1.0 OBSERVED MONTHLY FLATFISH D/K RATIO BY TEN MINUTE SQUARE ANALYSIS

1.1 Background

The Council has identified the creation and modification of flatfish accountability measures as a 2017 work priority. Currently, the scallop fishery has sub-ACLs and AMs in place for three flatfish stocks managed through the groundfish FMP: GB yellowtail, SNE/MA yellowtail, and southern windowpane flounder. The Council has recommended that a scallop sub-ACL for northern windowpane be established through Framework 56, with the development of accountability measures for this stock in the next available scallop action. Existing scallop fishery AMs vary by permit category and gear type. The Scallop AP, Committee, and full Council have expressed interest in redesigning the AMs for GB yellowtail flounder and SNE/MA yellowtail flounder to make AMs as consistent to the extent feasible with gear modification AMs for southern windowpane flounder (Council Motion #4a, June 22, 2016). The Scallop Committee reaffirmed its interest in exploring the use of gear modifications at its March 30, 2017 meeting in Providence, Rhode Island.
The Council Staff have worked with members of the PDT and scientific community to assemble information relevant to this management priority. This document is not an official product of the scallop PDT.

1.2 Methods

The following figures display observed monthly d/K ratios of GB yellowtail, SNE yellowtail, and N. windowpane to scallop meats kept by ten-minute square. Data included in analysis were observed hauls from standard observer trips on Limited Access and Limited Access General Category dredge/trawl vessels between FY2006 and FY2016; data were queried using the following script[1]:

```
select vessels,hauls, month, area, ten_m_sq, scallop_meat,  Yellowtail, Yellowtail/scallop_meat
as D_K, (yellowtail/scallop_meat) *100 as D_K_percent from (

select count(unique hullnum1)as vessels, count(link3) as hauls,  month, area, ten_m_sq,
sum(scallop_meat_k) as scallop_meat, sum(sum_yt_dk)as Yellowtail from (
select program, year, month, area,ten_m_sq, link1,link3, haulnum, sum_yt_dk,
round(scallop_meat_dr,0) scallop_meat_k, hullnum1  FROM (
select
a.program,
substr(a.qdsq,1,4)||a.tenmsq as ten_m_sq,
b.fleet_type,
b.hullnum1,
a.year,
```

[1] This query is specific to Georges Bank yellowtail flounder; however, this same query was used for SNE/MA yellowtail and Northern windowpane flounder by modifying the species code ("a.nespp4) and statistical reporting area (a.area).

```
a.month,
b.dateland,
a.tripid,
a.haulnum,
a.link1,
a.link3,
a.qtr,
a.negear,
a.obsrflag,
a.depth,
a.targspec1,
a.targspec2,
a.targspec3,
a.datehbeg,
a.datehend,
round(a.gis_lathbeg,6) gis_lathbeg,
round(a.gis_lonhbeg * 1,6) gis_lonbeg,
round(a.gis_lathend,6) gis_lathend,
round(a.gis_lonhend* 1,6) gis_lonend,
a.soakdur,
a.nemarea,
a.area,

sum(case when a.nespp4 = '1230' and a.obsrflag = 1 and a.catdisp = 0 then a.hailwt else null end)
as yt_d,
sum(case when a.nespp4 = '1230' and a.obsrflag = 1 and a.catdisp = 1 then a.hailwt else null end)
as yt_k,
((sum(case when a.nespp4 = '1230' and a.obsrflag = 1 and a.catdisp = 0 then a.hailwt else 0 end))
+ (sum(case when a.nespp4 = '1230' and a.obsrflag = 1 and a.catdisp = 1 then a.hailwt else 0
end))) as sum_yt_dk,
sum(case when a.nespp4 = '8009' and a.obsrflag = 1 and a.catdisp = 1 and drflag = 1 then
a.hailwt when a.nespp4 = '8009' and obsrflag = 1 and catdisp = 1 and drflag = 2 then a.hailwt /
8.33 else null end) as scallop_meat_dr,
--(sum(case when a.nespp4 = '8009' and a.obsrflag = 1 and a.catdisp = 1 and drflag = 1 then
a.hailwt when drflag = '2' then a.hailwt * .120048 else null end)) as conv_sc_meat,
sum(case when a.nespp4 = '8009' and a.obsrflag = 1 and a.catdisp = 1 and drflag = 2 then
a.hailwt else null end) as scallop_meat_rd

from obhauspp a, obtrp b
where a.link1 = b.link1
and targspec1 = '8009'
and b.fleet_type in ('046', '047') and
b.dateland between '01-JAN-2006' and sysdate and obsrflag = 1
and
--a.area in ('537','539','526','612','613')
a.area in ('522', '525','561','562')
```

```
group by
a.program,
b.fleet_type,
b.hullnum1,
a.month,
b.dateland,
a.year,
a.tripid,
a.haulnum,
a.link1,
a.qtr,
a.negear,
a.obsrflag,
a.depth,
a.targspec1,
a.targspec2,
a.targspec3,
a.datehbeg,
a.datehend,
a.gis_lathbeg,
a.gis_lonhbeg,
a.gis_lathend,
a.gis_lonhend,
a.soakdur,
a.nemarea,
a.area,
a.link3,
a.QDSQ,
a.TENMSQ)


group by  program, year, month, area,ten_m_sq, link1,link3, haulnum, sum_yt_dk,
scallop_meat_dr, hullnum1)
group by area, month, ten_m_sq)
where hauls > '9'
;
```

