

days absent) from 2012. Average trip length on non-groundfish trips for these vessels has increased since 2010, increasing in 2013 by 0.26 days absent (+22.0%) from 2010 and by 0.08 days absent (+5.9%) from 2012 (Table 15).

The largest class of vessels, $\geq 75'$ in length, took fewer non-groundfish trips, with fewer days absent on these trips in 2013. However, when these vessels did take a non-groundfish trip, they were generally longer in length than they were in 2012. Both the number of non-groundfish trips taken and the total days absent on these trips were at four-year lows in 2013, decreasing 7.2% (-94 trips) and 4.5% (-613 days absent) from 2012, respectively. Overall, the number of non-groundfish trips taken decreased 11.7% from 2010. The total number of days absent decreased 11.4% over the same time period. Average trip length on non-groundfish trips taken by the largest vessels increased by 0.12 days absent to 3.91 days absent (+3.2%) in 2013 from 2012 (Table 15).

4. ECONOMIC PERFORMANCE

A complete assessment of fishery economic performance requires information from all vessels on all fishing-related costs and on all fishing-related revenues to determine profits. Actual annual financial profit is the sum of the owner's share of net revenue for all trips made over a year less annual fixed costs.¹⁹ This information would include the cost of purchasing additional ACE or DAS and the revenues from the sales of fish and ACE. Although progress is being made to address critical data gaps, at this time the Social Sciences Branch (SSB) does not have sufficient information to estimate profitability for various segments of the groundfish fleet or at a finer level (e.g., at the vessel affiliation or the individual vessel level). The primary obstacles to this estimation are (1) a lack of data on fixed costs and crew payments²⁰ and (2) incomplete data on ACE trading and DAS leasing.

This report uses three metrics to evaluate financial performance: (1) revenue per vessel and day; (2) total factor productivity, and (3) net revenue. None of these measures alone provides a complete assessment, but taken together they allow insights into important aspects of economic performance and provide some indication of trends in the economic efficiency of the active groundfish fleet.

¹⁹ Fixed costs are typically those that do not vary with the amount of fishing effort such as insurance.

²⁰ Fixed cost and crew payment data were collected through a voluntary survey in 2006-2008. However, vessel owner response to that fixed cost survey was poor and the resulting data quality was insufficient. In 2012, SSB implemented a redesigned cost survey to collect information about fixed costs and crew payments incurred in 2011 from approximately 50% of the commercial fishing vessel owners in the Northeast, according to vessel size and primary gear type. The survey was repeated in 2013, surveying the remaining half of vessel owners in the Northeast for fixed costs and crew payments incurred in 2012. These more recent surveys have resulted in higher response rates than the 2006-2008 efforts, with response rates of 30% and 21%, respectively, and the SSB now has fixed cost and crew payment data for 741 commercial fishing vessels in the Northeast. These data are being analyzed now as the SSB strives towards a more complete understanding of profitability for various segments of the fleet. At this time, both the Northeast Fishery Observer Program (NEFOP) and the At-Sea Monitors (ASM) Program collect some of fishing-related costs, and these data can be used to evaluate financial performance. Information contained in VTR and dealer data can also be used to derive additional performance measures.

4.1. Revenue per Vessel

Landings revenue per unit of effort was used as a proxy measure for profitability. Profitability is often measured as the ratio of total revenue divided by total cost, with a ratio greater than one indicating positive profits. Because a complete accounting of costs is not available, effort is used as a proxy for cost. If the costs of inputs used to generate effort are constant, comparing the ratio of revenue per unit of effort in two time periods serves as a proxy for profitability change. With constant input prices and revenue, an increase in effort would increase costs, reducing the revenue per unit effort ratio, and imply reduced profitability between the two time periods. Conversely, increased revenue with constant (or lower) effort would imply increased profitability. However, even with constant effort, the costs of inputs used to generate effort could be increasing.

The gross revenue per effort metrics used in this report characterize the performance of an average vessel within each vessel size category. However, individual vessel performance can vary substantially, in either direction, from the average. As stated above, changes in gross revenue per unit effort can also be accompanied by changes in the use (and therefore the cost) of inputs.²¹ These caveats should be considered when evaluating the results that follow.

Average all species gross revenues per vessel on groundfish trips were at four-year lows in 2013 for all vessel size categories except for largest vessel length class, the $\geq 75'$ group. Decreases from 2012 ranged from 1.3% for vessels 50' to $<75'$ in length to 88.4% for vessels $<30'$ in length. The largest class of vessels saw a 7.6% increase from 2012 to 2013 in average all species revenue per vessel on groundfish trips. For all vessel length classes, average all species gross revenues on groundfish trips have declined over the four-year time span, with decreases ranging from 9.1% for the largest vessels to 80.2% for smallest vessels (Table 16).

