Introduction

The 2025 benchmark stock assessment for American lobster (*Homarus americanus*) provides the most recent information on the status of US American lobster stocks. The assessment was peer-reviewed by an independent panel of scientific experts through the Atlantic States Marine Fisheries Commission's external review process.

Management Overview

The management unit for American lobster extends from Maine through Virginia. The population is divided into two stock areas defined based on differences in life history traits (e.g., growth and maturity) and migration patterns. The Gulf of Maine/Georges Bank (GOM/GBK) stock includes waters to the north and east of Cape Cod, Massachusetts to the US/Canadian border in Maine. The Southern New England (SNE) stock includes waters southwest of Cape Cod.

American lobster is managed under Amendment 3 to the Interstate Fishery Management Plan (FMP) and its subsequent Addenda I-XXXII. Amendment 3 was approved in 1997 and aimed to limit effort and increase egg production in the fishery by instituting traps limits, setting minimum/maximum sizes, and prohibiting the possession of egg-bearing lobsters and v-notched females (females caught previously while bearing eggs that have had a V-shaped notch cut into their tail fin to protect them from future harvest).

Subsequent addenda to Amendment 3 have modified management measures to reduce exploitation and established reporting and data collection programs to improve understanding of the fisheries and stocks. Several addenda responded to the depleted stock status findings of the 2006, 2009, and 2015 stock assessments for the SNE stock. Addenda XVII – XXII implemented a suite of measures to reduce exploitation and rescale the size of the fishery to the size of the SNE resource, including a v-notching program, trap reductions, closed seasons for certain areas, and trap consolidation/transferability programs.

Addendum XXVII (2023) was approved following the 2020 assessment as a proactive measure to improve the resiliency of the GOM/GBK stock based on concerns about persistent low abundance of recently-hatched lobsters on sea floor habitats (settlement). The Addendum established a trigger mechanism to implement gauge and escape vent size changes to provide additional protection for the spawning stock biomass. Changes were triggered in October 2023 based on observed declines in recruit abundance indices, but these changes were ultimately repealed with the subsequent approval of Addendum XXXII in May 2025 due to lobster industry concern regarding the potential economic impacts of increasing the minimum gauge size in inshore GOM and about uncertainty surrounding the implications for trade with Canada.

What Data Were Used?

The assessment used catch and size composition data from both fishery-dependent and -independent sources, as well as information about lobster biology, life history, and environmental interactions. Fishery-dependent data came primarily from the commercial fishery. Fishery-independent data were collected through scientific research and surveys.

Life History

American lobster is a bottom-dwelling crustacean that prefers rocky habitat but can also be found on sand or mud bottoms. The species' range extends from Newfoundland, Canada south to the US Mid-Atlantic region. In the US, American lobster is most abundant in inshore waters from Maine to Cape Cod, Massachusetts.

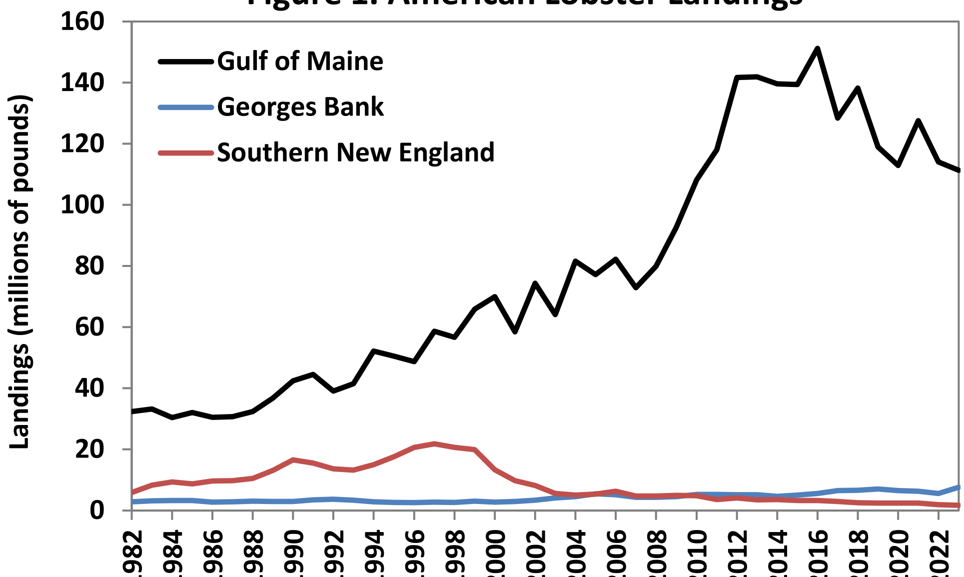
Lobsters grow by molting, which results in incremental growth patterns. This makes age determination, which is typically done using a hard part on or within an animal's body, difficult for lobster because all hard parts are shed and regenerated with each molt. Based on other characteristics like size, lobsters are believed to have long life spans and continue to grow throughout their lives, potentially reaching more than 40 pounds in weight. Females carry fertilized eggs externally for 9-11 months, which then hatch into pelagic larvae that are dispersed passively (by water currents) and actively (by swimming behaviors). Larvae then settle on the sea floor after about four to six weeks and begin the benthic phase of their life history that continues through the remainder of their life.