For each month, data were aggregated by ten-minute square.
The d/K ratios for each ten-minute square were estimated using the following equation:

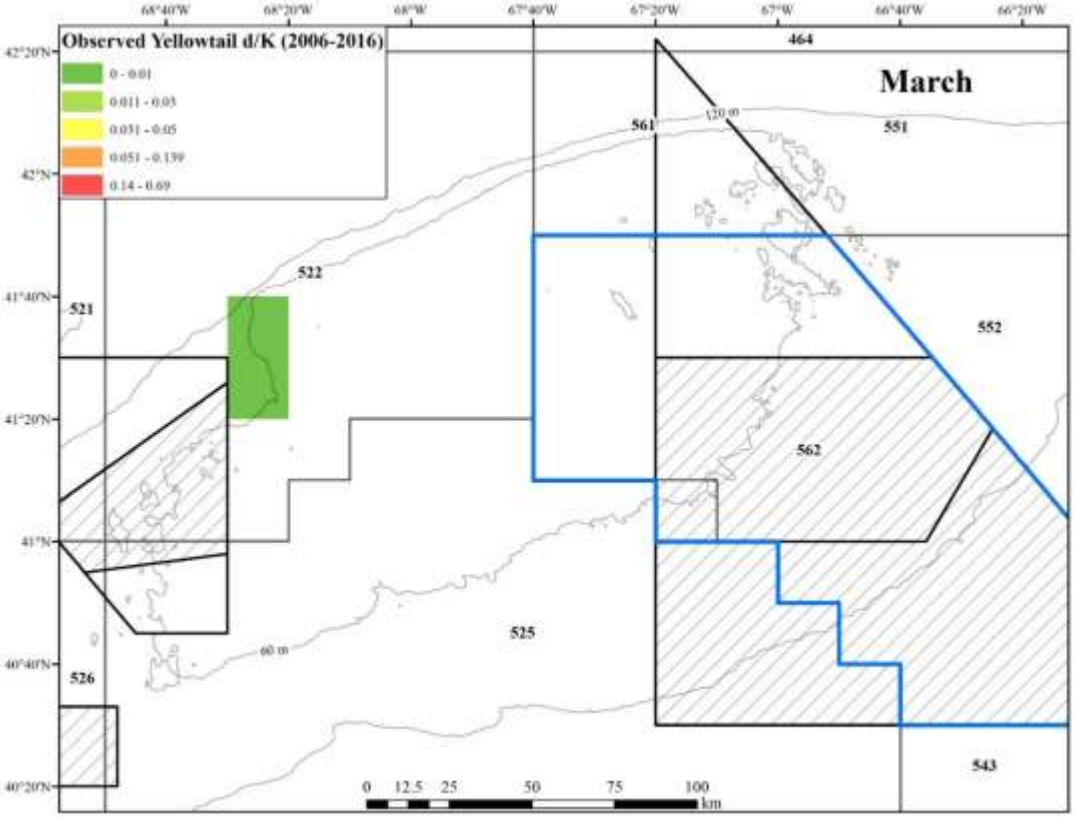
$$\frac{(d_{2006} + d_{2007} + d_{2008} + \cdots d_{2016})}{(K_{2006} + K_{2007} + K_{2008} + \cdots K_{2016})}$$

