Effort Displacement Overview

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Research Question and Motivation

Plain English

How will wind energy development affect the Limited Access Scallop Fishery? Where will firms choose to fish when areas are closed? Will firms fish less? How much worse off with firms be?

Economic Jargon

What are the annual changes in profits (or producer surplus) when a single wind area is closed? When many are closed? If all are closed?

Empirical Setting

Scallop Fishery

We are modeling the location choices of fishing vessels in the Limited Access Days-at-Sea scallop fishery. There are approximately 300-330 of these fishing vessels. They are allocated "Open Area Days-at-Sea" and a quantity of trips and/or pounds into the "Access Areas." They catch approximately 95% of the scallops. The Limited Access DAS fleet can be further subdivided into Full-Time, Part-Time, and Occasional Fleets. Vessels primarily use the New Bedford scallop dredge, but a few use a smaller dredge or a bottom trawl. Over the 13 years in our dataset, there are approximately 40,000 trips taken by this fleet, split roughly evenly into "Open areas" and "Access Areas."

For Fishing Year 2016 and earlier, the fishing year Ran from March 1 to Feb 28/29. For fishing year 2017, the year ran from March 1 to March 31. For 2018 and later, the fishing year runs from April 1 to March 31.

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Wind Energy

Here is a short description of the wind energy areas, how large they are, and how they will close (or not close) area to fishing. 18 wind areas currently under dev. But many more are likely.

How close will fishing be able to occur within Wind Lease Areas / Turbines?

The wind energy areas do not match the ten minute squares; we are currently planning on simulating the effects of closing a wind energy area by closing an entire ten minute square that is inside or touching a WEA.

The buried cable route from a WEA to shore is likely to be closed as well. Cable buried at shallow depths and marked with concrete.

Data

There are four main data sources (so far). None are perfect.

We have decided to use the DMIS as our primary dataset. DMIS primarily uses Vessel Trip Reports (VTRs) for "trip" and "effort" data and dealer databases for landings. A drawback of using these data are that there is a single point (latitude and longitude) for each time a vessel deploys a particular type of gear into a statistical area. In the LADAS scallop fleet, vessels rarely, if ever, will switch gears at sea. So, a trip is most likely to have multiple VTRs if it switches statistical areas.

Other possibilities were considered for our primary dataset:

1. Observer cover a subset of the fishery. According to the 2021 SBRM report, it was approximately 8-10% of effort for the Limited access fleet. This would provide haul level lat-lon and estimates of catch for the sampled subset. We viewed the subset as too limited - it would provide us with observations of approximately 200 Access area and 100 open area trips per year.Observer data contains the sailing and landing port.

2. VMS - VMS data would provide lat-lon at a high frequency. Other researchers have used this; however we uncomfortable with figuring out how to allocate catch along the VMS track. VMS data contains the sailing and landing port.

3. Rasters. The raster data are an intermediate data product that combines trip report with a statistical model describes the distance between observed hauls and the vtr point location. This allows for a smoothing of effort catch across a non-arbitrary grid (like a 10 minute square, statistical area, or just a lat-lon point).

Further detail about our data can be found here.