All aspects of lobster life history are strongly influenced by water temperature. Temperature effects are well researched and documented in published literature, indicating an optimal range of 12° – 18° C and a threshold for physiological stress at 20°C for adult lobsters. Temperature changes through time have likely played a role in population dynamics observed during the assessment such as changes in recruitment.

Commercial and Recreational Data

Fishery-dependent data sources used in the stock assessment include commercial landings, effort, and biological data collected during at-sea and port sampling. Commercial at-sea and port sampling programs provide data that characterize the commercial catch in terms of size composition and sex ratio. The commercial at-sea sampling programs also provide information on discards of egg-bearing females and v-notched females, which are released alive to protect the spawning stock.

Figure 1. American Lobster Landings



There are notable differences between the fisheries operating in the GOM and GBK portions of the GOM/GBK stock. The GOM fishery accounts for the vast majority of US lobster landings, averaging 82% of the annual landings since 1982, and is predominately carried out by small vessels (22 to 50 feet) making day trips in nearshore waters (< 12 miles from shore). The GBK fishery is considerably smaller, averaging 5% of the landings since 1982, and is predominantly carried out by larger vessels (55 to 75 feet) making multi-day trips to offshore waters (> 12 miles from shore). Total GOM/GBK annual landings increased from a stable period in the 1980s, averaging approximately 35.4 million pounds, through the 1990s and 2000s, exceeding 100 million pounds for the first time in 2009. Landings from 2012 through 2018 stabilized at record levels, averaging 145.7 million pounds. Landings have declined since the 2020 assessment, averaging 123.6 million pounds from 2019-2023.

Historically, the SNE fishery was predominately an inshore fishery. Landings peaked in 1997 at 21.8 million pounds and accounted for 26% of total US lobster landings. Following the peak, SNE landings have continuously declined to the lowest on record in 2023 (1.7 million pounds), now accounting for only 1% of US landings. The fishery has also shifted to a predominantly offshore fishery as inshore abundance declined at a faster rate.

Recreational fishery data are limited but indicate recreational harvest is a negligible source of fishery removals.

Fishery-independent Surveys

Multiple bottom trawl surveys are used in the assessment, which provide indices of relative lobster abundance for assessing changes in abundance through time. Maine/New Hampshire (ME/NH), Massachusetts, Rhode Island, and Connecticut conduct surveys within their respective state waters. Additional regional surveys include a nearshore survey conducted by the Northeast Area Monitoring and Assessment Program (NEAMAP), which encompasses the Mid-Atlantic to Block Island Sound, Rhode Island, and the NOAA Fisheries Northeast Fisheries Science Center (NEFSC) survey covering US offshore waters from Maine to North Carolina. These surveys all employ a stratified random sampling design and operate twice a year, in the spring and fall. GOM/GBK survey indices indicate increasing relative abundance from the early 2000s through the mid- to late 2010s, followed by declines to lower levels. SNE survey indices show a peak in abundance in the mid- to late 1990s, followed by declines to record low levels in recent years. Several SNE surveys that historically encountered lobsters have not caught any lobsters in recent years.

Since 2006, the states of Maine through New York have collaborated with commercial lobster harvesters to conduct standardized ventless trap surveys (VTS). These surveys provide stock-specific indices of abundance using a random stratified sampling design but utilize an alternative gear (traps) that can better access preferred lobster habitat than trawl surveys. Sampling in Long Island Sound by New York and Connecticut was discontinued in 2010. Current sampling includes Rhode Island and Massachusetts waters in SNE, and Massachusetts, New Hampshire, and Maine waters in GOM/GBK. VTS indices for GOM/GBK increased at the beginning of the time series, peaked in the mid-2010s, and declined from the late 2010s to levels similar to the late 2000s. SNE indices declined from their highest levels at the start of the survey to their lowest levels in the 2020s.

Young-of-year (YOY) larval and settlement surveys are also used to provide information about incoming recruitment to the stocks. There were two surveys available from Long Island Sound estimating larval densities; an entrainment survey and a plankton net survey. Several settlement surveys were also available from Maine (GOM/GBK), New Hampshire (GOM/GBK), Massachusetts (GOM/GBK and SNE), and Rhode Island (SNE). These surveys are SCUBA-based suction sampling that provide density estimates of newly settled YOY lobsters. GOM/GBK settlement indices show declines in the 2010s from time series highs in the 2000s followed by increases to moderate levels in the late 2010s and 2020s. In SNE, settlement and larval indices have declined throughout the time series to their lowest levels in recent years.

