APPENDIX I

ANNUAL LEASE PRICE MODEL
AND
ECONOMIC IMPACT OF
VARIOUS IFQ POSSESSION LIMITS

June 15, 2020 – Version 2.1

Simulation Analysis: Economic Impacts of Modeling the LAGC IFQ Possession Limit

The following document details methods, assumptions, and simulation results presented to the Scallop PDT on August 29th, 2018. Simulation outputs should not be considered as absolute values; instead, outputs should be considered in terms of relative change (%) compared to the 600-pound limit.

1. Annual lease price model

Average lease prices by individual owners and permit banks were calculated separately for each group and the differences in lease prices were estimated by a dummy variable (AFFGRP). Data includes annual average lease-out prices for 2010-2017 fishing years by inactive IFQ permit holders (mainly CPH) with lease value>1 and those who leased out to vessels in different affiliations. Therefore, those lease transactions (temporary transfers) that took place within the vessels in the same affiliation are excluded from the estimation because lease values were set to either to "zero" or "one" for many observations in this group.

Estimation of annual lease prices for the purposes of possession limit analyses is challenging due to the availability of only 8 years of annual data and 16 observations including the values for permit banks and individual leases restricting the number of explanatory variables that could be included in the model. After experimenting with a dozen models and taking into account the most important variables that could impact lease prices, the following model provided the best fit with statistically significant coefficients. The model is based on the actual data for lease prices representing equilibrium values each year taking into account the factors that impact the supply and demand for leasing in the scallop IFQ fishery. It shows that scallop prices, trip costs, the number of active vessels leasing quota and who leases out quota explains 89% of the variation in lease prices during 2010-2017 after correcting for the dip in lease prices in 2016 fishing year due to several factors including the peak in allocation to over 4.4 million in that year and limitations on landings of large scallops due to resource conditions resulting in over 0.9 million unused quota in that year.

Table 1 . Estimation results for lease prices

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	2.51182	0.50236	29.07	<.0001
Error	10	0.17280	0.01728		
Corrected Total	15	2.68462			

Root MSE	0.13145	R-Square	0.9356
Dependent Mean	0.80664	Adj R-Sq	0.9034
Coeff Var	16.29659		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	--Heteroscedasticity Consistent- Standard Error	t Value	Pr > |t|
INTERCEPT	1	-3.98589	1.00482	-3.97	0.0027	0.45605	-8.74	<.0001
PRICE17	1	0.15006	0.03445	4.36	0.0014	0.02702	5.55	0.0002
TRPCPLB2017	1	-0.71134	0.20158	-3.53	0.0055	0.11135	-6.39	<.0001
AFFGRP	1	0.57347	0.06573	8.73	<.0001	0.05196	11.04	<.0001
D2016	1	-1.37389	0.28705	-4.79	0.0007	0.17478	-7.86	<.0001
NUMVESNETLSIN	1	0.05169	0.01495	3.46	0.0061	0.00651	7.94	<.0001

Variables:

LEASEPR: Lease price per pound of scallop leased in 2017 dollars

PRICE2017: Ex-vessel price per lb. of scallops in 2017 dollars

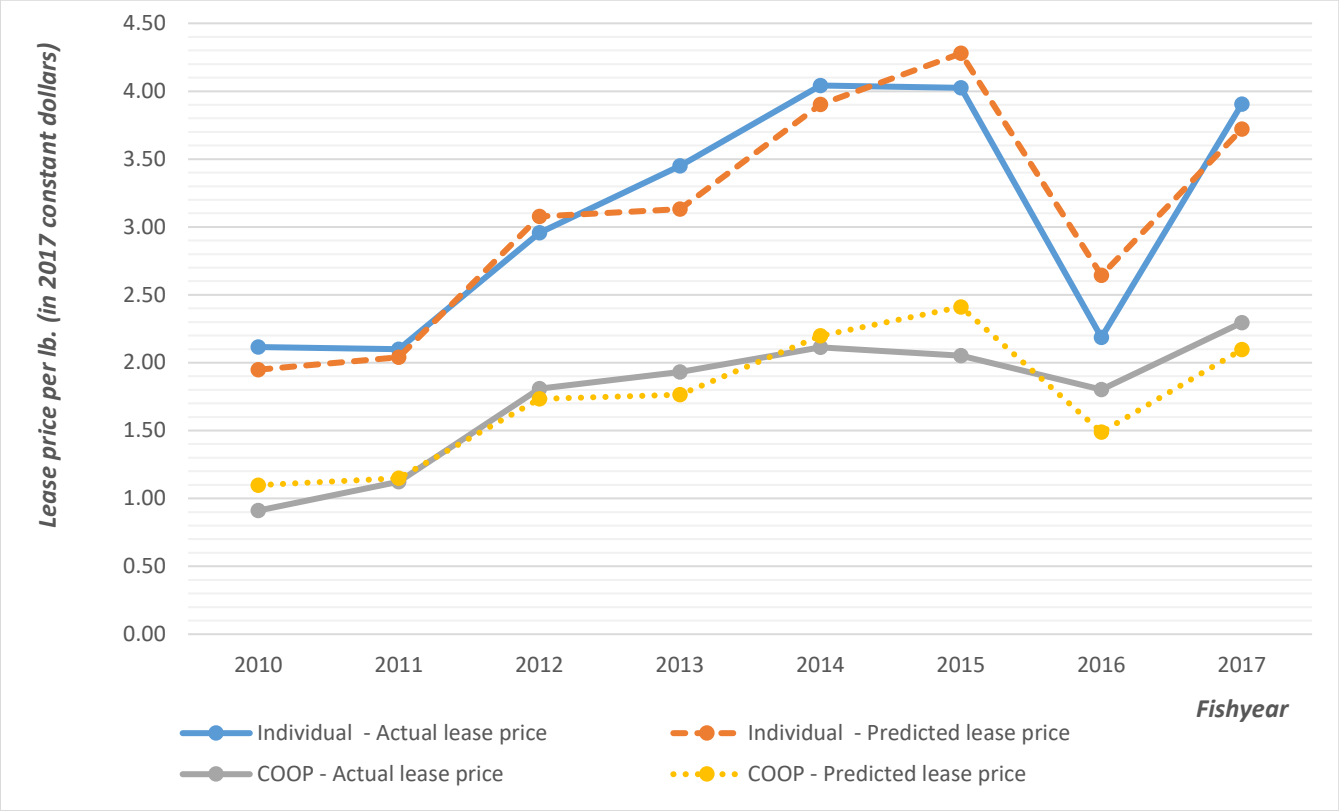
TRPCOSTPLB: Trip costs per lb. of scallops in 2017 dollars

AFFGRP: Individual owner=1, Permit bank=0

NUMVESCO: Number of vessels that were net leasers (lease-in)

D2016 = Dummy variable, 2016=1, other years=0, to take into account the impacts of about 4.5 million IFQ allocations and other factors.

Figure 1. Actual and predicted price by affiliation type from 2010 - 2017



The model assumes that the demand for quota is the primary factor that determines annual average lease prices as the supply of quota is mainly set by the LAGC IFQ allocation. It makes economic sense for most inactive permit holders, especially those with CPH permits, to lease out their quota rather than to hold them without any earnings unless the lease prices are too low to justify a lease transaction, or the profitability is too high to incentivize them to get a vessel to participate in the LAGC IFQ fishery. In addition, for a new vessel to become active in the fishery would require a sizeable investment, which may exceed the economic benefits if an owner with a CPH permit, or someone who is active mostly in other fisheries and doesn't have a good amount of quota to fish for scallops to justify the initial investment.

However, it must be cautioned that this estimation is based only 8 years of data during which trip limits were 600 pounds since 2011 with vessel and dredge sizes consistent with the limits on scallop catch per trip. If a significant change in trip limits leads to additional investments in vessel capacity, that could potentially increase magnitude of impact of trip limits on lease prices.

In terms of other statistical properties, the small sample size leads to weak multicollinearity between the number of vessels that were net leasers and the dummy variable for 2016. However, for the variables we are interested in projecting, namely price and trip costs per pounds of scallops, the variance inflation factors (VIF) are quite small. Removing year 2016 leads to normal VIFs and results in almost the same numerical values of the coefficients for ex-vessel price and trip costs per pound variables. The original model was also tested for endogeneity for

the number of vessels; the test results showed no significant endogeneity that will necessitate other methods of estimation. The small sample size also restricts the use of simultaneous equations.

Although more than a dozen models were tested in the estimation of annual lease prices, it is possible to experiment with at least another dozen models using various other statistical models. However, the model presented above is quite robust, providing a good fit to lease prices in the period of 2010-2017 and serves as a useful tool for scenario analyses with a range of potential increase in lease prices corresponding to higher trip limits.

