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[34], 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 32% of total allocated ACE/PSC was caught, and that less than 50% of these allocations were caught for 9 of the 16 stocks implies at first glance that the potential for efficiency gains from improving lease markets may be large (Table 32). 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: 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 nominal revenues for all species and groundfish. In discussing how nominal 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 earned through use of the fishery resource. It does not address concentration and consolidation of quota or permits, which allows for access to the fishery resource. A fisherman may not be actively landing fish, which means that he would not earn a share of the landings revenues discussed in this section. However, he may still be earning revenues from leasing his quota to other fishermen, and those earnings are not reflected in the discussion in this section.

[34] Leases that would have left both lessee and lessor better off had they occurred.

6.1. Number of Vessel Affiliations

Changes in the number of vessel affiliations, or networks of vessels connected by common owners, do not necessarily mean there are more or fewer individuals involved in the fishery. Changes in vessel ownership among existing individuals can also result in changes in the number of vessel affiliations; the results in Table 33 reflect the combination of these two possibilities. The number of vessel affiliations issued limited access groundfish permits declined 16% over 2009-2012 (934 to 787 affiliations), with a 7% reduction between 2011 and 2012 (846 to 787 affiliations).

The number of active vessel affiliations declined from 2011 to 2012 at a faster rate than the number of active vessels (Table 10 and Table 33). In addition, the number of vessel affiliations in the group of vessels that had revenue from at least one groundfish trip is declining at a faster rate than the number of vessel affiliations that had revenue from any species. The number of vessel affiliations in possession of at least one active vessel with revenue from any species on all trips declined 16% from 2009 to 2012 (737 to 618 affiliations), with a 2% decline occurring between 2011 and 2012 (633 to 618 affiliations). The number of vessel affiliations that had at least one vessel that reported revenue from at least one groundfish trip declined by 31% between 2009 and 2012 (450 to 310 affiliations), with an 8% decline occurring between 2011 and 2012 (338 to 310 affiliations) (Table 33).

Over the four year time series, the rates of decline for the numbers of active vessels and vessel affiliations were nearly identical, at around 16-17% for the numbers of vessels and affiliations with revenue from any species and 29-31% for the numbers of vessels and affiliations with revenue from at least one groundfish trip. The percentage of vessel affiliations that are inactive (i.e., have no landings) has remained relatively stable over the four year period, ranging from a low of 21% in 2009 and 2012, to a high of 25% in 2011 (Table 33).

Consolidation of vessels and vessel affiliations is occurring among owners that actively target groundfish, i.e. those vessels and vessel affiliations that had revenue from at least one groundfish trip. Vessels and vessel affiliations that were active (i.e. have revenue from any species while holding a limited access groundfish trip), but did not earn any revenue from a groundfish trip may be viewed as vessels and affiliations that do not actively target groundfish. Over 2009-2012, there does not appear to be ongoing consolidation in this group of vessels and owners. The number of active vessels with limited access groundfish permits that did not have revenue from a groundfish trip increased 3.7% (350 to 363 vessels) from 2009 to 2012, with a 1.7% increase (357 to 363 vessels) from 2011 to 2012 (Table 10). The number of active vessel affiliations that did not actively target groundfish increased 7.3% (287 to 308 affiliations) over 2009-2012, with a 4.4% increase (295 to 308 affiliations) from 2011 to 2012 (Table 33).

Data presented in Table 33 and Table 34 together suggest that the decline in the number of active vessels in 2009-2012 (Table 10) is primarily due to attrition of active vessel affiliations (fewer ownership groups) rather than consolidation at the affiliation level (i.e., vessel affiliations choosing to harvest fish on fewer vessels). In general, the percentages of vessel affiliations containing a single vessel versus those containing multiple numbers of vessels have remained stable over 2009-2012. The percentage of vessel affiliations with a single active vessel in 2012 was 86.1% (532 affiliations); a small decline from 86.6% (548 affiliations) in 2011. Only one vessel affiliation had 10+ vessels in 2011; this remains the case for 2012. The average number of active vessels per active vessel affiliation did not change between 2011 and 2012, at 1.23 active vessels per active vessel affiliation, and it has remained nearly constant since 2009 (Table 34).