Environmental Data

Extensive research has highlighted the influence of the environment on American lobster life history and population dynamics. Among the critical environmental variables, temperature stands out as the primary influence. Further, environmental conditions in the American lobster's range are changing at some of the fastest rates in the world. Therefore, considering these environmental influences is vital when assessing lobster stocks and was a focal point of this stock assessment. Environmental data time series analyzed in this assessment included water temperatures at several fixed monitoring stations throughout the lobster's range, average water temperatures over large areas such as those sampled by fishery-independent surveys, oceanographic processes affecting the environment, and other environmental indicators such as lobster prey abundance.

Environmental data were analyzed for **regime shifts**, which indicate a significant difference in the lobster's environment and population dynamics from one time period to another. Regime shifts can change a stock's productivity, impacting its recruitment levels and ability to support different levels of fishing pressure. Temperature time series were also analyzed to quantify the effect of temperature on the catchability of lobster in surveys and adjust annual survey estimates to account for temperature-driven changes in catchability.

What Assessment Methods Were Used?

A statistical catch-at-length population dynamics model (Chen et al. 2005) was the primary tool used to assess each stock and determine stock status. The model tracks the population of lobster by sex, size, and season over time, starting when they have grown to at least 53 mm carapace length (about 2.1 inches) so that all lobsters are tracked at least one molt before reaching harvestable size. At this size, they are approximately age-4 or age-5 in the SNE or GOM/GBK stocks, respectively. Inputs to the models include survey indices, time series measuring temperature effects on survey catchability, landings data, size compositions of catch, size selectivity of the commercial fishery, and assumed life history characteristics (growth, natural mortality, maturity). The model generates predictions of survey indices, landings, and size compositions as close to the observed inputs as possible and uses these predictions to estimate population parameters including recruitment, total abundance, spawning stock biomass, and exploitation rates (as a measure of fishing pressure). The trends in these model-estimated population parameters (e.g., changes in abundance over time) are more certain than the overall magnitude of the estimates (e.g., size of the population) due to uncertainties around natural mortality and growth. As such, trends and their respective reference points are most robust in determining stock status because they are not influenced by the magnitude of population estimates.

Stock indicators were also used as an independent, model-free assessment of the lobster stocks. These indicators are based strictly on observed data and are free from inherent assumptions in the population dynamics models. The use of indicators in the assessment provides a "gut check" on model estimates and status determiantion and also provide additonal information not avialable from the model (e.g., YOY abundance, environmental indicators). Indicators include exploitation rates and the proportion of marketable catch represented by newly-recruited lobsters (recruit-dependency) as indicators of fishing mortality; YOY, fishery recruitment, and spawning stock biomass as indicators of abundance; survey encounter rates as an indicator of distribution; total landings, effort, catch per unit effort, and monetary measures as fishery performance indicators; and epizootic shell disease prevalence and the number of degree days with water temperatures exceeding 20°C as indicators of environmental stress. For all indicators, the terminal five-year average (2019-2023) is used to assess the status (positive, neutral, poor) relative to the prior time series (through 2018).