Methods for determining trip lengths by area

Updated assumptions of trip length were based on observed LAGC IFQ trip data provided by NEFOP, which estimated the following attributes for open and access area trips:

- Transit time—the average of steam time (when vessel leaves dock until gear is deployed) plus calculated time from the end of the last haul until vessel lands, all converted to hours.
- Fishing time—calculated at the trip level by taking an average haul duration for observed hauls and then multiplying that by total hauls for the trip. Then fishing time was averaged among all trips in that particular fleet.
- Trip Length was simply DATELAND minus DATESAIL (in hours)
- Scallops landed is number of bags for trip multiplied by average bag weight.

The NEFOP data was then used to update trip length assumptions based on the following methods:

1. Deduct the transit time (i.e. steam time) from total trip length in the observer data to estimate total fishing time (TFT) = hauling time + other fishing operations. Other fishing operations include clearing the deck before the next tow, cutting scallops, maybe gear work, which are all considered as fishing operations.
2. Calculate the transit and TFT as a % of the total trip length in the observer data by area (Table 1)
3. For trip length by area, use the updated *annual IFQ data*.
4. Apply the percentages for the transit and TFT from the observer data to estimate the length in hours and DAS by hours.
5. Estimate TFT in hours per lb. of scallops by area
6. Use TFT in hours per lb. of scallops per area to estimate TFT corresponding to the different trip limit options (Table 2).

Table 2. Estimated trip lengths, transit and fishing times by area (based on the updated 2017 IFQ data for trip length and observer data for % of time spent for transit and fishing)

Rows	Data	Access	Open
	Observer Data		
1	Transit time (hrs)	10.1	6.3
2	Hauling (hrs)	4.2	11.5
3	Oth. fish. operations (hrs)	9.2	6.7
4	Total Fishing time (TFT, hrs)	13.4	18.2
5	Total trip length (hrs)	23.5	24.5
6	**transit time as a % of trip**	**0.4**	**0.3**
7	**TFT % of trip length**	**0.6**	**0.7**
8	Scal.land. per trip	754	604
9	Scal.land. per DAS	769	592
10	Trip length in days	0.98	1.02
11	Days to land 600 lb.	0.78	1.01
12	TFT to land 600 lb. (in days)	0.44	0.75
13	TFT per lb. of scallops (Hrs)	0.02	0.03
	Annual IFQ data (update)		
14	Annual avg. trip length (hrs)	22.32	23.3
15	Annual avg. trip length (days)	0.93	0.97
16	Avg.Scal.land.per trip	593	507
17	Avg.Scal.land.per DAS	637	522
18	**Transit time (Row 6*Row**	**9.6**	**5.9**
19	**TFT (Row 7*Row 14)**	**12.7**	**17.3**
19	Days to land 600 lb.	0.94	1.15
20	TFT to land 600 lb. (in days)	0.54	0.85
21	TFT per lb. of scallops (Hrs)	0.02	0.03
22	total trip length for 600 lb.	22.48	26.47

Table 3. Estimated trip lengths, transit and fishing times by area (based on the updated 2017 IFQ data for trip length and observer data for % of time spent for transit and fishing)

Access Areas: TFT per lb.= 0.02							
Trip limit	Trip length (hrs)	TFT (hrs)	Transit time (hrs)	Trip length in days	TFT in days	Transit time in days	LPUE (Scallop landings per DAS
600	22.48	12.9	9.6	0.94	0.54	0.40	641
800	26.78	17.19	9.6	1.12	0.72	0.40	717
1000	31.08	21.49	9.6	1.29	0.90	0.40	772
1200	35.38	25.79	9.6	1.47	1.07	0.40	814
Open Areas: TFT per lb. = 0.03							
Trip limit	Trip length (hrs)	TFT (hrs)	Transit time (hrs)	Trip length in days	TFT in days	Transit time in days	LPUE (Scallop landings per DAS
600	26.47	20.48	5.99	1.08	0.85	0.25	544
800	33.29	27.30	5.99	1.39	1.14	0.25	577
1000	40.12	34.13	5.99	1.67	1.42	0.25	598
1200	46.94	40.95	5.99	1.96	1.71	0.25	614

2. Assumptions for scenario analyses

1. Annual landings for an IFQ vessel that derives over 75% of its revenue from scallops with at least 10 days of fishing in the IFQ fishery is set to 30,000 lb. per year from all areas. This number is close to the average landings of those vessels in the 2017 fishing year.
2. It is assumed that average vessel landings from open areas will be about 59% of the total and those from access areas are 41% of total scallop landings. These numbers equivalent to what was observed for 2016 and 2017 fishing years using the updated annual IFQ data. Therefore, an average vessel with annual landings of 30,000 lb. is assumed to land 12,412 lb. from access areas and 17,587 lb. from open areas in the following scenario analyses below.
3. An unlimited amount of simulations could be run using different trip lengths, proportion of leasing, price, trip costs, percent of quota leased and average landings as well using alternative models. The analyses below provide results of scenarios at two different prices, maintenance costs and crew share lay formula. Lease prices are estimated separately for access and open area conditions as follows:
    a. Access area fishing conditions: Access area trip length is set to 0.94 days or 22.5 hours correspond to a trip limit of 600 lb. using the updated data and methods described above, as well as the variable estimates shown in Table 2 and Table 3. Steam time is estimated to be 0.4 days or 9.6 hours and the total fishing time is estimated to be 0.54 days, or 12.9 hours corresponding to 600 lb. trip limit. It was also assumed that an increase in trip limit will not change the transit time but increase fishing time (TFT) in the same proportion, resulting in an increase in the trip length. This is a conservative assumption since the fishing time may not increase proportionately with the increase in trip limit for some vessels that are fishing in areas with a higher stock abundance.
    b. Open area fishing conditions: Open area trip length is set to 1.08 days or 26.47 hours with a steam time of 0.25 days and a 0.85 days in total fishing time (TFT). Table 2

provides the trip lengths also in hours. It was also assumed that the increase in trip limit will increase fishing time in the same proportion while the steam time will stay the same, so trip length will increase (Table 3). This is again a conservative estimate in terms of trip productivity. In reality, trip length may increase less than proportionally as the possession limit increase depending on the area fished and vessel characteristics.

4. Estimation of lease price for all areas: If the leased pounds are distributed in the same proportion of open and access area landings, then the overall lease price could be explained as a weighted average of corresponding percentage distribution of landings by area. Lease price estimates for all areas presented in the Tables below is based on this assumption and assuming that 59% of landings came from open and 49% from access areas using the 2017 fishing year data.

3. Model Validation and Estimation of lease prices

Lease prices are estimated in Table 4 below by area and using the average ex-vessel prices for 2017 ($11.26 for the IFQ fleet), average trip costs per day at sea ($589 in 2017) and trip lengths as described in Table 2 and Table 3 above. The trip limit column in the table also includes the average scallop pounds landed per trip in the access and open areas. This shows that even though the trip limit was 600 lb., average landings per trip were less, 507 lb. for the open and 593 lb. for access areas based on the updated IFQ data by area for 2017 fishing year. Using these values in the lease price equation provided in Table 1 above, results in a lease price estimate of $3.67 for open and a lease price estimate of $4.24 for the access areas. Lease prices would be higher for access areas because the increase in trip length would be lower relative to open areas due to lower fishing time in the access versus open areas.

In reality, lease prices are not determined based on which areas leased pounds are used. Therefore, the estimates in Table 4 could only be used to have a rough idea about how lease prices would vary assuming that the productivity of the fishing areas either resembled open area or access area conditions. We could, however, estimate potential lease prices for all areas as an average of open and access area lease price estimates weighted respectively by the percentage landings coming from open versus access areas. Overall trip lengths and trip costs per lb. of scallops are also estimated by a weighted average of the corresponding numbers for open and access areas. The results show that estimated lease price for all areas using the 2017 data would be $3.91 per lb. of scallops. Incredibly, this is also equal to the actual price observed in the same year (see Figure 1 above)! Of course, this result cannot be used to assert that the price model will predict prices with 100% accuracy but at the least, it could be inferred that the model and the methods we used to estimate lease prices for all areas provide reasonable estimates lease prices at different trip limits.

The results also show that if trip limits were doubled from 600 lb. to 1200 lb., the lease prices would only increase by 9% if open area conditions prevailed and would increase by 15% under access area fishing conditions. For all areas, it would increase by 12%. The reason for this is that as trip limits increase, trip lengths go up as well resulting in a less than proportionate decline in trip costs per lb. of scallops. For example, increase in trip limit to 1200 would increase the average trip length from all areas from 24.82 hours for a trip limit of 600 lb. to 42.16 hours for a trip limit of 1200 lb. (Table 4). The updated estimates for the trip length, transit and total fishing

time resulted in a higher trip length, lowering the increase in the lease prices. Consequently, and as the results in the following sections show, negative impacts of higher trip limits on net revenues net of trip and lease costs and the impacts of crew shares are lower compared to the previous projections.