6.2. Distribution of Nominal Revenue among Vessels

All species and groundfish revenues were not evenly distributed among groundfish vessels during 2009-2012 (or probably at any time). Between 2011 and 2012, the amounts of nominal all species and groundfish revenues concentrated in the top earning categories remained relatively stable. Both all species and groundfish nominal revenues were unequally distributed in 2011, and they remained so in 2012, but inequality did not worsen significantly. Groundfish revenue remained more concentrated among the top earning vessels than all species revenue. Distributions of nominal revenues among active vessels during 2009-2012 were examined by ranking active vessels by nominal revenue from highest to lowest, and then categorizing the vessels into seven earnings brackets from highest to lowest: top 1%, 20%, 40%, 60%, 80%, 99% and bottom 1%. This was done for both all species revenues on all trips and groundfish revenues on all trips (Table 35 and Table 36).

During 2009-2012, the top 20% of vessels annually accounted for 60%-65% of the total nominal revenue from all species. In this same time period, little change occurred in the proportional share of the bottom 20% of vessels for all species nominal revenues (Table 35).

Groundfish revenues continue to be less equally distributed among active vessels than all species revenues in 2012. However, the degree to which groundfish revenues were unequally distributed did not worsen from 2011 to 2012. Between 2009 and 2010, groundfish nominal revenues became noticeably more concentrated in the highest-earning 20% of vessels, increasing from 66.3% to 76.3%. This level of revenue concentration has remained nearly constant since, with the top 20% of active vessels accounting for 76.2% of nominal groundfish revenues in 2012. On the other end of the earnings spectrum, the bottom 20% of active vessels earned 0.7% of total nominal groundfish revenues in 2012 (Table 36).

6.3. Distribution of Nominal Revenue among Vessel Affiliations

The distributions of both all species and groundfish nominal revenues are more concentrated at the vessel affiliation (ownership) level than at the vessel level. The concentration of revenues among top earning vessel affiliations was marked in 2009-2011, and this level of concentration persisted and slightly increased in 2012. Groundfish nominal revenue is more concentrated than all species revenue among the top earning vessel affiliations, as was the case for at the vessel level.

Distributions of nominal revenues among vessel affiliations in 2009-2012 were examined by ranking active vessel affiliations by nominal revenue from highest to lowest, and then categorizing the vessels into seven earnings brackets from highest to lowest: top 1%, 20%, 40%, 60%, 80%, 99% and bottom 1%. This was done for both all species revenues on all trips and groundfish revenues on all trips (Table 37 and Table 38). In addition, vessel affiliations with at least one active vessel in each year were divided into eight nominal revenue categories. The smallest nominal revenue category included affiliations earning less than $50,000 for all trips and species landed. The highest nominal revenue category included affiliations earning $1 million or more (Figure 12).

As noted in Section 6.1, the total number of vessel affiliations with active vessels declined annually between 2009 and 2012 (Table 33). From 2011 to 2012, declines in the

number of vessel affiliations occurred in five of the eight revenue categories: $200K-$300K, $300K-$500K, $500K-$700K, $700K to $1.0 million and $1.0 million and over. Both the $200K-$300K and the $500K-$700K revenue categories have experienced steady declines in the number of vessel affiliations throughout 2009-2012, with 37.9% (-39 affiliations) and 50% (-25 affiliations) declines, respectively. After falling from 2010 to 2011, the number of vessel affiliations in the <$50K, $50K to $100K, and the $100K-$200K categories increased in 2011 to 2012 by 5.3% (+7 affiliations), 2.7% (+2 affiliations) and 3.5% (+4 affiliations), respectively (Figure 12). This suggests that not only are there fewer vessel affiliations in 2012 than in 2011 and the two years prior, but the distribution of all species revenues among remaining active vessel affiliations changed somewhat over 2011-2012, with the bottom three revenue categories increasing its number of vessel affiliations, and the top five revenue categories losing vessel affiliations.

