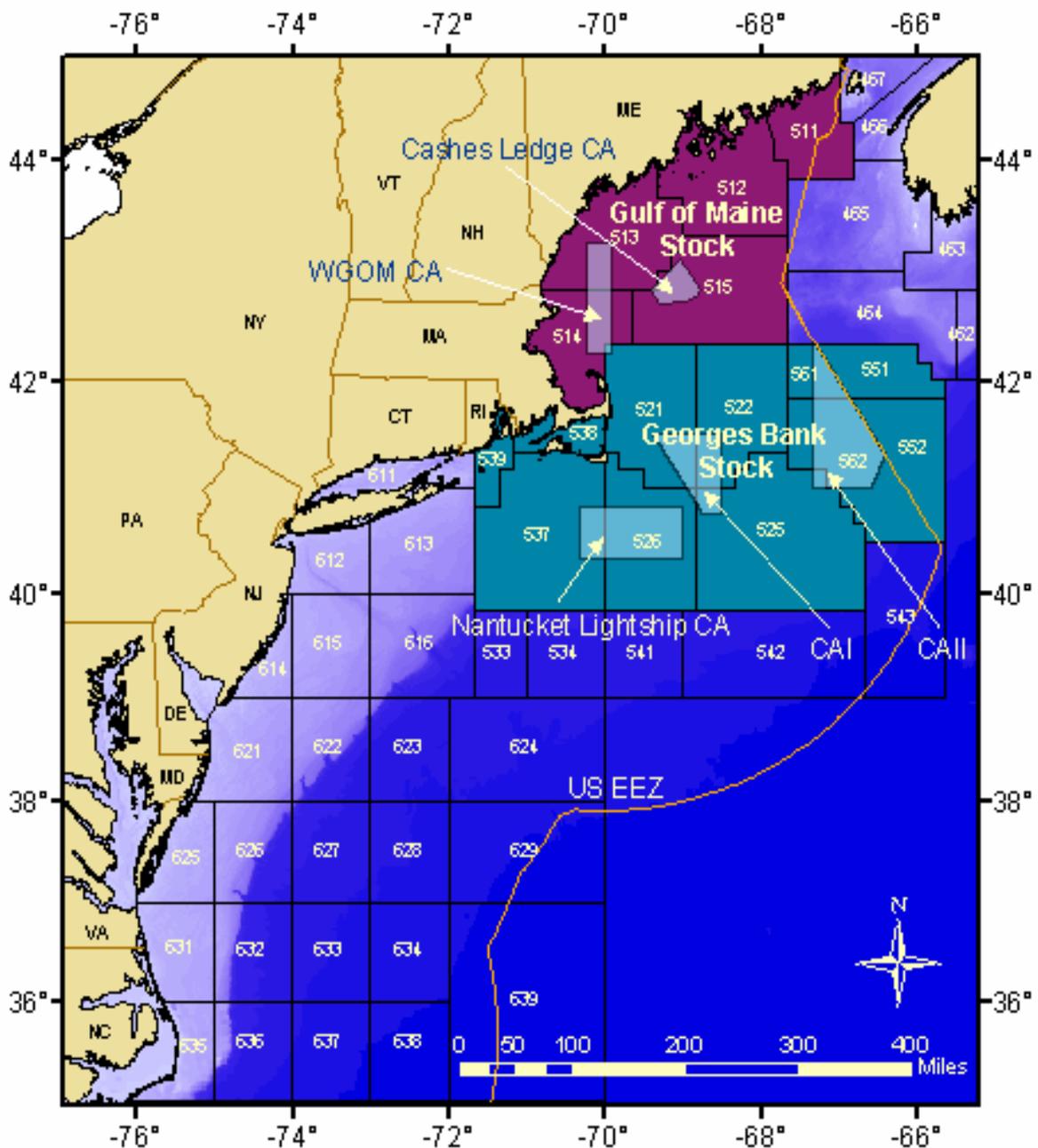