Table 4. Estimated lease price and trip costs (fuel, food, oil, water, ice & supplies) based on 2017 ex-vessel price of $11.26 and trip costs of $589 per DAS

Possession limit	Transit time (hrs)	TFT (hrs)	Total Trip length (hrs)	Trip costs	Trip costs per lb.	% Ch. in trip costs per lb. relative to 600 lb.	Lease Price Estimate	% Ch. in lease price	LPUE lb./DAS
OPEN AREAS									
507	**5.99**	**17.29**	**23.28**	**571.3**	**1.13**	**4%**	**3.67**	**-3%**	**522**
600	5.99	20.48	26.47	649.5	1.08	0%	3.79	0%	544
800	5.99	27.30	33.29	817.0	1.02	-6%	3.96	4%	577
1000	5.99	34.13	40.12	984.5	0.98	-9%	4.06	7%	598
1200	5.99	40.95	46.94	1152.0	0.96	-11%	4.13	9%	614
ACCESS AREAS									
593	9.58	12.74	22.32	547.8	0.92	1%	4.24	0%	637
600	9.58	12.90	22.48	551.7	0.92	0%	4.26	0%	641
800	9.58	17.19	26.78	657.2	0.82	-11%	4.56	7%	717
1000	9.58	21.49	31.08	762.7	0.76	-17%	4.76	12%	772
1200	9.58	25.79	35.38	868.2	0.72	-21%	4.89	15%	814
ALL AREAS (59% of landings from open and 41% of landings from access areas)									
539	**7.48**	**15.40**	**22.88**	**561.6**	**1.04**	**3%**	**3.91**	**-2%**	**570**
600	7.48	17.34	24.82	609.1	1.02	0%	3.98	0%	584
800	7.48	23.12	30.60	750.9	0.94	-8%	4.21	6%	635
1000	7.48	28.90	36.38	892.7	0.89	-12%	4.35	9%	670
1200	7.48	34.68	42.16	1034.6	0.86	-15%	4.45	12%	697

4. Scenario analyses for economic impacts

Assumptions for all scenarios:

1. Total landings from all areas are assumed to be 30,000 lb. (Equal to about average of landings per vessel that leased in from different owners in 2016-17. This is also the average landings for vessels that leased in more than 50% of landings in 2017).
2. Trip costs per day at sea = $589 (Average trip costs for vessels that were net leasers= i.e., Lease-in>Lease-out)
3. Fixed costs excluding maintenance and repairs are assumed to be $43,870, maintenance and repairs $20,330 and total fixed costs are assumed to be $64,200 in 2017 dollars based on the projections using cost survey data for 2011-2012 and corresponding to 600 lb. trip limit (Table 8).
4. It is assumed that the maintenance and repair costs will change in proportion to the change in trip length relative to the trip length at 600 lb. trip length (Table 8).
5. Scenarios are projected for two different average ex-vessel price scallop price per lb., $9 and $12, as well as for varying degrees of leasing, including at 0%, 12.5%, 37.5%, 62.5% and 87.5% corresponding to mid-points of ratios of net leasing to landings using a quartile grouping.
6. Economic impacts on boat and crew shares are estimated using two different lay systems:
   a) Boat receives 48% of gross, crew gets 52% of gross and pays for trip and lease costs.
   b) Boat receives 48% of gross, crew gets 52% of gross and pays for trip costs and vessel owner and crew share the lease costs. However, the column corresponding to % change in net revenue net of trip and lease prices could be used to analyze impacts of another crew lay system where vessel owner and crew share a proportion of gross revenue net of trip costs and lease prices.

Table 5. Number of active vessels that were net leasers

Ratio of net lease to landings	2010	2011	2012	2013	2014	2015	2016	2017
<=25%	7	6	18	10	11	11	15	8
25% to 50%	17	17	9	19	15	9	9	12
50% to 75%	16	25	20	16	14	10	12	14
>75%	29	21	28	26	37	44	53	40
NO NET LEASE (0%)	73	60	42	25	26	29	25	30
LEASEOUT (net)	9	9	6	22	28	25	27	33
Total	**151**	**138**	**123**	**118**	**131**	**128**	**141**	**137**

Table 6. Number of active vessels that were net leasers as a% of total active vessels

Ratio of net lease to landings	2010	2011	2012	2013	2014	2015	2016	2017	Grand Total
<=25%	5%	4%	15%	8%	8%	9%	11%	6%	8%
25% to 50%	11%	12%	7%	16%	11%	7%	6%	9%	10%
50% to 75%	11%	18%	16%	14%	11%	8%	9%	10%	12%
>75%	19%	15%	23%	22%	28%	34%	38%	29%	26%
NOLSINACTIVE	48%	43%	34%	21%	20%	23%	18%	22%	29%
LEASEOUTACTIVE	6%	7%	5%	19%	21%	20%	19%	24%	15%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 7. Number of active vessels that were net leasers as a% of total active vessels that leased in

Ratio of net lease to landings	2010	2011	2012	2013	2014	2015	2016	2017	Grand Total
<=25%	1%	1%	6%	4%	2%	1%	3%	1%	3%
25% to 50%	13%	11%	9%	16%	16%	9%	5%	8%	10%
50% to 75%	25%	40%	36%	26%	21%	12%	9%	23%	23%
>75%	61%	47%	49%	54%	60%	78%	82%	68%	64%
Grand Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Scenario A: Change in trip limits applies to ALL areas:

The number of trips, average trip length, trip costs per lb. of scallops, annual trip costs, and annual maintenance/repair costs at various trip limits for all areas are provided in Table 11. Changes in lease price, gross and net revenue is shown in Table 9 at two different ex-vessel prices, for $9 and for $12. It is evident from the Table 9 that IFQ quota lease price increase more than proportionately (by 57%) to the increase in price of scallop, by 33% in this case, i.e., one percent increase in price of scallop will increase lease price by much more than one percent. This could be a reflection in increase in profits at higher ex-vessel prices as other costs remain constant (as it was assumed here), leading to more demand for lease. However, the percentage increase in lease price from the level at 600 lb. trip to level corresponding to 1200 lb. stays the same at different ex-vessel prices.

Table 8. Changes in trip length, DAS, trip costs and maintenance and repair expenses, assuming possession limit increases in ALL areas.

Possession limit	Number of trips	Trip length	% Ch.in trip length	Trip costs per lb. of scallops	% ch.in trip costs per lb.	Annual DAS	Annual trip costs	Annual Maintenance & repair costs
600	50	24.8	0%	1.02	0%	52	30,453	20,330
800	38	30.6	23%	0.94	-8%	48	28,159	18,799
1000	30	36.4	47%	0.89	-12%	45	26,782	17,880
1200	25	42.2	70%	0.86	-15%	44	25,865	17,267

Table 9. Changes ex-vessel price, lease price, total and net revenue by possession limit in ALL areas.

Possession limit	Ex-vessel Price	Lease price	% Ch.in lease price	Total revenue	Net revenue (Gross-Trip costs)	% ch.in net revenue
600	9	2.84	0%	270,000	239,547	0.0%
800	9	3.00	6%	270,000	241,841	1.0%
1000	9	3.10	9%	270,000	243,218	1.5%
1200	9	3.17	12%	270,000	244,135	1.9%
600	12	4.45	0%	360,000	329,547	0.0%
800	12	4.70	6%	360,000	331,841	1.0%
1000	12	4.86	9%	360,000	333,218	1.5%
1200	13	4.97	12%	360,000	334,135	1.9%

Summary of results (ALL areas):

1) **Ex-vessel price = $9**

Because of the relatively small increase in lease prices as trip limits increase from 600 lb. to 1200 lb., the changes in revenue net of lease and trip costs will be small, slightly positive for those who don't lease or lease a relatively smaller proportion of their landings (such as at less than 50% of landings). This is because the savings in trip costs will outweigh the increase in lease costs at those levels as trip lengths decline for all trips. For example, if a vessel leases 37.5% of their landings and if trip limit increase to 1200 lb., trip costs will decline by $4,588 (from $30,453 at 600 lb. and $25,855 at 1200 lb., Table 8) , while the lease prices increase less, by $3,733 (from $31,916 at 600 lb. to $34,649 at 1200 lb., Table 10). However, as the ratio of lease to landings increase, increase in lease costs starts outweighing the decrease in trip costs, such as at lease ratios of 50% of landings and higher (Table 10).