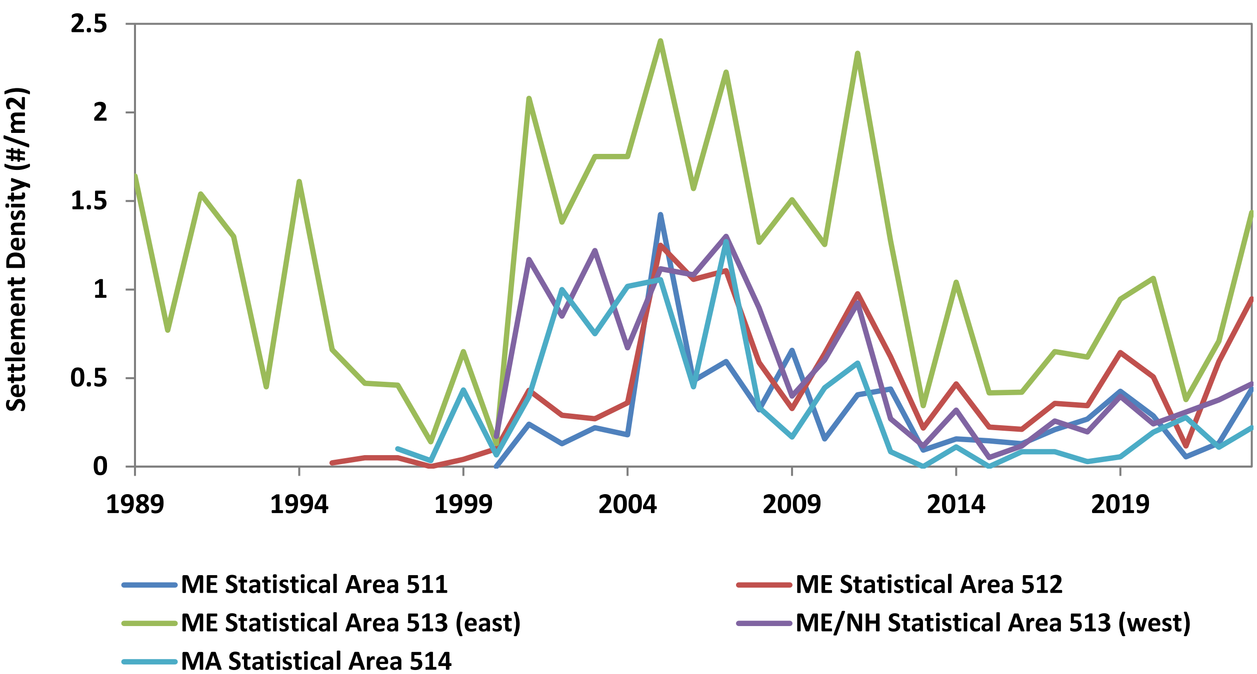
GOM/GBK

Model abundance estimates for the GOM/GBK stock show an increasing trend beginning in the late 1980s (Figure 2. After 2008, the rate of increase accelerated to a record high abundance level in 2018, the last year of data in the last assessment, and has since declined 34% in 2023. Recruitment and spawning stock biomass have also declined in recent years from record highs. Analysis of these estimates indicates stock productivity (number of recruits produced by spawning stock biomass) has increased over time, with a slight decrease in recent years, although still at high levels relative to the time series.

Model exploitation estimates, calculated as commercial landings divided by abundance, were higher in the mid-1980s, and then declined through the late 1990s and early 2000s (Figure 3). Since about 2010, exploitation increased slightly and has varied within a small range, with marginally higher rates in recent years.

YOY indicators have shown increases from lows in the 2010s, though remain neutral and below the positive levels observed in the 2000s (Figure 2). Abundance indicators of older lobsters generally showed similar results to the assessment model, with abundance declines from peaks since the last assessment. The smaller spatial scale (NOAA statistical areas versus lobster stock areas) used for the indicator time series reveals some spatial patterns within the stock that appear to be playing an important role in driving the overall stock dynamics as described by the model. Inshore surveys and particularly the ME/NH survey exhibit stronger declines than the offshore NEFSC survey. Similar patterns have occurred in exploitation with higher exploitation in the inshore area monitored by the

Figure 2. GOM/GBK Young-of-Year Indices



ME/NH survey and lower exploitation elsewhere. The new recruit-dependency indicators show inshore areas are highly dependent on incoming recruitment, which is a negative determination for exploitation. The encounter rate indicators show some contraction in the distribution within these inshore areas, likely related to declines in abundance. Landings and revenue fishery performance indicators show declining trends but remain positive.

Temperature data indicate that environmental conditions, particularly bottom water temperatures, remain positive in GOM/GBK and shell disease prevalence, although increasing in some areas, remains relatively low.

SNE

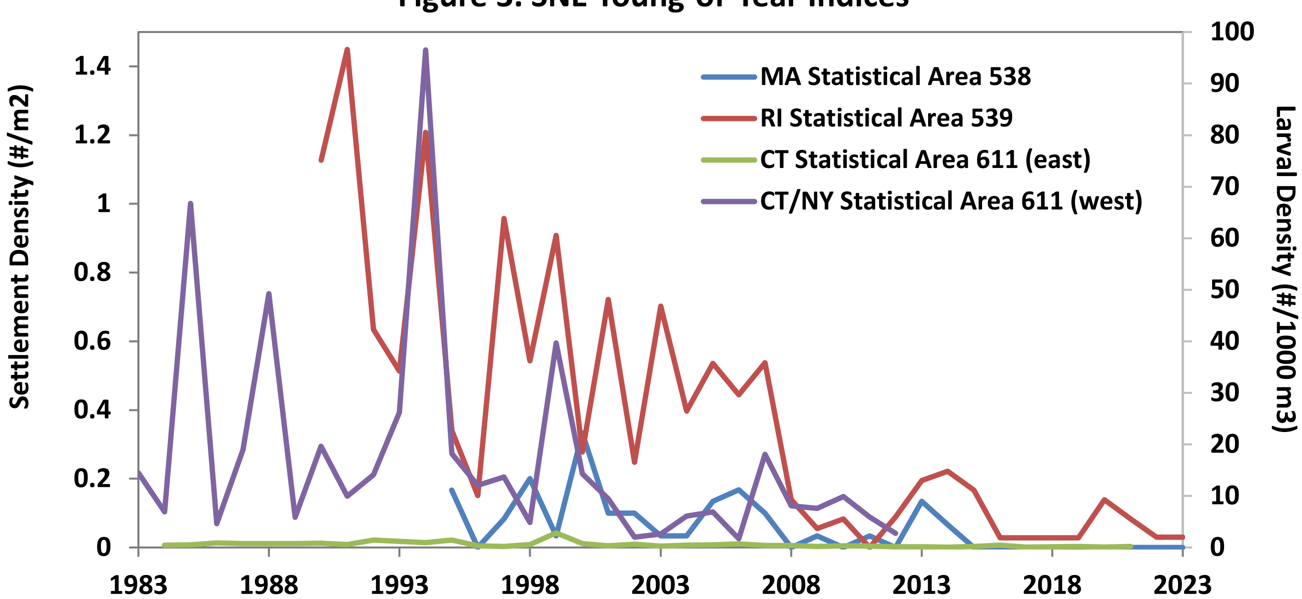
Model abundance estimates in SNE have declined since the late 1990s to record low levels, as have recruitment and spawning stock biomass estimates. Analysis of these estimates indicates a declining trend in stock productivity.