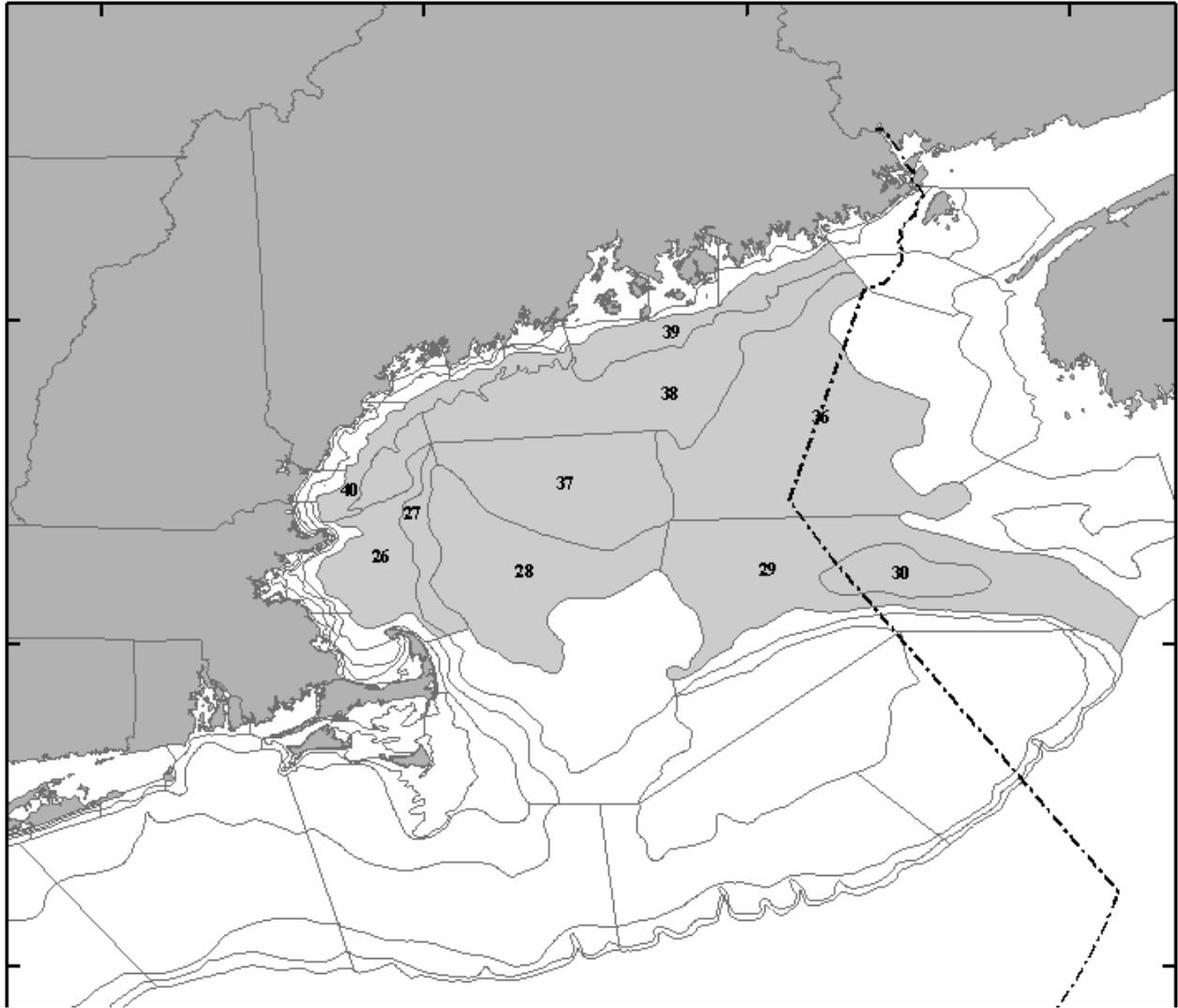