Given that for most of the active vessels that leased in (about 90% in 2017) this ratio was more than 50%, this scenario shows that gross revenue net of trip and lease costs may decline as trip limit increase from 600 lb. (Table 10).

The impacts of the increase in the trip limits on vessel owners and crew will vary, however, according to the crew lay system and to what extent the decline in the number of trips and trip length can lower some of the fixed costs, especially maintenance and repair expenditures. Vessel shares would remain constant if crew pays the lease, but would decline if vessel pays half of the lease for possession limits of 800 lb. or higher compared to the 600 lb. limit. However, a decline

in the number of trips could benefit vessel owners by reducing the maintenance, repair and some other fixed costs. If those costs decline in proportion to the decrease in annual DAS at different trip limits and if crew pays the lease costs, the impacts on profits could be positive, ranging from 2.3% to 4.7% in Table 10, depending on the trip limit and the magnitude of the maintenance and repair costs.

An increase in trip limit could increase crew shares, although slightly, for those who work on boats with a low lease to landings ratio (for example, 37.5% or less) even when crew pays 100% of the lease costs. However, crews shares could decline for crew working on the top leasing groups (Table 10). For example, crew income could decline by 12% for those boats that lease 87.5% of their landings at 1200 lb. trip limit (Table 10). If, however, crew pays half of the lease crew shares would remain almost constant for the top leasing group and would be positive at lower leasing ratios. If vessels pay half of lease costs profits could decline for those vessels especially for those in the top lease group. Even after the decline in maintenance and lease costs, the profits could decline by as much as 5% at 1200 lb. possession limit (or more) for those in the top group of leasers who comprise most of the active vessels (about 68% in 2017) that lease-in (Table 10).

Table 10. Impacts of trip limits on lease costs and net revenue (ALL areas, ex-vessel price $9)

Ratio of lease to landings	Trip limit pounds.	leased pounds	Lease costs ($)	Net rev. net of lease ($)	% Change in Net. rev. net of lease	% Change in Profits (Crew pays lease)	% Change in crew shares (Crew pays lease)	% Change in profits (crew pay 50% of lease)	% Change in crew shares (crew pay 50% of lease)
0.0%	600	0	0	239,547	0.0%	0.0%	0.0%	0.0%	0.0%
	800	0	0	241,841	1.0%	2.3%	2.1%	2.3%	2.1%
	1000	0	0	243,218	1.5%	3.7%	3.3%	3.7%	3.3%
	1200	0	0	244,135	1.9%	4.7%	4.2%	4.7%	4.2%
12.5%	600	3,750	10,639	228,909	0.0%	0.0%	0.0%	0.0%	0.0%
	800	3,750	11,243	230,599	0.7%	2.3%	1.7%	2.0%	1.9%
	1000	3,750	11,622	231,595	1.2%	3.7%	2.7%	3.3%	3.0%
	1200	3,750	11,883	232,252	1.5%	4.7%	3.4%	4.1%	3.8%
37.5%	600	11,250	31,916	207,631	0.0%	0.0%	0.0%	0.0%	0.0%
	800	11,250	33,728	208,113	0.2%	2.3%	0.6%	1.3%	1.5%
	1000	11,250	34,867	208,350	0.3%	3.7%	0.9%	2.0%	2.3%
	1200	11,250	35,649	208,486	0.4%	4.7%	1.1%	2.4%	2.9%
62.5%	600	18,750	53,194	186,354	0.0%	0.0%	0.0%	0.0%	0.0%
	800	18,750	56,214	185,627	-0.4%	2.3%	-1.3%	0.1%	0.9%
	1000	18,750	58,112	185,105	-0.7%	3.7%	-2.2%	0.0%	1.5%
	1200	18,750	59,415	184,720	-0.9%	4.7%	-2.9%	-0.1%	1.8%
87.5%	600	26,250	74,471	165,076	0.0%	0.0%	0.0%	0.0%	0.0%
	800	26,250	78,699	163,142	-1.2%	2.3%	-5.5%	-2.1%	0.2%
	1000	26,250	81,357	161,861	-1.9%	3.7%	-9.1%	-3.5%	0.3%
	1200	26,250	83,182	160,954	-2.5%	4.7%	-11.6%	-4.6%	0.3%

2) Ex-vessel price = $12

The results with a $12 price scenario are similar except that net revenue from trip and lease costs will increase less for those who are low leasers and decline relatively more for those who lease a high proportion of their landings, even though absolute values of net revenue net of lease and trip costs are larger with a $12 ex-vessel price. A higher scallop price leads to higher lease price and lease costs resulting in a relatively smaller net revenue at trip limits higher than 600 lb. for those that lease-in even 37.5% of their landings (Table 11).

Results are similar in terms of profits as well, except the percentage increase in profits would be slightly less as the savings in maintenance and repair costs now comprise a smaller proportion of total profits. The impacts on crew incomes net of trip and lease costs would be slightly positive for those who work on boats that rely on leasing less, but negative for most of crew who work on boats that lease a significant ratio of their landings. Again, with higher ex-vessel price and higher lease prices, the negative impacts on crew shares will be larger, for example, about 23% decrease at a trip limit of 1200 lb. for the top group of leasers if crew pays 100% of lease costs (Table 11).

However, if vessel owner pays half of the lease costs, the impacts on profits would be negative especially for the top group it could lead a decline if 8% in profits at a 1,200 lb. limit (Table 11).

Table 11. Impacts of trip limits on lease costs and net revenue (ALL areas, ex-vessel price $12)

Ratio of lease to landings	Trip limit	leased pounds	Lease costs ($)	Net rev.net of lease ($)	% Change in Net.rev.net of lease	% Change in Profits (Crew pays lease)	% Change in crew shares (Crew pays lease)	% Change in profits (crew pay 50% of lease)	% Change in crew shares (crew pay 50% of lease)
0.0%	600	0	0	329,547	0.0%	0.0%	0.0%	0.0%	0.0%
	800	0	0	331,841	0.7%	1.4%	1.5%	1.4%	1.5%
	1000	0	0	333,218	1.1%	2.3%	2.3%	2.3%	2.3%
	1200	0	0	334,135	1.4%	2.8%	2.9%	2.8%	2.9%
12.5%	600	3,750	16,688	312,859	0.0%	0.0%	0.0%	0.0%	0.0%
	800	3,750	17,635	314,206	0.4%	1.4%	1.0%	1.1%	1.2%
	1000	3,750	18,231	314,987	0.7%	2.3%	1.5%	1.7%	2.0%
	1200	3,750	18,640	315,496	0.8%	2.8%	1.9%	2.1%	2.4%
37.5%	600	11,250	50,064	279,484	0.0%	0.0%	0.0%	0.0%	0.0%
	800	11,250	52,906	278,935	-0.2%	1.4%	-0.5%	0.1%	0.7%
	1000	11,250	54,693	278,525	-0.3%	2.3%	-0.9%	0.2%	1.0%
	1200	11,250	55,919	278,216	-0.5%	2.8%	-1.2%	0.2%	1.3%
62.5%	600	18,750	83,440	246,108	0.0%	0.0%	0.0%	0.0%	0.0%
	800	18,750	88,177	243,665	-1.0%	1.4%	-3.3%	-1.3%	-0.1%
	1000	18,750	91,155	242,063	-1.6%	2.3%	-5.5%	-2.1%	-0.2%
	1200	18,750	93,199	240,937	-2.1%	2.8%	-7.1%	-2.7%	-0.3%
87.5%	600	26,250	116,815	212,732	0.0%	0.0%	0.0%	0.0%	0.0%
	800	26,250	123,448	208,394	-2.0%	1.4%	-10.9%	-3.6%	-1.0%
	1000	26,250	127,617	205,601	-3.4%	2.3%	-17.9%	-5.9%	-1.8%
	1200	26,250	130,478	203,657	-4.3%	2.8%	-22.7%	-7.5%	-2.3%

3) Increase in trip costs

Higher trip costs increase the benefits of higher trip limits or reduces the loss from the increase in lease prices. Table 13 shows the results of a scenario with an ex-vessel price of $9 and 20% increase in trip costs from $589 per DAS to $707 per DAS. In this case, higher trip costs lead to larger savings in the trip cost at higher trip limits and increases crew shares even when crew pays the lease costs as long as lease to landings ratio is not more than 50%. For the top lease groups, crew shares could still decline at higher trip limits, although relatively less compared to Table 10 above with lower trip costs. As long as crew pays the trip costs, there would be no change in profits.