Some summary statistcs

The filter we are doing is has scallop landings.

```
# Here are a few summary statistics tables.  Nothing too fancy. This may be sufficient.
```

```
summary(final_product_lease)
```

```
##      TRIPID             OPERATOR            OPERNUM            NSUBTRIP
## Min.   :2.679e+06   Length:165868      Min.   :  410392   Min.   :1.000
## 1st Qu.:3.157e+06   Class :character   1st Qu.:10002645   1st Qu.:1.000
## Median :4.020e+06   Mode  :character   Median :10009375   Median :1.000
## Mean   :6.238e+11                      Mean   :10008984   Mean   :1.031
## 3rd Qu.:4.891e+06                      3rd Qu.:10014818   3rd Qu.:1.000
## Max.   :4.105e+13                      Max.   :10024074   Max.   :8.000
```

```
##                                         NA's   :4370
##       CREW          VTR_PORTNUM        IMGID              YEAR
##  Min.   : 1.000   Min.   : 71011   Min.   :2.468e+06   Length:165868
##  1st Qu.: 3.000   1st Qu.:240403   1st Qu.:2.874e+06   Class :character
##  Median : 3.000   Median :330127   Median :3.755e+06   Mode  :character
##  Mean   : 3.843   Mean   :299650   Mean   :6.228e+13
##  3rd Qu.: 5.000   3rd Qu.:330309   3rd Qu.:4.657e+06
##  Max.   :33.000   Max.   :499101   Max.   :4.105e+15
##  NA's   :138      NA's   :3        NA's   :4
##    VTR_PORT          VTR_STATE         TRIP_LENGTH         PERMIT.y
##  Length:165868     Length:165868     Min.   : 0.0000   Min.   :110681
##  Class :character  Class :character  1st Qu.: 0.5938   1st Qu.:231428
##  Mode  :character  Mode  :character  Median : 0.9167   Median :310979
##                                      Mean   : 2.6138   Mean   :285436
##                                      3rd Qu.: 2.7083   3rd Qu.:330784
##                                      Max.   :24.7500   Max.   :550026
##
##    DEALNUM            DOLLAR             POUNDS             LANDED
##  Length:165868     Min.   :      0.5   Min.   :      0.5   Min.   :      0.29
##  Class :character  1st Qu.:   2141.0   1st Qu.:   2069.9   1st Qu.:    250.00
##  Mode  :character  Median :   3928.0   Median :   3332.0   Median :    400.00
##                    Mean   :  35550.8   Mean   :  31911.1   Mean   :   3834.71
##                    3rd Qu.:   8697.7   3rd Qu.:   6147.0   3rd Qu.:    750.00
##                    Max.   :1413380.0   Max.   :1186125.0   Max.   :142392.00
##
##    GEARCODE          SECGEARFISH         SPPNAME              geoid
##  Length:165868     Length:165868     Length:165868     Min.   :9.008e+08
##  Class :character  Class :character  Class :character  1st Qu.:2.501e+09
##  Mode  :character  Mode  :character  Mode  :character  Median :3.401e+09
##                                                        Mean   :3.106e+09
##                                                        3rd Qu.:3.403e+09
##                                                        Max.   :5.170e+09
##                                                        NA's   :1774
##    namelsad          state_fips       port_lat         port_lon
##  Length:165868     Min.   : 7.00    Min.   :34.71    Min.   :-76.86
##  Class :character  1st Qu.:24.00    1st Qu.:39.57    1st Qu.:-74.23
##  Mode  :character  Median :33.00    Median :40.87    Median :-72.52
##                    Mean   :29.92    Mean   :40.60    Mean   :-72.64
##                    3rd Qu.:33.00    3rd Qu.:41.64    3rd Qu.:-70.93
##                    Max.   :49.00    Max.   :44.95    Max.   :-66.98
##                    NA's   :1643     NA's   :1774     NA's   :1774
##  previous_geoid    previous_namelsad  previous_state_fips previous_port_lat
##  Min.   :9.008e+08  Length:165868     Min.   : 7.00       Min.   :40.68
##  1st Qu.:2.501e+09  Class :character  1st Qu.:24.00       1st Qu.:40.68
##  Median :3.401e+09  Mode  :character  Median :33.00       Median :40.68
##  Mean   :3.110e+09                    Mean   :29.96       Mean   :40.92
##  3rd Qu.:3.403e+09                    3rd Qu.:33.00       3rd Qu.:40.92
##  Max.   :5.181e+09                    Max.   :49.00       Max.   :41.63
##  NA's   :1882                         NA's   :1749        NA's   :165864
##  previous_port_lon     Date                Time              TRIP_ID
##  Min.   :-73.32    Min.   :2007-05-01   Length:165868     Length:165868
##  1st Qu.:-73.32    1st Qu.:2009-05-27   Class :character  Class :character
##  Median :-73.32    Median :2012-08-17   Mode  :character  Mode  :character
##  Mean   :-72.79    Mean   :2012-12-30
```