Model exploitation estimates are high and stable through 2002, declined sharply in 2003 as increases to minimum legal size were implemented, and remained at stable lower levels through the remainder of the time series (Figure 3).

Abundance indicators agree with model results and indicate declines to record low abundances for all life stages in recent years. The contraction of the SNE stock has continued and is now evident in the offshore portion as well as the inshore region. The ability to track YOY settlement and potential future recruitment years in advance has essentially ended with one of four YOY surveys being discontinued and the remaining three surveys occurring in non-suitable habitat according to lack of observed settlers and current thermal conditions.

Fishery performance indicators for SNE show continued declines in landings and revenue. Environmental conditions have worsened in the inshore region, and evidence suggests that the productivity of the stock is severely compromised with increased thermal stress and disease.

Figure 3. SNE Young-of-Year Indices



Combined, these indicators reflect the SNE stock's very poor condition and continuing recruitment failure.

What is the Status of the Stock?

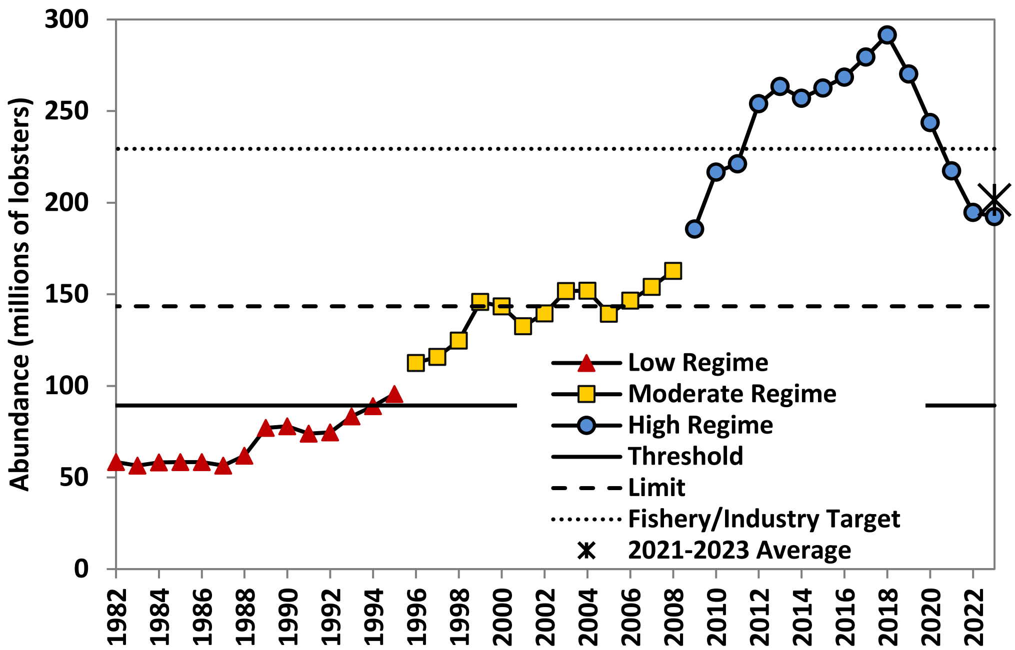
Reference Points

Abundance and exploitation reference points are used in the stock assessment to assess status of each stock. During the 2020 assessment, model-estimated abundance time series were analyzed for shifts that may be attributed to changing environmental conditions. These "regimes" reflect changing conditions impacting the lobster population's ability to survive, grow, and reproduce (i.e., stock productivity).

The GOM/GBK stock shifted from a low abundance regime encompassing the early 1980s through 1995 to a moderate abundance regime from 1996-2008 and shifted once again to a high abundance regime from 2009-2018 (Figure 4).