Table 12. Changes trip costs and lease price (trip limit applies to ALL areas)

Trip limit	Number of trips	Annual DAS	Trip cost per DAS	Lease Price	% Change in Lease Price	Annual trip costs
600	50	52	589	2.84	0%	30,453
800	38	48	589	3.00	6%	28,159
1000	30	45	589	3.10	9%	26,782
1200	25	44	589	3.17	12%	25,865
600	50	52	707	2.46	0%	36,543
800	38	48	707	2.63	7%	33,790
1000	30	45	707	2.73	11%	32,139
1200	25	44	707	2.81	14%	31,037

Table 13. Impacts of trip limits on revenue net of lease cost, profits and crew shares (ALL areas, ex-vessel price $9, and an increase in trip costs by 20% - $707 per DAS)

Ratio of lease to landings	Trip limit	leased pounds	Lease costs ($)	Net rev.net of lease ($)	% Change in Net.rev.net of lease	% Change in Profits (Crew pays lease)	% Change in crew shares (Crew pays lease)	% Change in profits (crew pay 50% of lease)	% Change in crew shares (crew pay 50% of lease)
0.0%	600	0	0	233,446	0.0%	0.0%	0.0%	0.0%	0.0%
	800	0	0	236,200	1.2%	2.3%	2.7%	2.3%	2.7%
	1000	0	0	237,852	1.9%	3.7%	4.2%	3.7%	4.2%
	1200	0	0	238,954	2.4%	4.7%	5.3%	4.7%	5.3%
12.5%	600	3,750	9,213	224,234	0.0%	0.0%	0.0%	0.0%	0.0%
	800	3,750	9,846	226,354	0.9%	2.3%	2.2%	2.0%	2.5%
	1000	3,750	10,248	227,604	1.5%	3.7%	3.6%	3.2%	3.9%
	1200	3,750	10,525	228,428	1.9%	4.7%	4.4%	4.0%	4.9%
37.5%	600	11,250	27,638	205,809	0.0%	0.0%	0.0%	0.0%	0.0%
	800	11,250	29,538	206,662	0.4%	2.3%	1.1%	1.1%	2.0%
	1000	11,250	30,743	207,109	0.6%	3.7%	1.7%	1.7%	3.2%
	1200	11,250	31,576	207,378	0.8%	4.7%	2.1%	2.1%	3.9%
62.5%	600	18,750	46,063	187,384	0.0%	0.0%	0.0%	0.0%	0.0%
	800	18,750	49,230	186,971	-0.2%	2.3%	-0.7%	-0.1%	1.4%
	1000	18,750	51,239	186,613	-0.4%	3.7%	-1.3%	-0.3%	2.2%
	1200	18,750	52,627	186,327	-0.6%	4.7%	-1.8%	-0.5%	2.8%
87.5%	600	26,250	64,488	168,958	0.0%	0.0%	0.0%	0.0%	0.0%
	800	26,250	68,921	167,279	-1.0%	2.3%	-4.3%	-2.1%	0.7%
	1000	26,250	71,735	166,118	-1.7%	3.7%	-7.2%	-3.5%	1.1%
	1200	26,250	73,677	165,276	-2.2%	4.7%	-9.4%	-4.6%	1.3%

Scenario B: Change in trip limits applies only to ACCESS areas:

Economic impacts of the trip limits when they only apply to access areas are analyzed by setting the trip limit at 600 lb. in the open areas, varying them in the access areas and estimating total number of trips, and DAS as a sum of the corresponding numbers in those areas (Table 14 and Table 15). The results of the simulations are provided in Table 16 at a $9 ex-vessel price and in Table 17 for an ex-vessel price of $12. The direction of the results is similar to the simulations provided for the OPEN areas; however, lease prices increase less when trip limit changes apply only to the access areas. For example, at a trip limit of 1,200 pounds, lease prices would increase by only 6% in this case compared to 12% if all areas could be fished at the increased trip limits. Although overall trip costs decline relatively less compared to scenario A, the economic impacts on profits and crew shares would be lower for all lease groups.

Table 14. Changes in trip length and lease price (trip limit applies to ACCESS areas only)

Possession limit	Area	Trip length (hrs)	Trip costs (per trip)	trip costs per lb.	% ch.in lease price	Lease price per lb.
600	Open	26.5	650	1.08	0.0%	2.70
800	Open	33.3	817	1.02	4.5%	2.82
1000	Open	40.1	985	0.98	7.2%	2.89
1200	Open	46.9	1152	0.96	9.1%	2.95
600	Access	22.5	552	0.92	0%	3.03
800	Access	26.8	657	0.82	7%	3.25
1000	Access	31.1	763	0.76	12%	3.39
1200	Access	35.4	868	0.72	15%	3.49
600	All	24.8	609	1.02	0%	2.84
800	All	26.6	653	0.97	3%	2.93
1000	All	28.4	696	0.95	5%	2.99
1200	All	30.2	740	0.93	6%	3.02

Table 15. Changes trip costs and lease price (trip limit applies to ALL areas)

Trip limit	Number of trips	Annual DAS	Trip cost per DAS	Annual trip costs	Net revenue
600	50	51.7	589	30,453	239,547
800	45	49.6	589	29,236	240,764
1000	42	48.4	589	28,506	241,494
1200	40	47.6	589	28,019	241,981

Table 16. Impacts of trip limits on revenue net of trip and lease costs, profits and crew shares (ex-vessel price $9, trip limit changes apply to ACCESS areas only)*

Ratio of lease to landing	Trip Limits	Leased Pounds	Lease costs ($)	*Net revenue net of lease ($)	% Change in Net revenue net of lease	% Change in profits (crew pays lease)	% Change in crews shares (crew pays lease)	% Change in profits (crew pays 50% of lease)	% Change in crew share (crew pays 50% of lease)
0%	600	0	0	239,547	0	0	0	0	0
	800	0	0	240,764	0.5	1.2	1.1	1.2	1.1
	1000	0	0	241,494	0.8	2.0	1.8	2.0	1.8
	1200	0	0	241,981	1.0	2.5	2.2	2.5	2.2
12.5%	600	3750	10639	228,909	0	0	0	0	0
	800	3750	10978	229,786	.4	1.2	0.9	1.1	1
	1000	3750	11194	230,300	.6	2.0	1.4	1.7	1.6
	1200	3750	11343	230,638	.8	2.5	1.7	2.1	2.0
37.5%	600	11,250	31,916	207,631	0	0	0	0	0
	800	11,250	32,935	207,829	0.1	1.2	0.3	0.6	0.8
	1000	11,250	33,582	207,912	0.1	2	0.4	0.9	1.2
	1200	11,250	34,028	207,953	0.2	2.5	0.4	1.2	1.5
62.5%	600	18750	50,194	186,354	0	0	0	0	0
	800	18750	54,892	185,872	-0.3	1.20	-0.80	-0.10	0.40
	1000	18750	55,969	185,872	-0.4	2.00	-1.50	-0.20	0.70
	1200	18750	56,713	185,524	-0.6	2.50	-1.90	-0.30	0.80
87.5%	600	26250	74,471	165,076	0	0	0	0	0
	800	26250	76,849	163,915	-0.7	1.2	-3.3	-1.3	0
	1000	26250	78,357	163,137	-1.2	2.0	-5.5	-2.3	0
	1200	26250	79,398	162,582	-1.5	2.5	-7.0	-3.0	0

* This is assuming 100% of individual IFQ vessel annual 30,000 landing pounds coming from Access area.

Table 17. Impacts of trip limits on revenue net of trip and lease costs, profits and crew shares (ex-vessel price $12, trip limit changes apply to ACCESS areas only)*

Ratio of lease to landing	Trip Limits	Leased Pounds	Lease costs ($)	*Net revenue net of lease ($)	% Change in Net revenue net of lease	% Change in profits (crew pays lease)	% Change in crews shares (crew pays lease)	% Change in profits (crew pays 50% of lease)	% Change in crew share (crew pays 50% of lease)
0%	600	0	0	329,547	0	0	0	0	0
	800	0	0	330,764	0.4	0.7	0.8	0.7	0.8
	1,000	0	0	331,494	0.6	1.2	1.2	1.2	1.2
	1,200	0	0	331,981	0.7	1.5	1.6	1.5	1.6
12.50%	600	3,750	16,888	312,859	0	0	0	0	0
	800	3,750	17,221	313,543	0.2	0.7	0.5	0.5	0.6
	1,000	3,750	17,559	313,935	0.3	1.2	0.8	0.9	1
	1,200	3,750	17,792	314,189	0.4	1.5	0.9	1.1	1.3
37.50%	600	11,250	50,064	279,484	0	0	0	0	0
	800	11,250	51,662	279,102	-0.1	0.7	-0.4	0	0.3
	1,000	11,250	52,676	278,818	-0.2	1.2	-0.6	0	0.5
	1,200	11,250	53,376	278,605	-0.3	1.5	-0.8	0	0.6
62.50%	600	18,750	83,440	246,108	0	0	0	0	0
	800	18,750	86,104	244,660	-0.6	0.7	-2	-0.8	-0.1
	1,000	18,750	87,793	243,701	-1	1.2	-3.3	-1.3	-0.2
	1,200	18,750	88,960	243,021	1.3	1.5	-4.2	-1.7	-0.3
87.50%	600	26,250	212,732	212,732	0	0	0	0	0
	800	26,250	210,219	210,219	-1.2	0.7	-6.3	-2.1	-0.7
	1,000	26,250	208,583	208,583	-2	1.2	-10.4	-3.5	-1.1
	1,200	26,250	207,437	207,437	-2.5	1.5	-13.3	-4.5	-1.5

* This is assuming 100% of individual IFQ vessel annual 30000 landing pounds coming from Access area.