```
##   3rd Qu.:-72.79    3rd Qu.:2016-06-17
##   Max.   :-71.21    Max.   :2019-12-31
##   NA's   :165864
##   Plan Code          Program Code        Area Identifier        ftpt
##   Length:165868      Length:165868       Length:165868       Length:165868
##   Class :character   Class :character    Class :character    Class :character
##   Mode  :character   Mode  :character    Mode  :character    Mode  :character
##
##
##
##
##     GC             LA              hours           DB_LANDING_YEAR
##   Mode :logical   Mode :logical   Min.   :  0.0333   Min.   :2007
##   FALSE:34428     FALSE:117141    1st Qu.: 14.2500   1st Qu.:2009
##   TRUE :131381    TRUE :48727     Median : 22.0000   Median :2012
##   NA's :59                        Mean   : 62.7184   Mean   :2013
##                                   3rd Qu.: 65.0000   3rd Qu.:2016
##                                   Max.   :594.0000   Max.   :2019
##                                   NA's   :1          NA's   :1
##   TRIP_COST_2020_DOL  TRIP_COST_WINSOR_2020_DOL  OBSERVED_COST_DUMMY
##   Min.   :   16.78   Min.   :   29.47          Min.   :0.00000
##   1st Qu.:  637.13   1st Qu.:  637.13          1st Qu.:0.00000
##   Median : 1223.95   Median : 1223.95          Median :0.00000
##   Mean   : 4742.65   Mean   : 4699.89          Mean   :0.04871
##   3rd Qu.: 5377.22   3rd Qu.: 5376.89          3rd Qu.:0.00000
##   Max.   :52122.12   Max.   :30595.61          Max.   :1.00000
##   NA's   :1          NA's   :1                 NA's   :1
##    MN30SQID         MN10SQID          NAME
##   Min.   :35734   Min.   :357311   Length:165868
##   1st Qu.:39731   1st Qu.:397331   Class :character
##   Median :40714   Median :407121   Mode  :character
##   Mean   :40560   Mean   :405618
##   3rd Qu.:41691   3rd Qu.:416922
##   Max.   :44691   Max.   :446966
##
```

```
table(final_product_lease$NSUBTRIP)
```

```
##
##      1      2      3      4      5      6      7      8
## 162045   2877    630    228     78      2      7      1
```

```
table(final_product_lease$YEAR)
```

```
##
##   2007   2008   2009   2010   2011   2012   2013   2014   2015   2016   2017   2018   2019
##  15905  18396  16483  11308  12546  12082  10970  10022  10728  12750  10922  12152  11604
```

```
table(final_product_lease$GEARCODE)
```

```
##
##      DREDGE-CLAM      DREDGE-OTHER   DREDGE-SCALLOP    GILLNET-OTHER     GILLNET-SINK
##             7996                35           130745                1               98
##         HANDLINE  LONGLINE-BOTTOM            OTHER        POT-OTHER      SEINE-OTHER
##               99                 3             4308               94                1
##      TRAWL-BOTTOM
```

```
##              22488
```

```
table(final_product_lease$ftpt)
```

```
##
## FullTime     None PartTime
##    42465   117141     6262
```

```
table(final_product_lease$VTR_STATE)
```

```
##
##    CT    DE    MA    MD    ME    NC    NH    NJ    NY    RI    VA
##  2371   196 58486  6162  5319   453  1831 63180 13779  7514  6536
```

```
table(final_product_lease$`Plan Code`)
```

```
##
##    DOF    HER    MID    MNK    NMS    SCO    SES    SMB
##   3459      2     12    431   5644   7280 139898    222
```

```
table(final_product_lease$`Program Code`)
```

```
##
##    BDP    CML    COM    DOF    HER    MMQ    MNK    MUL    NAC    NAF    NAS    NMA    OQU
##      6   1221    324   2190      2     54    161   1944      1      1     15      6   4462
##    PWD    REC    RSA    SAA    SAC    SAM    SAS    SCA    SCF    SCG    SCI    SEC    SFC
##    264      5    557  22496      1     13     67  18086      1  98498      4   2509   2764
##    SLM    SMA    SQI    SQL    SQM    SWE    TSP    TST    USC
##     25    327      4    134     59     11      3     35    698
```

The "SES" Plan code corresponds to declaring into the Scallop Fishery (Limited access or General Category).

The Program codes of most interest are probably:

1. SES-SAA - Scallop Access Area
2. SES-SCA - Scallop Days at Sea
3. SES-SCG General Category Scallop

Methods

1. FishSET
2. Spatial Econometrics