

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.

between sectors via approved annual leases, while PSC is transferable within sectors using lease arrangements. ACE and PSC are generally leased because one fisherman or sector wishes to catch more than their initial allocation for a particular stock. It is important to note that some sectors or fishermen may choose to lease most or all of their ACE/PSC rather than catch it.²⁴ ACE and PSC leases result in transfer payments within the industry. If there are no transaction costs—that is, no costs associated with these transfers²⁵—the payments are not a cost to the industry. Every pound of ACE or PSC leased represents a cost to the lessee and a reimbursement to the lessor, both of whom are industry members or, in some cases, permit banks. A frictionless lease market²⁶ allows industry members to better align their allocated PSC portfolio with their actual catch. It is also particularly important to note that the ability to lease allows fisherman to use improved technology such as selective gears to target stocks for which they may not have been allocated sufficient PSC. But the benefits of leasing decrease as transaction costs increase: imperfect information on lease quantities and prices, for example, may cause fisherman to hold PSC when they should lease, or vice versa. Other structural aspects of the sector system such as operating rules that require multiple rights-of-refusal within sectors and between affiliated sectors may increase transaction costs, decreasing market liquidity and reducing efficiency in the leasing market. This section evaluates how ACE and PSC moved within and between sectors with an emphasis on market structure and size, prices, total transfers, and transaction costs.

5.1. Market Structure, Size, and Characteristics

There are two forms of leasing: ACE leases between sectors and PSC leases within sectors. Although by regulation ACE is pooled within sectors, most sectors seem to follow the practice of assigning catch allowances to member vessels based on PSC allocations. If this is standard practice for all sectors, catching more fish than an individual PSC allocation must require either a lease of ACE (between-sector) or PSC (within-sector).²⁷

Between-sector leases are formally reported to NMFS, noting the stock, total weight, and, often but not always, compensation. Catch and individual allocation data at the MRI level can be combined with between-sector lease data to estimate the size of these two components of the leasing market. Within-sector PSC leases are not tracked by NMFS; ACE is assigned to a sector with no restrictions on how and by whom it may be fished. However, sectors are asked to voluntarily report their within sector trades in reports submitted to NMFS at the end of each fishing year. Sectors also voluntarily report which sector members transfer quota out of the sector and which sector members receive quota from another sector. Not all sectors report these within and between sector trades in the same fashion. Within-sector PSC leases data were reported voluntarily and comprehensively for the first time in 2012. However, these data are not uniformly traceable to the individual permit or MRI level. Many sector members own multiple

²⁴ Presumably because the benefit from leasing the quota outweighs the expected benefits from catching it (revenues from landing ACE less the cost of catching the ACE). Often, ACE is transferred in order to achieve an optimal balance of species/stocks since many species/stocks are caught jointly.

²⁵ Transaction costs include, for example, payments to a broker, the cost associated with finding buyers or sellers, or the opportunity costs associated with leases that didn't happen due to poor market information or other factors.

²⁶ A lease market with no transaction costs.

²⁷ In FY2011 this became more difficult as FY2010 carryover was allocated to sectors and the method of re-allocation within a sector is not reported. For the purposes of this analysis, it was assumed that the total amount of sector-level carryover was re-allocated to individual sector members proportional to their unused PSC from the prior year.

vessels but the data do not distinguish which permits were responsible for leasing in, or out, quota. In addition, fishing permits can be associated with different MRIs, due to ownership changes and other reasons, and can move in and out of CPH status.²⁸ This further complicates associating vessels with actual quota trades.

Two hundred and twenty four sector-affiliated MRIs had catch that exceeded individual PSC allocations for at least one stock in 2013, down from 242 in FY 2012. These MRIs leased in nearly 21 million live pounds of ACE and/or PSC in FY 2013 (Table 18). A similar comparison at the vessel affiliation level²⁹ shows 156 affiliations leased in nearly 12 million live pounds in 2013 (Table 19). Of all the major home ports, Gloucester, Massachusetts, had the largest number of lessees with 41 at the vessel level (Table 18) and 32 at the affiliation level (Table 19). The largest percentage of the 224 lessees identified (45.5%) were attached to vessels in the 30' to <50' vessel length category (Table 20).