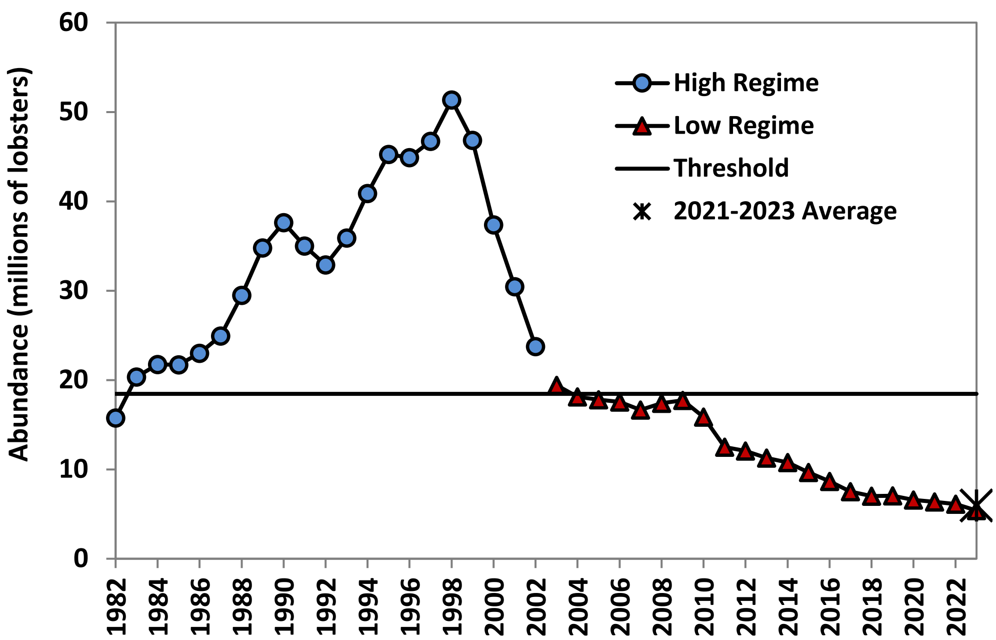
Conversely, the SNE stock shifted from a

Figure 4. GOM/GBK Stock Abundance



GOM/GBK stock abundance (line with symbols) compared to the fishery/industry target (dotted line), abundance limit (dashed line), and abundance threshold (solid line) reference points based on detected low (period with triangle symbols), moderate (period with square symbols), and high (period with circle symbols) regimes. The asterisk is the three-year (2021-2023) average abundance used for status determination.

Figure 5. SNE Stock Abundance



SNE stock abundance (line with symbols) compared to the abundance threshold (solid line) reference point based on detected high (period with circle symbols) and low (period with triangle symbols) regimes. The asterisk is the three-year (2021-2023) average abundance used for status determination.

high abundance regime during the early 1980s through 2002 to a low abundance regime during 2003-2018. The regime shift analysis was updated during this assessment and results were consistent with the previous assessment, so the same regime periods were used to structure trend-based reference points (Figure 5).

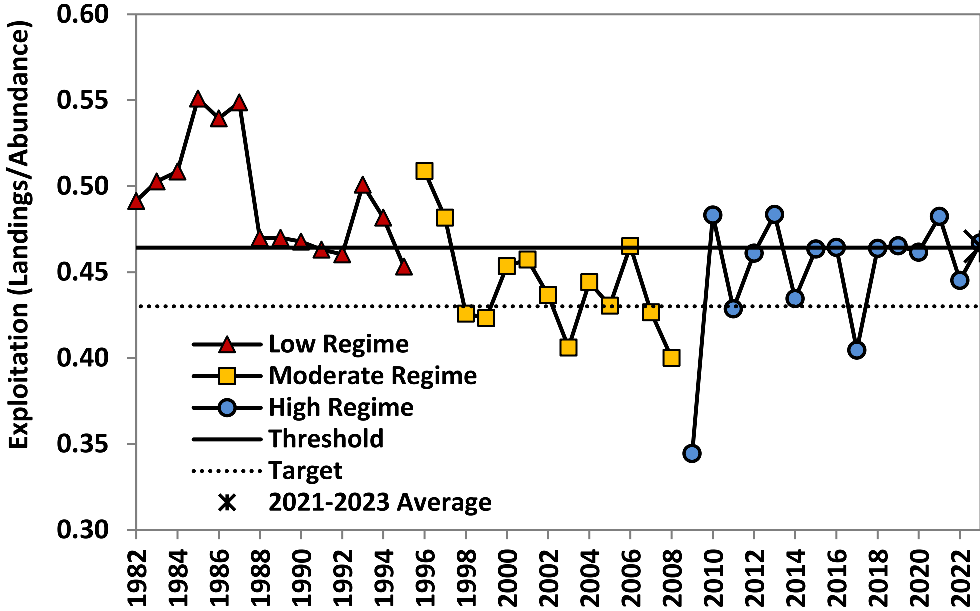
Three reference points are used to characterize stock abundance. The **abundance threshold** is calculated as the average of the three highest abundance years during the low abundance regime. A stock abundance level below this threshold is considered significantly depleted and in danger of stock collapse. This was the only abundance reference point recommended for the SNE stock due to its record low abundance and low likelihood of surpassing this threshold in the near future. The **abundance limit** is calculated as the median abundance during the moderate abundance regime. Stock abundance that falls below this limit is considered depleted because the stock's ability to replenish itself is diminished. The **fishery/industry target** is calculated as the 25th percentile of the abundance during the high abundance regime. In this case, when abundance falls below this target, the stock's ability to replenish itself is not jeopardized, but it may indicate degrading economic conditions for the lobster fishery.