Figure 1.1. Statistical areas used to define the Gulf of Maine and Georges Bank cod stocks.



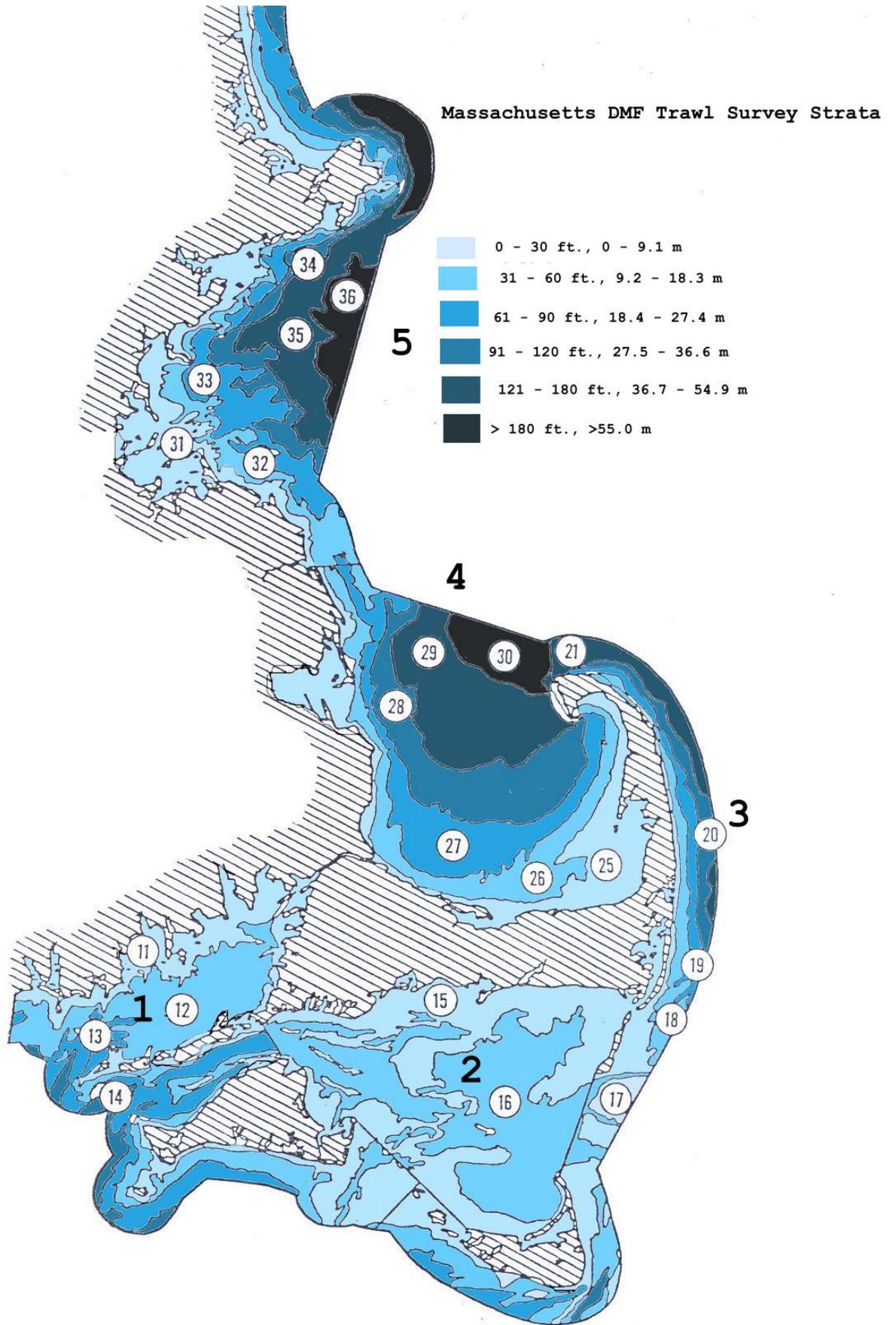


Figure 5. Strata sampled by the Massachusetts DMF inshore bottom trawl survey.