The difference between the 21 million live pounds at the MRI level and the 11.7 million live pounds at the vessel affiliation level, which is 9.3 million live pounds, is the transfer of ACE among MRIs within a vessel affiliation. A vessel affiliation could be a single owner with multiple MRIs and these “leases” could simply be transfers of ACE from one MRI to another.

While lessee fishermen and/or ownership groups can be determined by comparing catch with allocated PSC at the MRI level, the fishermen on the other side of those transactions (lessors) are more difficult to identify. Fishermen who failed to convert their allocated PSC into catch may be easily identified, but these permits create a pool of potential ACE/PSC that is much larger than aggregate lessee requirements (Table 21). Further, many active fishermen chose to lease ACE/PSC for particular stocks while targeting others, so those with zero catch are not the sole pool of potential lessors. Some broad conclusions may be reached. For example, Table 22 shows that, while the largest vessel size category ($\geq 75'$) was allocated 37% of all ACE in 2013, this size category caught 53% of total catch, indicating a broad shift of ACE/PSC from smaller to larger vessels.

Figure 8 reveals that the distribution of catch and ACE among vessel size categories changes considerably across the 17 allocated stocks but confirms the conclusion that the smallest vessel length category, most likely inactive skiffs, was a primary source of leased ACE/PSC. Additionally, CPH permits are a significant source of leased ACE/PSC.

The intersector, or between sector, lease market declined in FY 2013, with volume down more than 28% from the previous year, to almost 16 million live pounds (Table 23).

5.2. Prices

Analyzing price and quantity data for the between-sector component of the market, a hedonic price model was used to estimate lease values for all 17 stocks of leased ACE (Table 24 and Table 25).³⁰ Statistically significant prices were estimated in 2013 for 10 of the 17 stocks.

²⁸ CPH provides a temporary holding place for inactive permits while allowing the fishing history (and ultimately the quota) to be used on another permit.

²⁹ Vessel affiliations are groups of vessels connected by common ownership. Note that these data may not be comprehensive, as vessel affiliation data are not currently collected on CPH permits.

³⁰ ACE leases between sectors take three forms: (1) single-stock leases with single-value cash compensation (single stock leases); (2) multi-stock leases with single-value cash compensation (bundled leases); and (3) single or multi-stock leases with single or multi-stock compensation (swap leases). This model decomposes the lease arrangements into constituent parts representing the 17 individual stocks, where a price (P) is a function of various quantities of

Seven stocks—Georges Bank East cod, East and West GB haddock, pollock, redfish, Gulf of Maine winter flounder, and Georges Bank yellowtail flounder—were traded at a price no different from zero.³¹ Gulf of Maine cod obtained the highest lease price at an annual average of \$1.22 per pound, which is its highest average price in the four-year period (Table 25). For reference, Table 26 contains mean price estimates from single stock lease data only and Table 27 contains ex-vessel and estimated ACE lease prices.

Prices based only on one portion of the lease market (between sector ACE leases vs. within sector trades) may be biased due to structural issues affecting the lease markets. Most sectors maintain rights of first refusal when a sector member wishes to lease ACE out of the sector, and the Northeast Fishery Sectors maintain an additional second-refusal right for all members of their affiliated sectors. These structures place frictions in the market by concentrating liquidity into small pools before opening the market to all participants. The impact of this on lease prices is uncertain, but within-sector markets may clear at lower prices than between-sector markets and therefore estimates based on between-sector transactions may be biased upward. This is not certain, however, as the large pool of available ACE for most stocks should be sufficient to meet leasing demand and erode any between-sector price premium. Permit banks and similar privately funded ACE leasing organizations may choose to lease ACE at below market rates, which might create an additional upward bias on the price estimates. These leases typically take place within sectors, and therefore the proportion of total ACE leased out by such entities is unknown. Such lease arrangements are not factored into price estimates reported here since no data are available for them.

