Northeast Regional Habitat Assessment Species Distribution Maps and Methods

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Introduction and Background

Fisheries are vital to the socio-economic well-being of coastal communities, supporting food security, livelihoods, and recreational activities. Effective management of these resources requires a thorough understanding of species distribution and abundance. The Northeast Region of the United States, spanning from Maine to North Carolina, hosts diverse marine ecosystems and productive fisheries. However, sustainable management is complex due to the interplay of environmental factors, fishing activities, and species dynamics.

The Northeast Regional Habitat Assessment (NRHA) was established to characterize estuarine, coastal, and offshore fish habitats in the region. This initiative aligns fish habitat science priorities with available resources, creating data-driven tools to support fisheries assessment and management. NRHA integrates data from federal and state fisheries surveys, including bottom trawl and seine surveys, to assess species composition, abundance, and distribution. Data spanning from 1963 to 2019 were aggregated from NOAA databases and other regional sources, with updated information to be added to NRHA in the future.

To facilitate data sharing and visualization, the NRHA team developed the NRHA Data Explorer, a custom R-Shiny application that serves as the primary platform for accessing NRHA products and results. This interactive tool provides users with access to fishery-independent survey data, species distribution models, habitat datasets, species profiles, and supporting reports. The application is publicly available at NRHA Data Explorer.

Methods

Before integration into the NRHA Data Explorer, raw datasets were cleaned and standardized to ensure consistency across multiple surveys. This process involved standardizing columns to common units, such as depth, salinity, temperature, fish lengths, coordinate systems, and date-time formats. Species codes were matched to the Integrated Taxonomic Information System (ITIS) format, and catch effort was standardized using swept area calculations.

Bottom trawl surveys used for mapping fish abundance:

- Connecticut Long Island Sound Trawl Survey
- NorthEast Area Monitoring and Assessment Program (NEAMAP)
- Maine-New Hampshire Inshore Trawl Survey
- Massachusetts Bottom Trawl Survey
- Rhode Island Narragansett Bay Trawl Survey
- New Jersey Delaware Bay Juvenile Trawl Survey
- New Jersey Ocean Stock Assessment Program
- Delaware 30ft Bottom Trawl Survey
- Delaware Bay Juvenile Finfish Trawl Survey
- Maryland Bottom Trawl Survey
- North Carolina Nursery Area Juvenile Survey (NC120)
- North Carolina Pamlico Sound Survey (N195)

- SEAMAP-SA Coastal Trawl Survey
- Peconic Bay Small Mesh Trawl Survey
- Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP)
- VIMS Juvenile Trawl Survey

Swept Area Calculation

Survey methodologies vary, necessitating adjustments to standardize effort across datasets. When available, swept area values were obtained directly from data providers. If unavailable, swept area was estimated using tow duration, speed, and net width adjustments. This standardization facilitates cross-survey comparisons, though users should interpret combined datasets cautiously due to methodological differences. Additional details on survey methodologies are available in the trawl and seine comparison tables and the NRHA report, accessible on the NRHA Data Explorer Reports page.

Species Distribution Maps

The NRHA Data Explorer includes various data visualizations, with a key focus on species distribution maps that display mean abundance estimates across hexagonal grid cells. This interactive visualization allows users to filter by species and by trawl surveys (one or multiple), enabling a spatial view of species abundance. Only trawl surveys were used due to challenges in standardizing data between trawl and seine surveys. These figures illustrate species distributions based on trawl survey catch, with filtering options for specific years, year ranges, and seasons.

The process for creating species distribution maps involved calculating the total unique tows per scenario (unique combinations of years and seasons) in each hexagon, normalizing catch using swept area calculations (CPSA), and dividing by the total number of tows per hexagon. The mean CPSA was then calculated for each hexagon, species, and season. Values were normalized on a 0-1 scale within each species-season-year combination to facilitate comparisons across species and regions. Empty hexagons were retained to distinguish between unsampled areas and areas where surveys occurred but did not record the selected species.

Field Names and Descriptions

Field Name	Field Description	
Hexbin_ID	H3 Hexagonal Grid ID	
CommonName	Common Name of Species	
Season	Season (Spring or Fall)	
Trawl_Sources	The trawls that conducted surveys for this species and season in this hexbin.	
Mean_CatchPerSweptArea	The mean catch per swept area for this species and season.	
Total_Survey_Count	The total number of surveys conducted by the trawls for this species and season in this hexbin.	
Relative_Abundance	The relativized mean CPSA for this season and species in this hexbin.	
NEAMAP	NEAMAP Bottom Trawl	For all the trawls, the value in these columns represents the number of surveys conducted by the trawl for this species and season in this hexbin.
RI_NarrangansettBay	Rhode Island Narragansett Bay	
MA_BottomTrawl	Massachusetts Bottom Trawl	
NJ_Ocean_StockAssessment	New Jersey Ocean Stock Assessment	
CT_LongIslandSound	Connecticut Long Island Sound Trawl	
PeconicBay	Peconic Bay Small Mesh Trawl	
MD_BottomTrawl	Maryland Bottom Trawl	
ME_NH_Inshore	Maine-New Hampshire Inshore Trawl	
VA_ChesMMAP	Virginia ChesMMAP Trawl	
VIMS_ChesapeakeBay_Juvenile	VIMS Chesapeake Bay Juvenile Trawl	
DE_30ft_BottomTrawl	Delaware 30ft Bottom Trawl	
NJ_DelawareBay_Juvenile	New Jersey Delaware Bay Juvenile Trawl	

DE_DelawareBay_Juvenile	Delaware Bay Juvenile Finfish Trawl	For all the trawls, the value in these columns represents the number of surveys conducted by the trawl for this species and season in this hexbin.
SEAMAP_SouthAtlantic	SEAMAP-SA Coastal Trawl	
NC_Juvenile_Nursery	North Carolina Nursery Area Juvenile Trawl	
NC_PamlicoSound	North Carolina Pamlico Sound Survey	

Conclusion, Next Steps, and Applications

By integrating diverse datasets and advanced analytical techniques, NRHA provides valuable insights into fish abundance and distribution. Continuous monitoring and adaptive management remain essential for long-term fisheries sustainability.

NRHA researchers are currently incorporating survey data with environmental variables such as oceanographic and habitat characteristics to develop predictive models of fish habitat suitability. These analyses will be published on the NRHA Data Explorer in the near future. Additionally, the Mid-Atlantic Fishery Management Council is conducting an Essential Fish Habitat (EFH) review, expected to be completed in early 2026. NRHA products are being used to refine EFH designations by providing spatial estimates of habitat suitability and identifying environmental factors influencing species distributions.

NRHA offers a robust framework for integrating habitat science into fisheries management, promoting sustainable practices through data-driven decision-making and comprehensive spatial and temporal analyses. This report serves as a foundation for managers, researchers, and the public to understand the methodologies behind NRHA data products, specifically survey catch distributions. As new analyses emerge, the NRHA Data Explorer will be updated to ensure continued access to the latest habitat science research.