Gulf of Maine Cod Total Commercial Landings

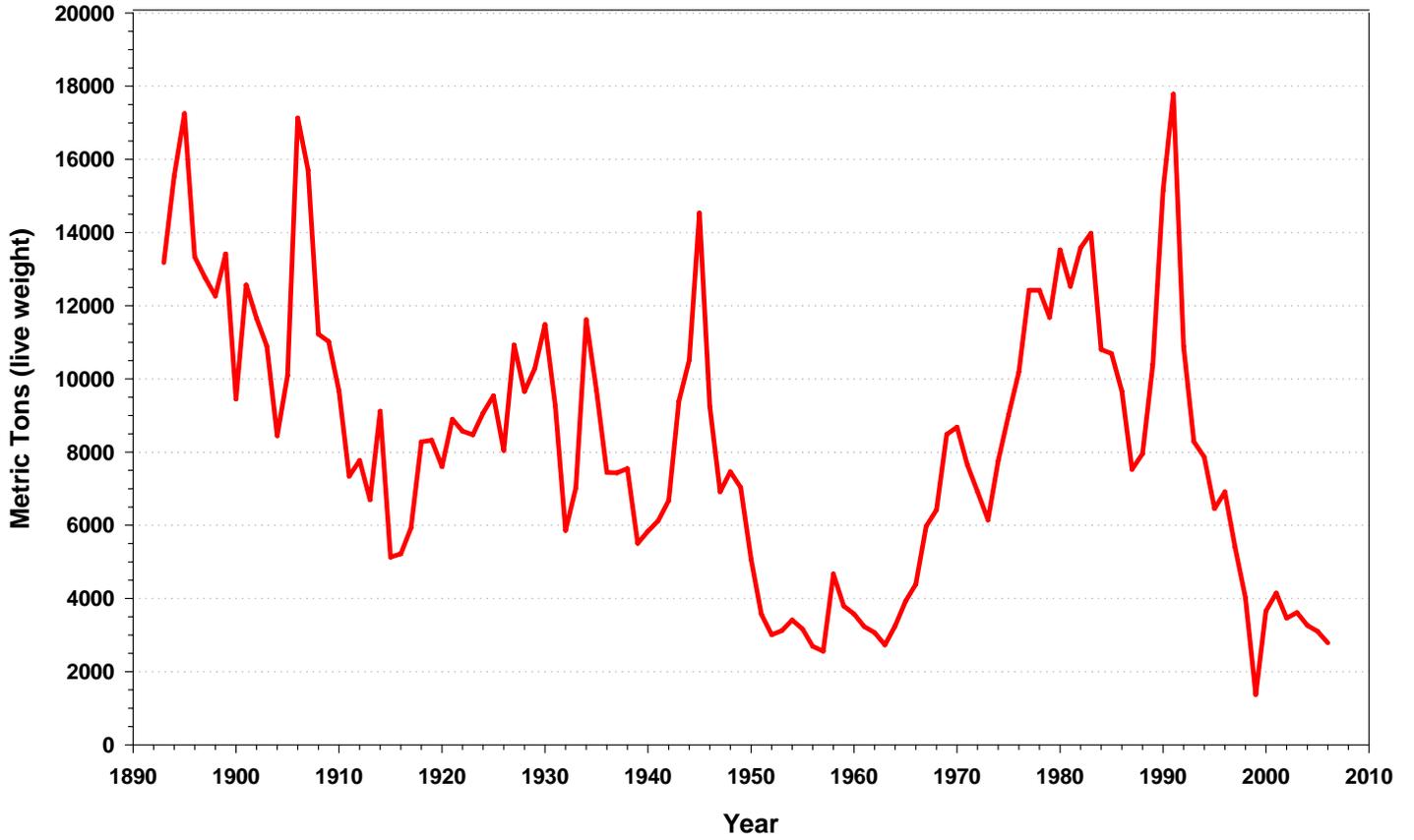


Figure F1. Total commercial landings of Gulf of Maine cod (NAFO Div. 5Y), 1893-2004.