5.3. Transfer Payments

At the MRI level, the total value of ACE/PSC lease market transfers in 2013 is estimated at 4.4 million dollars, down 46% from 2012 and 62% from 2010 (Table 28). When collapsed to vessel affiliations, the total transfer payment due to leasing is estimated at just over three million dollars, down 25.4% from 2012 and 53.4% from 2010, and implying that approximately 30% of all leasing (by value) is occurring within vessel affiliations (Table 29). The proportion of leases within and between vessel affiliations varies considerably at the homeport and state level (Table 30). For example, in Boston and New Bedford a large portion of the trades (transfers) occur between vessels within vessel affiliations whereas this is not the case in other ports.

5.4. Transactions Costs

The transfers described thus far do not represent a cost to the industry as a whole. Any costs associated with ACE and PSC leasing result from two primary sources: the direct costs of

the sixteen stocks for which ACE is traded. The specification of the model is $P = \beta_0 + \beta_1\chi_1 + \dots + \beta_n\chi_n + \varepsilon$. The weights, β , are the portion of the total price (P) attributable to each quantity of ACE stock leased (x) and represent the marginal price of ACE lease. In this case n is the sixteenth ACE stock. Additional variables were added to estimate the contribution of bundled and swap leases, as well as the effects on prices for ACE leased by Northeast Fishery Sector IV and state permit banks. To include swap leases in the model, price was set at zero dollars and one side of the swap recorded negative lease quantities while the other recorded positive quantities. By using swap, bundle, and single-stock lease data, it is possible to provide a comprehensive estimate of ACE lease values.

³¹ This could be because the quota were truly valueless (likely the case for the GB haddock stocks) or because data were insufficient to allow the model to estimate a non-zero price.

getting buyers (lessees) and sellers (lessors) to negotiate lease prices and quantities and the indirect costs associated with leases that would have made both buyers and sellers better off but did not happen. Together, these are considered transaction costs.

It was not possible to estimate the value of transaction costs for three reasons. The first is a structural impediment. The fact that ACE is held at the sector level but leases almost universally occur at the individual permit (MRI) and/or vessel affiliation level means that lease market data are opaque, leaving only the lessee side of the transaction obviously discernible from official NOAA records. Second, while most sectors included some perspective on some forms of transaction costs in their annual reports, no comprehensive data are available on all of the costs associated with orchestrating leases between individuals, firms, or sectors. Such costs may include fees paid to sector managers or brokers, costs associated with advertising ACE availability, or the cost of time spent searching for and completing suitable leases. The third and final reason for being unable to estimate transaction costs is that no data are available on which to base estimates for the cost of lost leasing opportunities,³² the largest form of transaction cost in this market. Primarily these lost opportunities are due to search frictions and/or structural market impediments that prevent or impair lease negotiation. That is to say, it is not possible to estimate which fishermen or vessel affiliations wanted to lease quota but could not and what the impact of any inability to match buyers and sellers may have been on the potential for increasing the catch of non-binding stocks. The fact that only 33% of total allocated ACE/PSC was caught in 2013 and that less than half of these allocations were caught for eight of the 17 stocks implies at first glance that the potential for efficiency gains from improving lease markets may be large (Table 31). In fact, the inability of sectors to catch their allocated ACE is not likely attributable to any one factor. For example, it may be due to search frictions and/or structural impediments, but it may also be due to fish availability and/or imperfect quota setting, insufficient technology to target particular stocks, expectations about future market conditions, or other factors altogether.

6. DISTRIBUTIONAL ISSUES

Considerable attention has been given to consolidation in the groundfish fishery and whether the degree of consolidation has been heightened by Amendment 16. There is concern also that consolidation may generate a loss of diversity in the fishery. The term “consolidation” can be used to refer to many possible events including the following: a reduction in the number of vessel affiliations (i.e., ownership groups), a reduction in the number of active vessels, a narrower range of vessel sizes, or fewer landed or home ports. To avoid confusion, this report uses the term “consolidation” to mean fewer active vessels or fewer active vessel affiliations earning total revenues for all species and groundfish. In discussing how revenues for all species and groundfish are distributed among existing active vessels and active vessel owners in a given fishing year, we either use the term “concentration” or refer to revenue distributions as being relatively more or less equally distributed.

It is important to note that this section addresses the consolidation and concentration of all species and groundfish revenues from landings by active vessels and vessel affiliations, which are earned through *use* of the fishery resource. It does not address concentration and

³² Leases that would have left both lessee and lessor better off had they occurred.