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Research Paper

The seasonal distribution and abundance of barndoor skate on Georges Bank based on scallop dredge surveys

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ABSTRACT

Barndoor skate (*Dipturus laevis*) is one of the largest skate species in the Northwest Atlantic, and seasonal trawl surveys have identified Georges Bank as critical barndoor skate habitat. We examined fine-scale changes in the seasonal distribution and relative abundance of barndoor skate in the scallop access areas in Closed Area I (CAI) and Closed Area II (CAII) on Georges Bank using catch data from a three-year seasonal scallop dredge survey. Throughout the survey, 2664 barndoor skates were caught and measured, and over 92% of the skates were juveniles. Seasonal changes in skate abundance were documented in both Closed Areas, with catches peaking in August and September. During the summer and fall, skates were caught across all surveyed depths, while catch was limited to deeper waters in the winter and spring. Barndoor skate relative abundance in each Closed Area was modeled using generalized additive mixed models with Tweedie distributions, and the final models, with month, depth, and bottom temperature as fixed effects, effectively explained the spatiotemporal distribution patterns observed in each area. Barndoor skate abundance estimates are based on data collected during the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys, and the Essential Fish Habitat (EFH) designations for barndoor skate are currently being reassessed as part of the Omnibus Habitat Amendment 2. Our study strongly supports the recommendation to expand barndoor skate EFH since we observed high numbers of barndoor skate on Georges Bank in the late summer, a season with limited numbers of NEFSC surveys.

1. Introduction

Barndoor skate (*Dipturus laevis*) is one of the largest skate species in the Northwest Atlantic skate complex, reaching lengths greater than 145 cm and weights of up to 20 kg (Bigelow et al., 2002; Simon et al., 2002). It was historically thought that the species ranged from Cape Hatteras to southern Nova Scotia in depths from shallow water to 400 m (McEachran and Musick, 1975). However, recent survey data has shown that the geographical range of barndoor skate is in more northern waters, from Hudson Canyon to the Labrador Shelf (Kulka et al., 2002; Packer et al., 2003; Simon et al., 2002). Furthermore, the depth range for the species was previously underestimated. Recent surveys suggest that barndoor skate are found in waters as deep as 1600 m, with significantly higher catch rates below 450 m (Kulka et al., 2002; Simon et al., 2002).

Barndoor skates are often caught as bycatch in sea scallop dredges and groundfish trawls, but until the late 1990s, this bycatch was largely ignored (Gedamke et al., 2005). Like those of most elasmobranchs,

barndoor skate populations are especially vulnerable to the impacts of fishing mortality due to their slow growth, late maturity, and low fecundity (Gedamke et al., 2005). The threat to this species from bycatch was brought to the forefront when Casey and Myers (1998) published a report asserting that the species was in danger of becoming extinct due to overfishing and was already extirpated throughout much of its northern range. The Northeast Fisheries Science Center (NEFSC) seasonal trawl surveys on Georges Bank and in the Gulf of Maine caught only 116 individuals between 1970 and 2000 (Gedamke et al., 2008). However, since the late 1990s, increases in catch rates during these seasonal surveys indicate the population seems to be recovering (Gedamke et al., 2008). Updated population growth estimates using seasonal trawl survey data indicate that barndoor skates are not at risk of extinction (Gedamke et al., 2009). Although it has been listed as “endangered” by the International Union for Conservation of Nature (IUCN) (Dulvy 2003), repeated petitions to list it as a federally endangered species in the United States have failed (NMFS, 2002; NMFS, 2011).