Aggregate fleet level impacts of Trip Limits – A scenario analysis using FY2017 data for the IFQ fishery

The earlier analysis in this Appendix was for an individual IFQ vessel that on average annually lands 30000 pounds of scallop from ALL areas. The analysis below aggregates at the LAGC IFQ fleet level by considering the economic numbers of an individual IFQ vessel in ALL area. It also takes into account of the lease costs for different clusters of IFQ vessels that lease-in IFQ quota in different proportion of lease-in to landings.

Assumptions

- Ex-vessel price=$11.26 and trip costs per DAS in including food, fuel, oil, water & ice =$589
- Trip limit changes apply ALL areas
- Transit time, TFT and total trip length, LPUE and lease price are provided in Table 4.
- 59% of total scallop landings come from open and 41% from the access areas.
- Crew share system: Crew receives 52% of gross revenue, pays trip costs and pays either 100% or 50% of lease costs.
- Those assumptions combined with the annual price model results in the following percent changes in trip costs, DAS and lease prices.
- The FY2017 data group by leasing activity shown in is used to estimate the aggregate impacts for different groups (Table 19)

Table 18. Percentage changes in average trip lengths from ALL areas

Possession limit	%ch.in trip length	% ch.in DAS	%ch.in LPUE (per DAS)	% Ch. Lease price	% Ch.in trip costs
600	0%	0%	0%	0%	0%
800	23%	-8%	9%	6%	-8%
1000	47%	-12%	15%	9%	-12%
1200	70%	-15%	19%	12%	-15%

Table 19. Number of IFQ holders and total net lease pounds, DAS and landings by activity and net leasing (2017)

ACTVITY	Ratio of net lease	Number of IFQ holders (num. of MRI)	Total net lease	Sum of SCAL_DAS	Average Scallop lb. per vessel	Ratio of net lease to landings*
ACTIVE	<=25%	8	12,205	366	18,368	8%
	26% to 50%	12	109,181	562	23,991	38%
	51% to 75%	14	320,086	945	34,532	66%
	>75%	40	958,762	1,933	25,441	94%
	NO LEASE	30	-	456	7,246	0%
	LEASE-OUT	33	-215,629	739	9,925	*-66%
ACTIVE Total		**137**	**1,184,605**	**5,002**	**18,108**	
NOT ACTIVE	NO LEASING	67	-	-	-	NA
	LEASEOUT	111	- 1,184,605	-	-	NA
Grand Total		**315**	**0**	**5,002**	**7,876**	

Table 20. Estimated change in trip costs (in 2017 dollars & fuel prices, - indicates decline)

Lease groups	600	800	1,000	1,200
Lease out - active		-25,046	-40,074	-50,093
Zero lease		-16,622	-26,595	-33,244
<=25%		-11,236	-17,978	-22,472
26% to 50%		-22,015	-35,224	-44,030
51% to 75%		-36,968	-59,149	-73,936
>75%		-77,816	-124,506	-155,632
Grand Total		**-189,703**	**-303,526**	**-379,407**

Table 21. Estimated change in total maintenance and repair costs (in 2017 dollars, - indicates decline)

Lease group	600	800	1000	1200
Lease out - active		-14,320	-22,911	-28,639
Zero lease		-8,784	-14,054	-17,568
<=25%		-6,533	-10,453	-13,066
26% to 50%		-12,774	-20,438	-25,547
51% to 75%		-22,581	-36,130	-45,162
>75%		-43,035	-68,855	-86,069
Grand Total		**-108,026**	**-172,841**	**-216,052**

Note: Maintenance costs for each group is estimated using the cost equation which is estimated as a function of HP*LENGTH of vessel based on 2011-2012 surveys. Then those costs are adjusted by % the ratio of landings in each group to landings of the most active group, which is the 50% to 75% net leasing group with scallop landings of over 34,000 lb. each year.

Table 22. Estimated total lease costs (-) and earnings (+) (in 2017 dollars)

Lease group	600	800	1000	1200
Lease out - not active	4,717,571	4,985,409	5,153,774	5,269,343
Lease out - active	858,721	907,474	938,121	959,158
Zero lease	0	0	0	0
<=25%	-48,605	-51,365	-53,099	-54,290
26% to 50%	-434,802	-459,488	-475,006	-485,657
51% to 75%	-1,274,710	-1,347,082	-1,392,575	-1,423,802
>75%	-3,818,174	-4,034,949	-4,171,215	-4,264,752
Grand Total	**0**	**0**	**0**	**0**

Table 23. Estimated changes in total lease costs (- shows increase) and lease earnings (+ shows increase) compared to the levels for 600 trip limit (in 2017 dollars)

Lease group	600	800	1000	1200
Leaseout -not active		267,838	436,203	551,772
Leaseout -active		48,753	79,400	100,437
Zero lease		0	0	0
<=25%		-2,760	-4,494	-5,685
26% to 50%		-24,686	-40,203	-50,855
51% to 75%		-72,371	-117,864	-149,092
>75%		-216,775	-353,042	-446,578

Table 24. Estimated changes total costs including trip, lease and maintenance and repairs (- shows the increase in costs and + shows the decline and/or increase in lease revenues in 2017 dollars)

Lease group	600	800	1000	1200	No. of Permit holders
Lease-out groups					
• Lease out -not active		267,838	436,203	551,772	111
• Lease out - active		88,120	142,386	179,169	33
Total gains for lease-out groups		**355,957**	**578,589**	**730,942**	144
No lease, active		**25,406**	**40,649**	**50,812**	**30**
Lease-in groups					
<=25%		15,010	23,937	29,854	8
26% to 50%		10,103	15,458	18,722	12
51% to 75%		-12,822	-22,586	-29,994	14
>75%		-95,924	-159,681	-204,877	40
Total gains for lease-in groups		**-83,634**	**-142,872**	**-186,294**	**74**

Table 25. Estimated changes in crew shares if crew pays the lease costs (as a % difference from the levels for 600 lb. trip limit)

Lease group	600	800	1000	1200	crew	Crew numbers as a % of total
<=25%		1%	2%	3%	30	6%
26% to 50%		0%	-1%	-1%	49	10%
51% to 75%		-3%	-6%	-7%	58	11%
>75%		-13%	-21%	-26%	149	29%
Zero lease		2%	3%	3%	103	20%
Lease out -active		3%	5%	6%	123	24%
Grand Total		**-1%**	**-1%**	**-1%**	**512**	100%

Table 26. Estimated changes in profits if crew pays lease costs (as a % difference from the levels for 600 lb. trip limit)

Lease group	600	800	1000	1200	No. of IFQ holders
<=25%		1.2%	2.0%	2.5%	8
26% to 50%		1.2%	2.0%	2.5%	12
51% to 75%		1.3%	2.1%	2.6%	14
>75%		1.2%	1.9%	2.4%	40
Zero lease		1.1%	1.8%	2.2%	30
Lease out -active		3.1%	5.0%	6.3%	33
Lease out -not active		5.7%	9.2%	11.7%	111
Grand Total		**1.8%**	**3.0%**	**3.7%**	*248

*excluding those who don't lease and not active in the fishery

Table 27. Estimated changes* crew shares and profits if crew pays half of lease costs

Values	Lease group	800	1000	1200
Crew shares	<=25%	1.3%	2.1%	2.6%
	26% to 50%	0.0%	0.0%	-0.1%
	51% to 75%	-2.2%	-3.6%	-4.7%
	>75%	-6.8%	-11.2%	-14.3%
	Zero lease	1.6%	2.5%	3.2%
	Lease out -active	2.9%	4.7%	5.9%
	Lease out -not active	NA	NA	NA
Vessel Owner's Profits	<=25%	1.00%	1.59%	1.98%
	26% to 50%	0.05%	0.04%	0.01%
	51% to 75%	-0.98%	-1.65%	-2.12%
	>75%	-2.98%	-4.92%	-6.27%
	Zero lease	2.02%	3.23%	4.03%
	Lease out -active	2.92%	4.73%	5.95%
	Lease out -not active	0.00%	0.00%	0.00%
Crew shares		**-1.10%**	**-1.87%**	**-2.42%**
Vessel Owner's Profits		**-0.14%**	**-0.27%**	**-0.38%**

* Percent change compared to 600 lbs. trip limit in all areas.