During 2009-2012, the distribution of nominal all species revenue among vessel affiliations remained unequal, but relatively stable. The top 20% of vessel affiliations annually accounted for between 68% and 73% of the total nominal revenue from all species, with 72.8% of all species revenues earned by the top 20% of vessel affiliations in 2012, up from 72.1% in 2011. The bottom 20% of vessel affiliations fared slightly worse, earning 3.9% of all species revenues in 2012, compared to 4.2% in 2011(Table 37).

Groundfish nominal revenues were highly concentrated among top earning vessel affiliations in 2011 and remained so in 2012, with minimal change in the degree of concentration from 2011 to 2012. The percentage of total groundfish nominal revenue earned by the top 20% of vessel affiliations increased from 84% in 2011 to 85.1% in 2012. This slight increase was due to an increase in the share of groundfish nominal revenue by the top 2% to 20% of vessel affiliations (57.9% to 59%); the percentage of groundfish revenues earned by the top 1% of vessel affiliations remained constant at 26.1%. The percentage of groundfish nominal revenues held by the bottom 20% of vessel affiliations decreased very slightly from 0.5% in 2011 to 0.4% in 2012 (Table 38).

6.4. Distribution of Nominal Revenue Using Lorenz Curves and Gini Coefficients

Lorenz curves provide a graphical interpretation of how revenue is dispersed among the income levels of a population[35]. For any given point on the Lorenz curve, the vertical axis value is the share of total nominal revenue accounted for by all vessels that earned revenue equal to or less than the proportion of the population indicated by the horizontal axis value. The Gini coefficient can be derived from the Lorenz curve, and reflects the degree of deviation between the Lorenz curve and the 45 degree line that represents perfect equality[36]. Gini coefficient values are bounded by 0 and 1, where 0 indicates perfect equality and 1 indicates maximum inequality.

It is important to recall that nominal revenues have not been equally distributed for some time, as seen earlier in this section. During 2009-2012, the distribution of groundfish nominal revenues was more unequal than the distribution of all species nominal revenues among vessel

[35] A Lorenz curve is constructed by ranking vessels in order of increasing nominal revenue and then plotting the cumulative proportion of the population on the horizontal axis versus the cumulative share of nominal revenue on the vertical axis.

[36] The Gini coefficient is equal to twice the area between the diagonal and the Lorenz curve.

affiliations, which can be seen by comparing the Gini coefficients over 2009-2012 for all species nominal revenues (Figure 13) with the Gini coefficients for the same time period for groundfish nominal revenues (Figure 14).

The 2009 to 2010 period brought an increase in inequality to the fishery, as seen by the increase in the Gini coefficient for both all species and groundfish nominal revenues (0.657 to 0.696 for all species and 0.745 to 0.814 for groundfish). From 2010 to 2011, there was a slight decrease in inequality for both all species and groundfish revenues earned by vessel affiliations, with the Gini coefficients falling slightly to 0.689 for all species and 0.810 for groundfish nominal revenues. This downward shift in the level of inequality did not continue into 2012. Based on Gini coefficient analysis, inequality in the groundfish fishery, for both all species and groundfish nominal revenues, has increased very slightly from 2011 to 2012.

The Gini coefficient for all species nominal revenues increased from 0.689 in 2011 to 0.694 in 2012 (Figure 13). Inequality among active vessel affiliations for all species revenue (as measured by the Gini coefficient) was at a four year high in 2010, suggesting that although inequality for all species revenue increased from 2011 to 2012, in 2012 inequality was not as marked as it was in 2010.

The Gini coefficient for groundfish nominal revenues among vessel affiliations also increased from 0.810 in 2011 to a four year high of 0.818 in 2012. Gini coefficients greater than 0.75 generally indicate extreme inequality, which suggests that the distribution of groundfish nominal revenues is highly skewed among vessel affiliations and has been for some time.