Two reference points are used to evaluate the fishing mortality condition of the stocks, determining whether or not overfishing is occurring. The **exploitation threshold** is calculated as the 75th percentile of exploitation during the current abundance regime. The stock is considered to be experiencing overfishing if exploitation exceeds the exploitation threshold. The **exploitation target** is calculated as the 25th percentile of exploitation during the current abundance regime. The stock's fishing mortality condition is considered favorable if the three-year average exploitation is less than or equal to the target. This overfishing reference point serves as an extra safeguard against sudden increases in exploitation that may not be explained by decreasing abundance.

However, there are several caveats associated with the fishing mortality condition. Lobster fisheries are efficient at removing the harvestable part of the population that enters the fishery each year. So, trends in landings closely track changes in population abundance. This relationship results in relatively stable exploitation during periods of consistent regulations, even during periods of rapid and consistent abundance increases and decreases. This complicates our understanding of the population's response to fishing pressure. The stability of exploitation rates creates a narrow range of values separating favorable and unfavorable exploitation status, making the overfishing status determination sensitive to data and model uncertainty. Additionally, due to the time lag between YOY settlement and recruitment into the fishery, impacts of current fishing mortality on population productivity do not become apparent for several years. This is further confounded by uncertainty around how future environmental changes will impact young lobsters before they recruit to the fishery. For these reasons, if the three-year average exploitation exceeds the threshold, the assessment recommends initiating additional research to better understand the cause of increased exploitation and determine if management action is necessary. Abundance status is considered a more certain measure of stock status and thus is used for assessing the current health of the stocks and triggering management action.

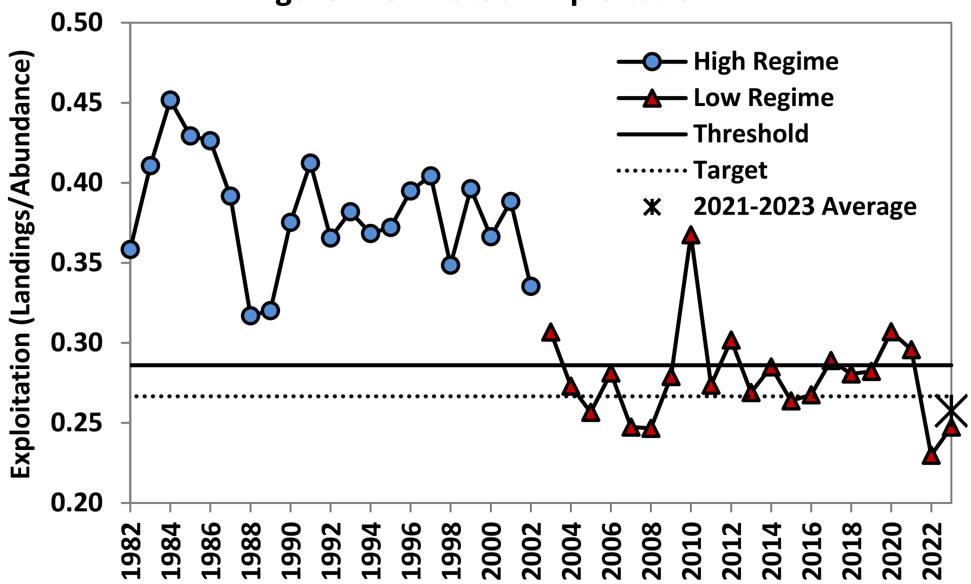
Based on these reference points, **the GOM/GBK stock is not depleted and overfishing is occurring** (Figures 4 and 6, respectively). The average abundance from 2021-2023 (202 million lobsters) has declined below the fishery/industry target (229 million lobsters) but remains above the abundance limit (143 million lobsters) and abundance threshold (89 million lobsters). The average exploitation from 2021-2023 (0.465) was just above the exploitation threshold (0.464), resulting in an overfishing status . Given the rapid declines in abundance to levels below the fishery/industry target and the overfishing status, the assessment recommends the American Lobster Management Board immediately initiate a Management Strategy Evaluation (MSE) to clearly define management objectives (across all stakeholders), better understand socioeconomic status and concerns, and identify potential management tools that might be supported by the industry and prevent further declines towards biological thresholds.