Average all species revenue per vessel on non-groundfish trips increased to four-year highs in 2013 for all vessel length classes except the $\geq 75'$ group. Increases from 2012 ranged from 4.7% for the 50' to $<75'$ length to 17.2% for the 30' to $<50'$ length class. For the largest class of vessels, average all species revenue on non-groundfish trips fell 6.3% in 2013 from 2012. Over the four-year time period, increases in average all species revenue per vessel on non-groundfish trips have ranged from 10.6% for the largest vessel length class to 26.9% for the 50' to $<75'$ class (Table 16).

4.2. Fleet Productivity

Productivity and productivity change are key economic indicators and critical factors in economic growth. With a single output and single input, productivity is typically measured as the ratio of output produced to the input used. With a more complicated production process, productivity is measured as aggregate output divided by aggregate input, and is called Total Factor Productivity (TFP). TFP is the most general measure of productivity, and changes in TFP can be measured at the firm level or at the aggregate industry level.

Fishing vessels typically catch multiple species on a trip using multiple inputs. For example, vessels use labor (crew), capital stock (vessel length and horsepower), and energy (fuel) on fishing trips to harvest a variety of fish and shellfish species. Because of this multiple

²¹ For example, the amount of fuel used could increase because of a change in fishing behavior that may generate an increase in revenue per day absent.

output, multiple-input fishing technology, index numbers that combine outputs and inputs into a single number, and compare those totals with a base year or time period total, are necessary to measure TFP change.

A recent national effort estimated productivity change for all catch share fisheries in the United States, including the Northeast Multispecies Fishery, using the Lowe Index.²² Productivity change was defined as the ratio of a Lowe output quantity index to a Lowe input quantity index. The Lowe output and input quantity indices are aggregate values of total outputs produced, and total inputs used to produce the outputs, with both indices constructed using fixed prices. The index is constructed at the fishery level, which differs from estimates of productivity in prior reports, which estimated productivity change with the Malmquist Index²³ at the vessel level.

For the Northeast Multispecies Fishery, the Lowe output index was constructed using all species (outputs) landed on those trips identified as groundfish trips. The Lowe input index was constructed by aggregating the value of capital services, labor services, fuel, and materials used on all fishing trips identified as a groundfish trip. The base year for the indices was 2007. A value greater than 1 for the Lowe Index indicates an improvement in productivity, while a value less than 1 signifies a decline in productivity, compared with 2007. A final point is that these numbers have not been adjusted to account for any changes in biomass that may have occurred. Data for 2013 to make the biomass correction were not yet available.

Productivity for the Northeast Multispecies Fishery peaked in 2009 (1.23) and has since slowly declined. In 2013, the value was 0.96, which is a 4% reduction in productivity since 2007. Focusing on outputs, the output quantity index has declined steadily from 2007 and reached a low of 0.58 in 2013, meaning the fishery output was 42% less than in 2007. However, inputs used also declined during the same period, resulting in an input index value of 0.6 in 2013, a 40% reduction from 2007 levels (Table 17). The decline in inputs was chiefly caused by the exit of vessels. Input usage declining more than outputs produced was the reason the productivity index was greater than 1 until 2011. In terms of yearly change, only 2009 and 2013 saw positive gains in productivity from the prior year. For 2013, this occurred because total input usage declined further than total outputs produced, leading to a slight upturn in productivity.

5. ACE LEASING

Every limited access groundfish permit has a potential sector contribution (PSC) based on its fishing history. The PSC is a percentage share of the total allocation for each allocated groundfish stock. Every limited access groundfish permit also has a tracking identification number called a Moratorium Right Identifier (MRI). PSC is technically allocated to MRIs, which are subsequently linked to vessels through Northeast Multispecies limited access fishing permits. When fishermen join a sector, their PSC is pooled and becomes the sector's annual catch entitlement (ACE). Each sector determines how to distribute its ACE among its members. All groundfish caught on sector fishing trips count toward that sector's ACE. ACE is transferable

²² See O'Donnell 2012. The Lowe TFP index can be written as the ratio of two indexes attributed to Lowe (1823).

²³ The Malmquist Index (MI), which was introduced by Caves, Christensen and Diewert (1982), is an index well suited for measuring TFP change. Because only outputs and inputs are needed to construct the MI, this index is particularly advantageous for estimating changes in productivity of fishing vessels. Other productivity metrics require data on output and input prices. Although price data for landed species are extensive, data on input prices are only available for a subset of vessels.