6.5. Consolidation and Concentration of Nominal Revenue among Vessels

Another way of analyzing the distribution of revenue is to evaluate the number of vessels that earn various shares of the overall revenue. When fewer vessels earn nominal all species and groundfish revenues, consolidation has occurred. To assess whether changes in the concentration of revenue have occurred, annual changes in the proportion of vessels by nominal revenue quartile were examined adjusting for yearly changes in the total number of vessels. The number of vessels accounting for 25%, 50%, 75%, and 100% of the nominal revenue from all species on all trips and groundfish species on all trips was tabulated for each year from 2009 to 2012 (Table 39 and Table 40).

The number of vessels earning the top 25% and 50% of all species revenues decreased from 2011 to 2012, suggesting that all species revenues were consolidated onto fewer vessels. In addition, minor evidence of a slight increase in the concentration of all species revenues on the top earning vessels can be seen by the decrease in the percentage of vessels earning the top 25% and 50% of all species revenues. The percentage of vessels accounting for the top 25% of all species nominal revenues dropped modestly from 5.3% in 2011 to 5.1% in 2012. Similarly, the percentage of vessels that accounted for the top 50% of all species nominal revenues declined slightly from 2011 to 2012, from 13.7% to 13.4% (Table 39).

Comparison of Table 39 and Table 40 indicates that groundfish revenues are more concentrated amongst top earning vessels than all species revenues. Table 40 also shows that both the number and percentages of vessels earning the top 25% and top 50% of groundfish revenues decreased from 2011 to 2012, but again, the changes in the percentages of vessels in the top 25% and 50% were very modest. For the top 25% of groundfish revenues, the percentage of vessels earning those revenues decreased from 3.6% in 2011 to 3.5% in 2012. For the top 50%,

The percentage of vessels earning the top 50% of groundfish revenues decreased from 9.6% in 2011 to 9.4% in 2012 (Table 40).

Consolidation of both all species and groundfish nominal revenues onto fewer vessels clearly occurred over 2009 to 2012. In 2011, it appeared that the level of concentration for both all species and groundfish nominal revenues among active vessels had leveled off from what it was in 2010. However, from 2011 to 2012, concentration of both all species and groundfish nominal revenues appear to have either remained relatively constant or very modestly increased.

6.6. Consolidation and Concentration of Nominal Revenue among Vessel Affiliations

The vessel-level analyses do not provide information about consolidation at the ownership/business entity level. An analysis at the affiliated vessel level evaluates whether revenues were concentrated among fewer business entities rather than fewer vessels. For example, if the same number of vessel affiliations used fewer vessels, a vessel-level analysis would show consolidation whereas an affiliated vessel level analysis would not. That is, when a vessel leaves the fishery, it may be because its owner (or owners) consolidated quota onto another vessel or vessels, rather than the owner(s) left fishing altogether.

To evaluate consolidation and concentration of nominal revenues among owners, the number of vessel affiliations accounting for 25%, 50%, 75%, and 100% of nominal revenues from all species (and separately, groundfish) on all trips was tabulated (Table 41 and Table 42, respectively).

Consolidation of all species revenues into fewer ownership groups has occurred, meaning some ownership groups are no longer actively fishing under their limited access groundfish permits. From 2009 to 2012, there has been decline in the number of vessel affiliations in each earnings quartile. For the 25% and 50% quartiles, the number of vessel affiliations with revenue from all species remained the same from 2011 to 2012. In the 75th quartile, there was a decline to 134 affiliations in 2012 from 141 affiliations in 2011. Overall, there were 15 fewer affiliations earning total all species revenues in 2012 (633 affiliations) than in 2011 (618 affiliations). The percentages of vessel affiliations earning the top 25% and 50% of all species nominal revenues have remained relatively stable from 2011 to 2012. In both 2011 and 2012, 1.9% of vessel affiliations earned the top 25% of all species revenue. The percentage of vessel affiliations earning the top 50% of all species revenues increased very slightly to 8.6% in 2012, from 8.4% in 2011 (Table 41). This analysis suggests that while the number of affiliations earning all species revenue has declined, the distribution of all species revenues among those vessel affiliations that remain active in the fishery has not changed significantly.