Figure 6. GOM/GBK Stock Exploitation



GOM/GBK stock exploitation (line with symbols) compared to the exploitation target (dotted line) and exploitation threshold (solid line) reference points based on detected low (period with triangle symbols), moderate (period with square symbols), and high (period with circle symbols) regimes. The asterisk is the three-year (2021-2023) average exploitation used for status determination.

Figure 7. SNE Stock Exploitation



SNE stock exploitation (line with symbols) compared to the exploitation target (dotted line) and exploitation threshold (solid line) reference points based on detected low (period with triangle symbols) and high (period with circle symbols) regimes. The asterisk is the three-year (2021-2023) average exploitation used for status determination.

The SNE stock is significantly depleted and overfishing is not occurring (Figures 5 and 7, respectively). The average abundance from 2021-2023 (6 million lobsters) was well below the abundance threshold (18 million lobsters). The average exploitation from 2021-2023 (0.258) fell below the exploitation threshold (0.286) and exploitation target (0.267). Although continued adverse environmental indicators suggest environmental conditions are major contributors to the poor abundance status, the assessment states significant management action would provide the best chance of stabilizing or improving stock abundance and reproductive capacity.

Data and Research Needs

The assessment includes a list of prioritized research needs to improve understanding of lobster life history and population dynamics and aid in the development of future stock assessments. High-priority fishery-dependent needs include continuation of biological sampling and analytical work focused on the increased commercial catch and effort data now available since implementation of enhanced reporting requirements. High-priority fishery-independent needs include collection of growth data to improve current estimates and detect changes through time, assessment of settlement in largely unsampled habitats (deep waters, offshore areas like Georges Bank) and evaluation of the contribution of settlement in these regions to overall stock productivity, and transitioning population dynamics models to more modern and flexible software platforms.

What are the Next Steps for Management?

The American Lobster Management Board accepted the Benchmark Stock Assessment and Peer Review Report for management use. After considering the findings and recommendations of the assessment, the Board tasked the Technical Committee with the following items to inform potential management responses: (1) create a combined index for tracking recruit abundance in GOM/GBK as part of future data updates to the Board; and (2) estimate the benefits to the GOM/GBK fishery that would have resulted from implementing the minimum gauge size increases under Addendum XXVII that were ultimately repealed. The Technical Committee will report to the Board on these analyses and review the process for conducting an MSE for the GOM/GBK stock at upcoming Commission meetings.

Whom Do I Contact For More Information?

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Glossary

Abundance limit: The median abundance during the moderate abundance regime. Stock abundance that falls below this limit is considered depleted because the stock's ability to replenish itself is diminished.

Abundance threshold: The average of the three highest abundance years during the low abundance regime. A stock abundance level below this threshold is considered significantly depleted and in danger of stock collapse.

Benthic: Inhabiting or occurring at the bottom of a body of water.

Depleted: Reflects low levels of abundance though it is unclear whether fishing mortality is the primary cause for reduced stock size.

Exploitation: The proportion of abundance removed by fishing over the course of a year.

Fishery-Dependent Data: Information collected from anglers, commercial harvesters, and seafood dealers on catch, landings, and effort.

Fishery-Independent Data: Information collected by scientists via a long-term research survey or other scientific survey.

Fishery/Industry Target: The 25th percentile of the abundance during the high abundance regime. In this case, when abundance falls below this target, the stock's ability to replenish itself is not jeopardized, but it may indicate degrading economic conditions for the lobster fishery.

Management Strategy Evaluation: A simulation-based process that compares possible management strategies to assess their ability to achieve specific objectives given key uncertainties while identifying ecological, economic, and/or social trade-offs.

Overfishing: Removing individuals from a population at a rate that exceeds the threshold established in the FMP, impacting the stock's reproductive capacity to replace individuals removed through harvest.

Pelagic: Inhabiting or occurring throughout the water column.

Recruit: An individual fish/organism that has entered a defined group through growth, migration, or maturation. Individuals recruit to the fishery when they reach the minimum legal size. Individuals recruit to the spawning stock when they become sexually mature.

Recruitment: The total weight or number of individuals that enter a defined group, such as the spawning stock or fishable stock.

Statistical catch-at-length model: A length-structured stock assessment model that works forward in time to estimate population size and fishing mortality in each year.

Spawning stock: The female portion of a stock that is mature.

Young-of-year (YOY): An individual fish/organism in its first year of life.

Additional Resources

ASMFC. 2025. American Lobster Benchmark Stock Assessment and Peer Review Report. Arlington, VA.

ASMFC. 2009. Guide to Fisheries Science and Stock Assessments. Arlington, VA. http://www.asmfc.org/publications/GuideToFisheriesScienceAndStockAssessments.pdf

Chen, Y., M. Kanaiwa, and C. Wilson. 2005. Developing and evaluating a size-structured stock assessment model for the American lobster, *Homarus americanus* fishery. New Zeal. J. Mar. Freshwater Res. 39: 645-660.