Summary of aggregate fleet level results in LAGC IFQ Fishery:

- Scenario analysis used FY2017 data to estimate lease and trip costs at a range of trip limits, and showed that an increased possession limit could increase profits for all lease groups if crew pays for lease costs, and could decline for vessels that lease more than 50% of their landings. If the estimated lease price at each trip limit increases greater than expected, the costs and benefits would be greater than shown in the scenario analyses.
- If an increase in lease price lowers crew shares below the levels that could be earned in alternative occupations (opportunity costs of labor), either the crew lay formula will need to adjust, or the demand for leased quota would be reduced due to fewer crew members participating in the fishery. In this scenario, the increase in lease prices could be less drastic in; however, this dynamic effect needs further analyses.

Uncertainties and caveats with analysis:

- These scenarios are based on conservative assumptions regarding in the changes in total fishing time (TFT) and trip length. If vessel owners upgrade the capacity of the vessel, trip lengths could decline more so than estimated here. This could lead to a greater increase in lease prices.
- If lease prices increase is greater than estimated here, the lease costs would be greater and net benefits after lease costs would be further lower than shown in the scenario analyses.
- If the decline in maintenance and repair costs is less than estimated here, the change in profits will not be as great as the change in the lease costs.

5. Economic analysis with the standardized economic values and accounting for saved DAS

The LAGC IFQ trip limit analyses show small differences in fleet level aggregated net benefits and other economic values across different possession limit alternatives. Any differences in economic values across alternatives were primarily stemming from differences in aggregated annual trip costs and lease costs associated with the alternatives for an open, access or ALL areas. Below is further explanation for the similarities in those economic values in the analyses with or without lease costs and further steps in the economic analysis of the IFQ trip limit alternatives:

i. The LAGC IFQ allocation is fixed annually, therefore, landings occur considering the annual limit at the fleet level and corresponding individual allocations. The annual allocation is generally harvested or landed up to an annual allocation except for overage or shortages in some years which are adjusted in the following fish year. Because of the fixed allocation, aggregated fleet revenue in the LAGC IFQ fishery is fixed and identical across alternatives regardless of differences in LAGC IFQ possession limits. Therefore, the differences in net revenues after trip or lease costs are small across alternatives. However, with a higher trip possession limit the major advantage will be in savings in annual DAS compared to the base case 600-pound trip limit (Alternative 1). However, fishermen will not be able to use any saved DAS in the same LAGC IFQ fishery for a higher fishing income. Instead, they may use the saved DAS in non-IFQ fishing or other economic activities. Additional incomes from saved DAS are subjective depending on individual differences in other economic opportunities. However, proxy income estimates using saved DAS in other less restrictive fisheries could be considered as part of the net revenue to get an estimate of augmented fishing income in the LAGC IFQ fishery.

ii. Given direct unavailability of information on the amount of benefits from other economic activities from the saved DAS in higher trip limits, the LAGC IFQ trip analysis is further analyzed by estimating and using standardized economic values, primarily net revenues (with or without lease costs) normalized by effort, so that trip limit alternatives can be compared. Hence, net revenues per DAS (with or without lease costs) was also estimated and used in the economic analysis. Considering the standardized economic values, notable differences in economic outcomes among the alternatives can be seen. Table 1 provides the economic impacts of the LAGC IFQ possession limit alternatives in terms of normalized economic values without lease cost. It also compares the values with the 600-pound trip limit. Table 2 estimates the normalized economic values for all alternatives while accounting for lease cost.

iii. The fleet level economic impact for an alternative is analyzed by estimating a shadow net income for the saved DAS potentially used in other fisheries. A shadow net income is conservatively estimated by multiplying the saved DAS with 40% of the net revenue per DAS (with or without lease cost) in the base case 600-pound trip limit (Alternative 1) for an area, i.e., Shadow net income = Saved.DAS x (40% x Net.Revenue.per.DAS)[1]. The shadow income is added to the net revenue to get the total net revenue for an alternative by area. The total net incomes are then compared across alternatives for a management decision. Table 3 summarizes the economic impacts of the LAGC IFQ trip limit alternatives with or without trip costs by considering the shadow value of saved DAS as well.

[1] It is assumed that scallop IFQ fishery has a higher profit margin compared to other fisheries in the New England and Mid-Atlantic regions. If the scallop fishermen were engaged in other fisheries, their net revenue per DAS is very conservatively assumed to be 60% lower than that from in the IFQ fishery. Shadow income from saved DAS is estimated with this assumption in this analysis.

iv. Below are some key points from this supplemental analysis:

a) There is an increasing savings in DAS with the higher trip possession limit alternatives compared to the base case (Alternative 1). DAS saved is highest in the 1,200-pound trip limit (Alternative 3 sub-option 1), and within the range of alternatives, it is highest in access areas with DAS savings being roughly 21% greater than the access area savings associated with Alternative 1 (Table 1 and Table 2).

b) Standardized economic values (with or without lease costs) in terms of net revenue, crew share, vessel share and owner profits per DAS are higher with the higher trip possession limits. It is highest in the 1,200-pound trip limit (Alternative 3.1) followed by Alternative 3.2, Alternative 2.1 and Alternative 2.2 (Table 1 and Table 2). Compared to Alternative 1, overall net revenue per DAS in the 1,200-pound trip limit alternative is higher by about 22% without the lease cost and 17% considering the lease cost. In access areas, the net revenue per DAS is higher by about 30% without the lease cost and 27% considering the lease cost relative to Alternative 1.

c) Compared to the 600-pound trip limit (Alternative 1), annual savings in DAS is highest in the 1,200-pound trip limit (Alternative 3.1), i.e., 719 DAS saved annually in ALL area. In other alternatives, there are 382 DAS saved annually in Alternative 3.2, 360 DAS saved in Alternative 2.1, and 191 DAS saved in Alternative 2.2.

d) Imputing the annual DAS in terms of net revenues generated from other fisheries other than LAGC IFQ fishery and adding the shadow income to the net revenue, the aggregate fleet level net revenue is highest in the 1,200-pound trip limit (Alternative 3.1) followed by Alternative 3.2, Alternative 2.1, and Alternative 2.2 in both scenarios of lease cost considerations (Table 3). By considering the imputed values of saved DAS, overall total net revenue is about $32 million (without lease cost) and $27 million (with lease cost) in under Alternative 3.1. They are 5.2% to 7.5% higher compared to Alternative 1, respectively, depending on the consideration of lease cost in the net revenue values. The percentage increase is higher in access areas is higher compared to open and ALL areas within an alternative.

v. In conclusion, overall ranking of alternatives is similar across different economic evaluation measures whether with or without lease cost considerations, using standardized economic values, or adding shadow income from saved DAS to the net revenues. Economically, the 1,200-pound possession limit (Alternative 3.1) produces the highest economic outcome among all alternatives. Depending on the lease cost consideration, the 1,200-pound trip limit alternative (Alternative 3.1) is estimated to add about 4.5% to 5.3% of the LAGC IFQ fleet revenue. Similarly, the 800-pound trip limit (Alternative 2.1) is estimated to add about 2.3% to 2.6% of LAGC IFQ fleet revenue.

a) While the focus of the trip limit alternative analyses is focused on DAS savings relative to net revenues in the LAGC IFQ fishery, it is worth noting that savings in DAS as a result of a higher possession limit in the LAGC IFQ could lead to additional effort in other fisheries that LAGC IFQ vessels typically participate in. It is possible that the DAS savings from a higher LAGC IFQ trip limit could have an impact (potentially a negative impact) on LAGC IFQ vessels that derive a large proportion of their annual income from

these other fisheries. This is also the case for other fisheries that are subject to an overall TAC (i.e. not individual vessel allocations); any redirected effort from LAGC IFQ vessels with greater DAS savings from a higher trip limit could have negative impacts for participants in other fisheries if those fisheries are already harvesting the full TAC. That being said, any negative spillover effect could vary, depending on whether the other fisheries are constrained by overall TACs and the realized utilization of the fishery absent of any redirected effort by LAGC IFQ vessels. For example, it is possible that some other fisheries could support additional effort from LAGC IFQ vessels utilizing saved DAS as a result of a higher possession limit.

