Effort Displacement Overview

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```
#This code looks into data_intermediate and sets the vintage_string according to the most recent data
datasets_list<-list.files(path=here("data","main"), pattern="final_product_lease")
datasets_list<-gsub("final_product_lease","",datasets_list )
datasets_list<-gsub(".Rds","",datasets_list)
datasets_list<-gsub(".csv","",datasets_list)
vintage_string<-max(datasets_list)
rm(datasets_list)
```

```
#############################################################################################################
#
# If we are going to use "the data" (generated by data_extraction_and_processing_code.Rmd) to do anythi
#
# Anyone who has put the output of the data processing code in their data/main folder should be able to
# document.
#############################################################################################################
# Load in the data.
final_product_savename<-paste0("final_product_lease",vintage_string,".Rds")
final_product_lease<-readRDS(here("data","main",final_product_savename))
```

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?

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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.

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?

> There is no one size fits all approach to the question of distance between wind turbines and where scallop fishing may occur. Based on interviews conducted by the Cooperative Research Branch with scallop industry members, it was determined that operations within 1nm of the turbines are unlikely due to both safety concerns and insurance liability. Captains will have varying levels of risk aversion, and corporations may develop their own guidance to captains of their vessels. The buffer zone between turbines and vessel operations is unlikely to be greater than 5nm.

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.

> Wind energy areas and 10 minute squares frequently have partial overlap. We make an assumption in these cases that if X% (TBD, maybe >0%) of a ten minute square is located in a wind energy lease area, that square will be considered off limits to fishing. The presence of wind energy areas will increase transit times for many scallop trips, even if their fishing location was not impacted by turbines. Our model accounts for the increased cost of transit... (TBD)

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. > Scallop dredging will not be possible in areas where buried cables, running from the shore out to the turbines, are located. Cables are buried at shallow depths and reinforced with concrete. Vessel operators will not want to risk damaging their gear by dredging too close to these areas; we estimate that operators will avoid dredging within 0.5nm of any buried cables. The location of the cables is extracted from construction operations plans (there will be more to add here).

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_namelsad  previous_state_fips previous_geoid      previous_port_lat
##  Length:165868      Min.   : 7.00       Min.   :9.008e+08   Min.   :34.71
##  Class :character   1st Qu.:24.00       1st Qu.:2.501e+09   1st Qu.:39.57
##  Mode  :character   Median :33.00       Median :3.401e+09   Median :40.87
##                     Mean   :29.96       Mean   :3.110e+09   Mean   :40.59
##                     3rd Qu.:33.00       3rd Qu.:3.403e+09   3rd Qu.:41.64
##                     Max.   :49.00       Max.   :5.181e+09   Max.   :44.95
##                     NA's   :1749        NA's   :1882        NA's   :1882
##  previous_port_lon      Date                Time             TRIP_ID
##  Min.   :-76.86    Min.   :2007-05-01   Length:165868      Length:165868
##  1st Qu.:-74.23    1st Qu.:2009-05-27   Class :character   Class :character
##  Median :-72.52    Median :2012-08-17   Mode  :character   Mode  :character
##  Mean   :-72.65    Mean   :2012-12-30
##  3rd Qu.:-70.93    3rd Qu.:2016-06-17
##  Max.   :-66.98    Max.   :2019-12-31
##  NA's   :1882
##   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
##      DDLAT           DDLON           MN30SQID        MN10SQID
##  Min.   :36.00   Min.   :-75.92   Min.   :35734   Min.   :357311
##  1st Qu.:39.38   1st Qu.:-73.53   1st Qu.:39731   1st Qu.:397331
##  Median :40.20   Median :-72.83   Median :40714   Median :407121
##  Mean   :40.34   Mean   :-71.95   Mean   :40560   Mean   :405618
##  3rd Qu.:41.09   3rd Qu.:-70.17   3rd Qu.:41691   3rd Qu.:416922
##  Max.   :44.77   Max.   :-66.03   Max.   :44691   Max.   :446966
##
##      NAME
##  Length:165868
##  Class :character
##  Mode  :character
##
##
##
##
```

```
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          135051               1              98
##        HANDLINE LONGLINE-BOTTOM           OTHER       POT-OTHER     SEINE-OTHER
##              99               3               2              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