Gulf of Maine Cod NEFSC Spring and Autumn Biomass Indices

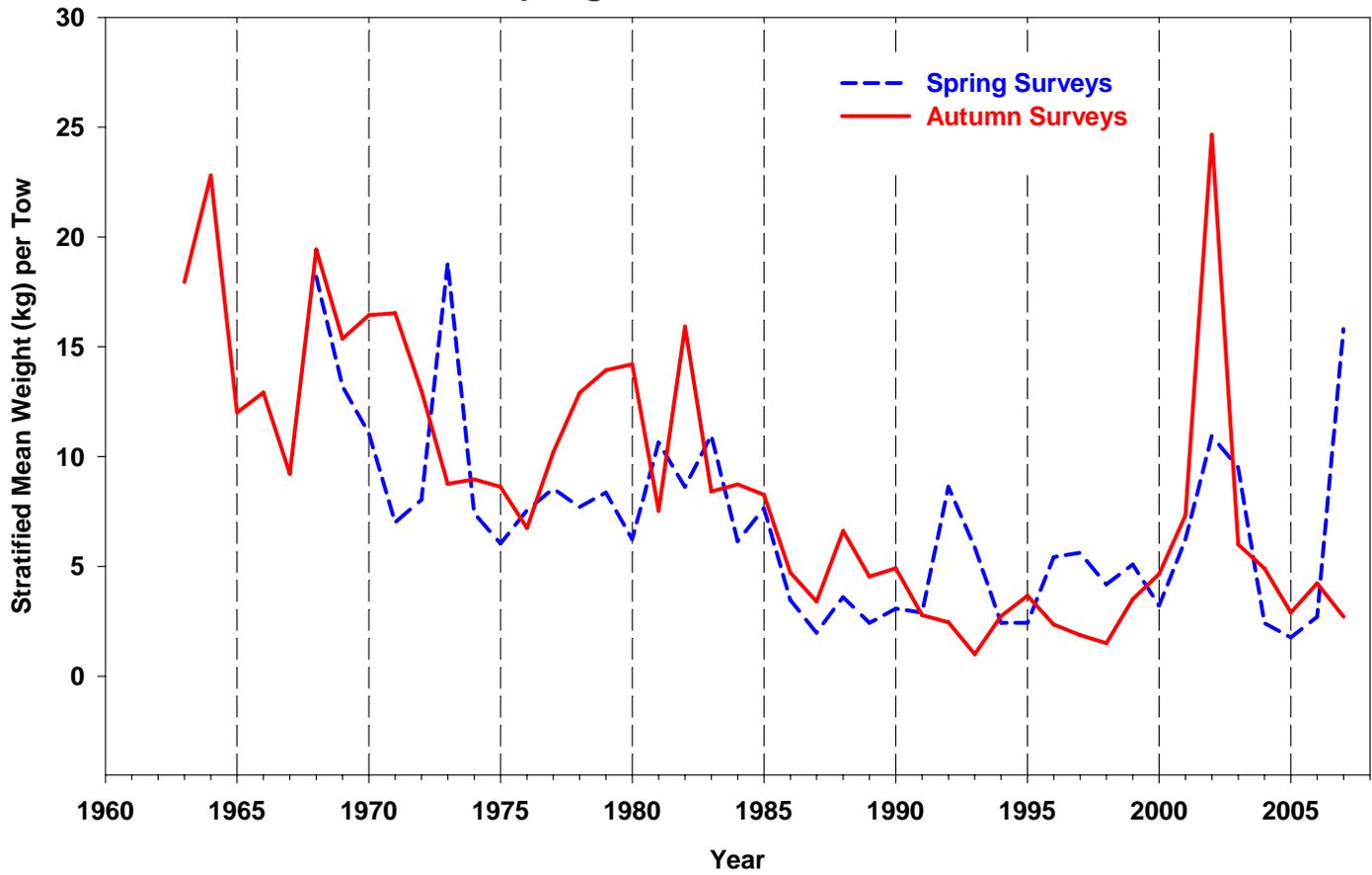


Figure F4. Biomass indices (stratified mean weight per tow) for Gulf of Maine cod from NEFSC autumn bottom trawl surveys.

Status of Gulf of Maine Cod from the 2005 GARM II

Yield and SSB per Recruit-based Reference Points

$$F_{0.1} = 0.15$$

$$F_{\max} = 0.27$$

$$F_{20\%} = 0.36$$

MSY-based Reference Points

$$\text{MSY} = 16,600 \text{ mt}$$

$$\text{SSB}_{\text{MSY}} = 82,830 \text{ mt}$$

$$F_{\text{MSY}} = 0.23$$

Gulf of Maine cod spawning stock biomass has increased since the late 1990s from 11,100 mt in 1997 to 20,500 mt in 2004, but the stock remains low relative to SSB_{MSY} (82,830 mt).

Fully recruited fishing mortality declined to about 0.35 in 2000 and 2001, but has since increased to 0.58 in 2004, indicating that F continues to remain very high relative to fully recruited F reference points ($F_{0.1} = 0.15$; $F_{\text{msy}} = 0.23$; $F_{\max} = 0.27$).

Thus, the stock remains in an overfished condition and overfishing continues to occur.

Description and history of current approach.

The first age-disaggregated assessment using Virtual Population Analysis was not accomplished until the early 1990s when a sufficient time series of catch-at-age data (1982 onward) became available.

The most recent peer review occurred at SAW 31 in 2001 (Mayo et al. 2002). Since then updated assessments were reviewed at GARM I (2002) and GARM II (2005) Mayo and Col (2006).

The VPA is calibrated using the Adapt method (Parrack 1986, Gavaris 1988, Conser and Powers 1990).

Key strengths and weaknesses

VPA has been successful in capturing the large-scale stock dynamics of the Gulf of Maine cod stock (i.e., trends in fully recruited fishing mortality and stock size) throughout most of the period since 1982.

The age composition for this stock includes true ages 1-6 and a 7+ group. The first fully recruited age is age 4. For logistical purposes, F on the oldest true age (age 6) is based on only two ages (ages 4 and 5). Estimates of terminal F, therefore, can be variable from year to year and highly dependent on a single value, as was the case in the 2005 GARMII assessment.

Although there is no consistent retrospective **pattern** for this stock, F and stock size are generally over- or under estimated in the terminal year.

Feasibility of changing assessment model

Alternative forward projecting approaches for assessing this stock can use the existing age data in the same manner as VPA

These provide direct estimates of biological reference points and can provide the same input data to NOAA/NFT projection software.

The NOAA/NFT assessment models have been validated and are practical to implement.

Proposed model for the Gulf of Maine cod stock

We propose that the NOAA/NFT model, ASAP, be compared against VPA to evaluate the feasibility of changing to this model for the GARMIII assessment.