Table 28. Economic impact of LAGC IFQ trip possession limit in terms of normalized economic values (in 2019$) without lease cost

Alternatives and Ranking	Area	Possession limit	Annual DAS	% Change from 600 lbs.	Net Revenue per DAS	% Change from 600 lbs.	Crew share per DAS	% Change from 600 lbs.	Vessel Share per DAS	% Change from 600 lbs.	Owner's Profit per DAS	% Change from 600 lbs.
Alt 1 (rank 5)	Open	600	2,984		$5,814		$2,729		$3,086		$1,864	
	Access	600	1,789		$6,838		$3,261		$3,577		$2,161	
	ALL	600	4,773		$6,198		$2,928		$3,270		$1,975	
Alt 2 SO1 (rank 3)	Open	800	2,815	-5.7%	$6,200	6.6%	$2,929	7.3%	$3,271	6.0%	$1,999	7.2%
	Access	800	1,598	-10.7%	$7,727	13.0%	$3,723	14.2%	$4,004	11.9%	$2,472	14.4%
	ALL	800	4,413	-7.5%	$6,753	9.0%	$3,217	9.9%	$3,536	8.1%	$2,169	9.8%
n/a	Open	1000	2,714	-9.1%	$6,455	11.0%	$3,062	12.2%	$3,393	10.0%	$2,088	12.0%
	Access	1000	1,484	-17.1%	$8,370	22.4%	$4,058	24.4%	$4,312	20.6%	$2,697	24.8%
	ALL	1000	4,197	-12.1%	$7,132	15.1%	$3,414	16.6%	$3,718	13.7%	$2,302	16.5%
Alt 3 SO1 (rank 1)	Open	1200	2,646	-11.3%	$6,635	14.1%	$3,155	15.6%	$3,480	12.8%	$2,151	15.4%
	Access	1200	1,407	-21.3%	$8,857	29.5%	$4,311	32.2%	$4,546	27.1%	$2,868	32.7%
	ALL	1200	4,053	-15.1%	$7,406	19.5%	$3,557	21.5%	$3,850	17.7%	$2,398	21.4%
Alt 2 SO2 (rank 4)	Open	600	2,984		$5,814		$2,729		$3,086		$1,864	
	Access	800	1,598		$7,727		$3,723		$4,004		$2,472	
	ALL	Hybrid	4,582	-4.0%	$6,481	4.6%	$3,076	5.0%	$3,406	4.2%	$2,076	5.1%
Alt 3 SO2 (rank 2)	Open	600	2,984		$5,814		$2,729		$3,086		$1,864	
	Access	1200	1,407		$8,859		$4,311		$4,546		$2,868	
	ALL	Hybrid	4,391	-8.0%	$6,790	9.5%	$3,236	10.5%	$3,554	8.7%	$2,186	10.7%

Note: Hybrid is compared with ALL when compared to 600 lbs. trip possession limit by area.

Table 29. Economic impact of IFQ possession limit in terms of normalized economic values with lease cost (INCLUDES vessels with lease-in to landing proportion group =0%)

Alternatives and Ranking	Area	Possession limit	Annual DAS	% Change from 600	Lease cost per DAS	% Change from 600	Net Revenue per DAS	% Change from 600	Crew share per DAS (100% lease cost)	% Change from 600	Owner's Profit per DAS (0% lease cost)	% Change from 600	Crew Share per DAS (50% lease cost)	% Change from 600	Owner's Profit per DAS (50% lease cost)	% Change from 600
Alt 1 (rank 5)	Open	600	2,984		$1,129		$4,968		$1,732		$1,955		$2,297		$1,390	
	Access	600	1,789		$1,309		$5,862		$2,111		$2,266		$2,765		$1,611	
	ALL	600	4,773		$1,196		$5,303		$1,874		$2,071		$2,472		$1,473	
Alt 2 SO1 (rank 3)	Open	800	2,815	-5.7%	$1,265	12.0%	$5,237	5.4%	$1,807	4.3%	$2,096	7.2%	$2,439	6.2%	$1,464	5.3%
	Access	800	1,598	-10.7%	$1,548	18.3%	$6,555	11.8%	$2,356	11.6%	$2,592	14.4%	$3,130	13.2%	$1,818	12.8%
	ALL	800	4,413	-7.5%	$1,367	14.3%	$5,714	7.8%	$2,006	7.0%	$2,275	9.8%	$2,690	8.8%	$1,591	8.0%
Alt 3 SO1 (rank 1)	Open	1200	2,646	-11.3%	$1,422	26.0%	$5,536	11.4%	$1,887	8.9%	$2,256	15.4%	$2,598	13.1%	$1,545	11.1%
	Access	1200	1,407	-21.3%	$1,858	42.0%	$7,430	26.8%	$2,663	26.1%	$3,007	32.7%	$3,592	29.9%	$2,078	29.0%
	ALL	1200	4,053	-15.1%	$1,573	31.5%	$6,193	16.8%	$2,156	15.0%	$2,515	21.4%	$2,943	19.0%	$1,728	17.3%
Alt 2 SO2 (rank 4)	Open	600	2,984		$1,129		$4,968		$1,732		$1,955		$2,297		$1,390	
	Access	800	1,598		$1,548		$6,555		$2,356		$2,592		$3,130		$1,818	
	ALL	Hybrid	4,582	-4.0%	$1,275	6.6%	$5,521	4.1%	$1,950	4.0%	$2,177	5.1%	$2,588	4.7%	$1,539	4.5%
Alt 3 SO2 (rank 2)	Open	600	2,984		$1,129		$4,968		$1,732		$1,955		$2,297		$1,390	
	Access	1200	1,407		$1,859		$7,432		$2,663		$3,008		$3,593		$2,079	
	ALL	Hybrid	4,391	-8.0%	$1,363	13.9%	$5,758	8.6%	$2,031	8.3%	$2,292	10.7%	$2,712	9.7%	$1,611	9.3%

Note: Hybrid is compared with ALL when compared to 600 trip possession limits by area.

Table 30. Summary of economic impacts of IFQ trip possession limits with and without lease cost (economic values in 2019$)

Alternatives and Ranking	AREA	Possession limit	Annual DAS Savings	Economic Impact without Lease Cost				Economic Impact with Lease Cost			
				*Shadow Income from saved DAS	Net revenue	Net revenue plus Shadow Income	% Change from 600 trip limit	*Shadow Income from saved DAS	Net revenue	Net revenue plus Shadow Income	% Change from 600 trip limit
Alt 1 (rank 5)	Open	600		$0.00	$17,349,152	$17,349,152	-	$0.00	$14,824,477	$14,824,477	-
	Access	600		$0.00	$12,231,053	$12,231,053	-	$0.00	$10,485,130	$10,485,130	-
	ALL	600		$0.00	$29,580,205	$29,580,205	-	$0.00	$25,309,607	$25,309,607	-
Alt 2 SO1 (rank 3)	Open	800	169	$392,727	$17,452,849	$17,845,576	2.86%	$335,577	$14,741,962	$15,077,539	1.71%
	Access	800	191	$521,492	$12,348,143	$12,869,634	5.22%	$447,051	$10,474,998	$10,922,049	4.17%
	ALL	800	360	$891,330	$29,800,992	$30,692,322	3.76%	$762,646	$25,216,970	$25,979,615	2.65%
Alt 3 SO1 (rank 1)	Open	1200	338	$785,454	$17,556,547	$18,342,001	5.72%	$671,154	$14,647,929	$15,319,082	3.34%
	Access	1200	381	$1,042,983	$12,465,233	$13,508,216	10.44%	$894,102	$10,456,881	$11,350,984	8.26%
	ALL	1200	719	$1,782,660	$30,021,780	$31,804,440	7.52%	$1,525,292	$25,104,797	$26,630,089	5.22%
Alt 2 SO2 (rank 4)	Open	600	0	-	$17,349,152	$17,349,152	-	-	$14,824,477	$14,824,477	-
	Access	800	191	$472,337	$12,348,143	$12,820,480	-	$404,144	$10,474,998	$10,879,142	-
	ALL	Hybrid	191	$472,337	$29,697,295	$30,169,632	1.99%	$404,144	$25,299,475	$25,703,619	1.56%
Alt 3 SO2 (rank 5)	Open	600	0	-	$17,349,152	$17,349,152	-	-	$14,824,477	$14,824,477	-
	Access	1200	382	$945,867	$12,465,233	$13,411,100	-	$809,308	$10,456,881	$11,266,190	-
	ALL	Hybrid	382	$945,867	$29,814,385	$30,760,252	3.99%	$809,308	$25,281,358	$26,090,667	3.09%

*shadow income from saved DAS = saved DAS multiplied by 40% of Net Revenue per DAS (with or without lease cost) in the base case 600 lbs. possession limit (Alternative 1) for an area