Groundfish nominal revenues continue to be consolidated into fewer ownership groups. Between 2011 and 2012, the degree of concentration of groundfish revenues among those vessel affiliations remaining in the fishery slightly increased. Overall, there were 28 fewer vessel affiliations earning total groundfish revenues in 2012 than there were in 2011. Both the number (2 affiliations) and the percentage of affiliations (0.6%) that earned the top 25% of groundfish revenues remained the same from 2011 to 2012. A slight increase in the concentration of groundfish revenues among vessel affiliations occurred in the percentages of vessel affiliations earning the top 50% and 75% of groundfish revenues. The percentage of vessel affiliations earning the top 50% of groundfish revenues decreased from 4.7% in 2011 to 4.5% in 2012. From

2011 to 2012, the parentage of vessel affiliations earning the top 75% of groundfish revenues also decreased, from 12.7% to 11.9% (Table 42).

Taken together, Table 41 and Table 42 imply that there are fewer ownership groups remaining in the fishery, and therefore fewer ownership groups dividing up all species and groundfish revenues earned from actively fishing under limited access groundfish permits. Groundfish revenues were distributed among vessel affiliations slightly less equally in 2012 than they were in 2011. The distributions of nominal revenues among vessel affiliations indicate that groundfish revenues are more concentrated among vessel affiliations than all species revenues, as was also the case for vessels.

Sections 6.2 – 6.6 provide different ways of looking at the issues of consolidation and the concentration of all species and groundfish nominal revenues among active vessels and vessel affiliations. In 2009, all species nominal revenues and groundfish nominal revenues were not equally distributed among active vessels or vessel affiliations. As well, groundfish nominal revenue distributions were more unequal than all species nominal revenue distributions for both active vessels and vessel affiliations. In 2010, these revenue distributions became further concentrated, or even more unequal, than in 2009. There were indications in 2011 that the level of concentration, or inequality, in the fishery, may have leveled off or possibly decreased. The analysis presented in Section 6 indicates the level of concentration did not continue to decrease in 2012; it has leveled off or possibly slightly increased, particularly for groundfish revenues.

Both the number of active vessels and vessel affiliations continued to decline in 2012, indicating that there were fewer vessels and fewer groups of owners than in the three previous years. Therefore, consolidation of revenues on fewer vessels and fewer vessel affiliations continued. Both all species and groundfish nominal revenues were no more equally distributed (or less concentrated) in 2012 than in 2011 among active participants in the fishery, and may be very slightly more concentrated.

7. EMPLOYMENT

Changes in employment levels can result from changes in fishery regulations. If new management approaches, such as catch shares, foster vessel consolidation or reductions in fishing effort, working conditions may be affected including pay, time spent at sea, and the number of jobs. Although NMFS does not track employment in the fishing industry in the Northeast, Vessel Trip Reports contain information about crew size on fishing trips and on the duration of trips. While these reports do not identify the actual number of individuals employed (e.g., crew often work for more than one vessel owner), the VTR data can be used to determine the number of crew positions available and the length of time that crew spend at sea. In general, trends in crew employment indicators were negative, suggesting that in 2012 there were fewer opportunities for crew work on most vessel sizes and in most home port states. The exceptions to this trend were in the home port states of Connecticut and Maine. However, even in those states, it appears that the time spent per crew earning opportunity, as measured by the ratio of crew days to crew trips, has increased.

7.1. Number of Crew Positions

The total number of crew positions, measured by summing the average crew size of all active vessels on all trips, declined annually between 2009 and 2012 from 2,416 to 2,136 (a 12%