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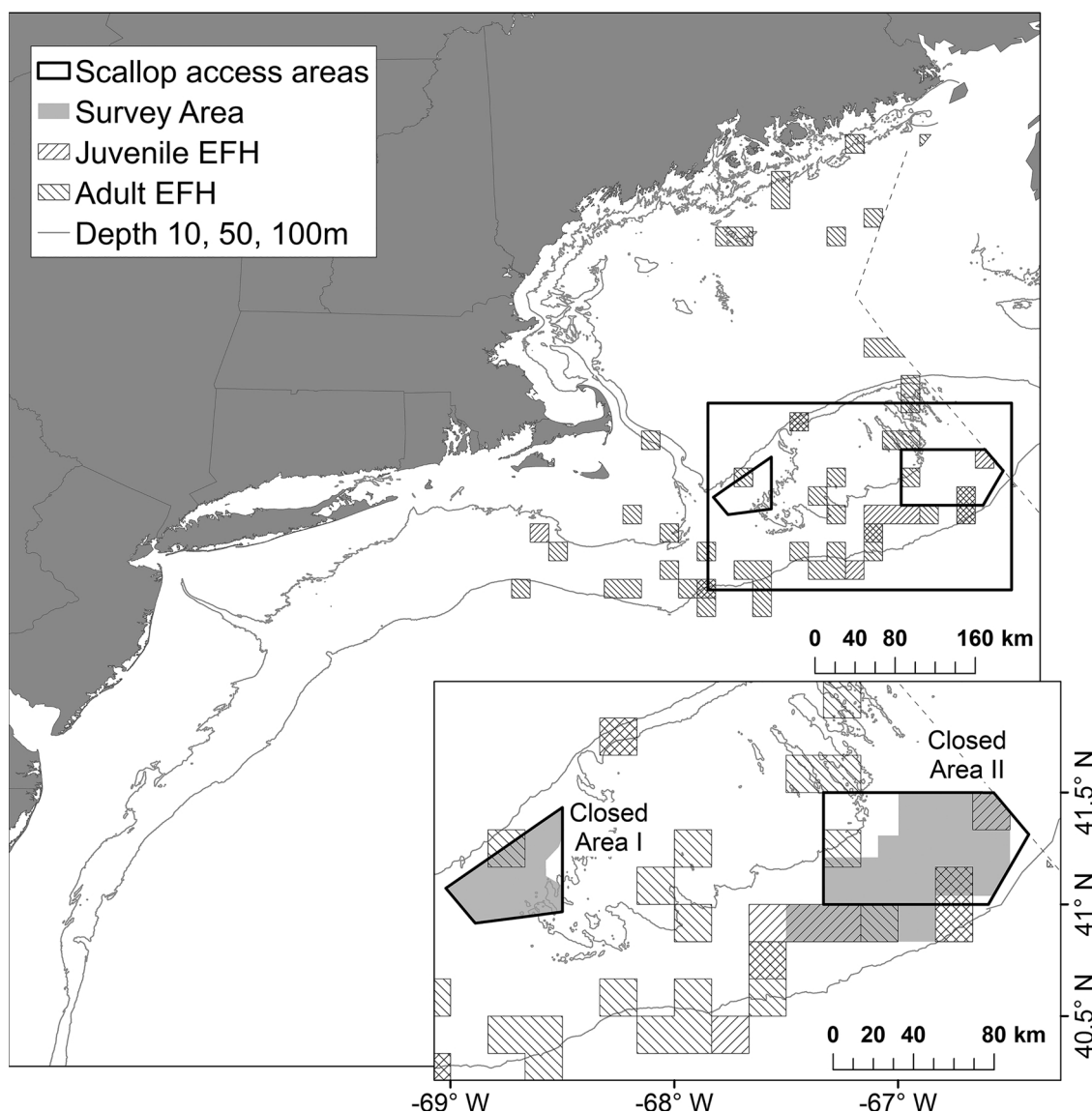


Fig. 1. Location of bycatch survey project in scallop access areas in Closed Area I and Closed Area II (inset). The designated boundaries of current Essential Fish Habitats for juvenile and adult barndoor skate are also shown (GIS shapefiles from <http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am1/shapefiles.html>).

Past estimates of barndoor skate abundance used long-term data from the NEFSC surveys collected every fall (since 1963) and spring (since 1968) (Packer et al., 2003). Limited presence/absence data was also collected during NEFSC winter and summer surveys that are now discontinued (Packer et al., 2003). Low numbers of adult skates were found on Georges Bank year-round, with a few found as far south as Mid-Atlantic waters and north into the Gulf of Maine in the winter and the Bay of Fundy in the fall (Packer et al., 2003). Juvenile skates were found primarily on the southern half of Georges Bank throughout the year, with the highest catches occurring in the fall (Packer et al., 2003). Based on these trawl surveys, Essential Fish Habitat (EFH) for barndoor skate has been identified (NEFMC, 2016) (Fig. 1). The EFH for adult barndoor skate includes areas across Georges Bank and in the northern Gulf of Maine (NEFMC, 2016). Except for a few scattered locations, the EFH for juvenile barndoor skate is limited to the southern edge of Georges Bank (NEFMC, 2016). New EFH designations have been proposed, which would expand the area to include more of Georges Bank (NEFMC, 2016).

The NEFSC seasonal trawl surveys have been instrumental for tracking long-term population fluctuations and identifying Georges Bank as critical barndoor skate habitat. Yet they do not provide

sufficient data at a fine enough spatiotemporal scale for examining seasonal changes in barndoor skate distributions on Georges Bank. Analysis of the seasonal distributions of flatfish on Georges Bank have shown that peak abundances may occur in summer or winter, seasons not covered by the NEFSC trawl survey (Winton et al., 2017). As such, the trawl survey may underestimate the importance of Georges Bank for species that utilize the area during summer or winter months. Because Georges Bank is a highly productive area for the scallop industry, Coonamessett Farm Foundation (CFF) has conducted a three-year seasonal scallop dredge survey in the scallop access areas of Closed Area I (CAI) and Closed Area II (CAII). This study uses the catch data from this survey to examine fine-scale changes in the seasonal distribution of this species in two areas of Georges Bank.

2. Materials and methods

2.1. Seasonal bycatch survey

We conducted twenty-seven survey trips aboard sixteen commercial sea scallop fishing vessels between May 2011 and March 2014. Surveys were performed monthly from May 2011 through November 2011, and

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