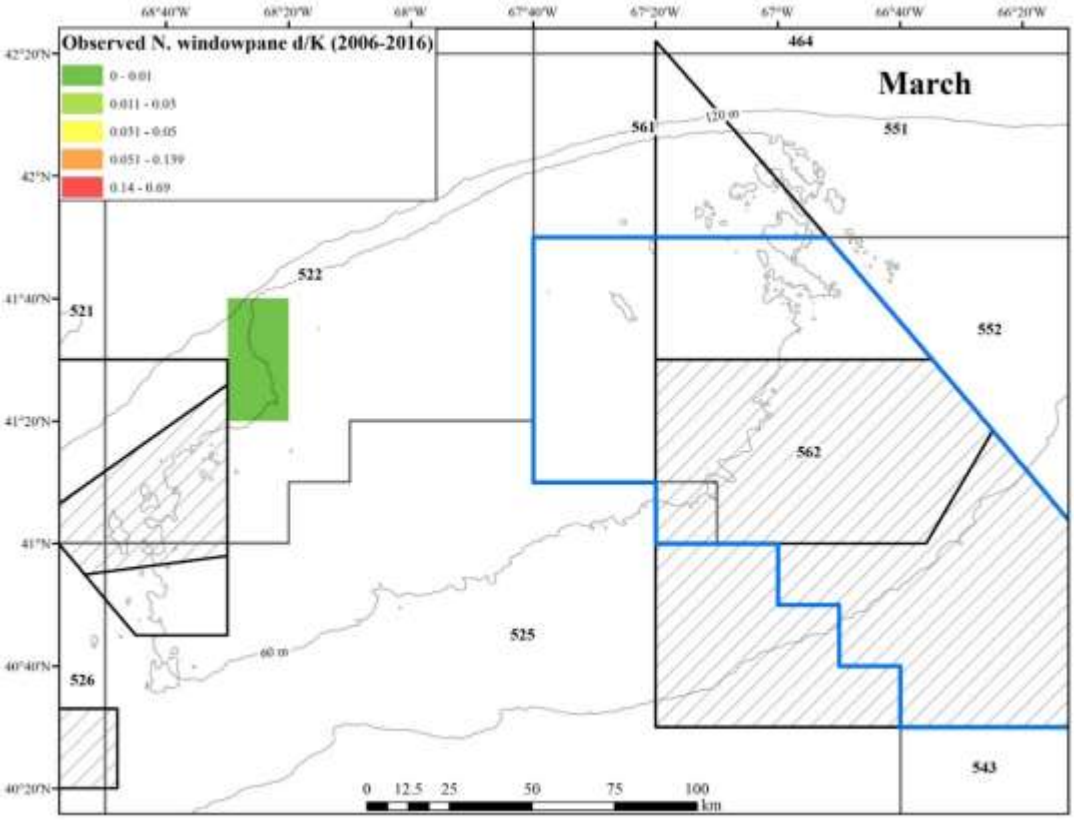
Where d = observed weight of discarded flatfish (lbs) and K = observed weight of kept scallops (lbs). For observed hauls where only round weights of scallops were recorded, lbs of round scallops were converted to lbs of dressed scallops using the equation:

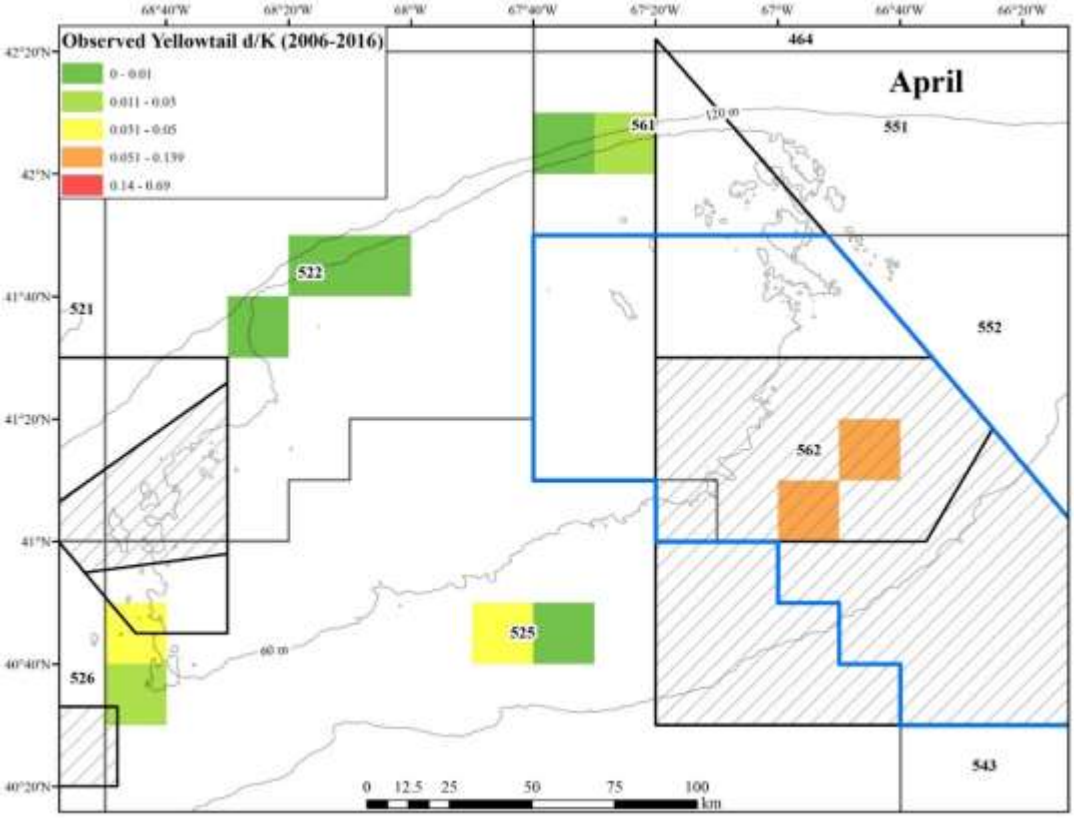
$$\frac{K_{round}}{8.33}$$

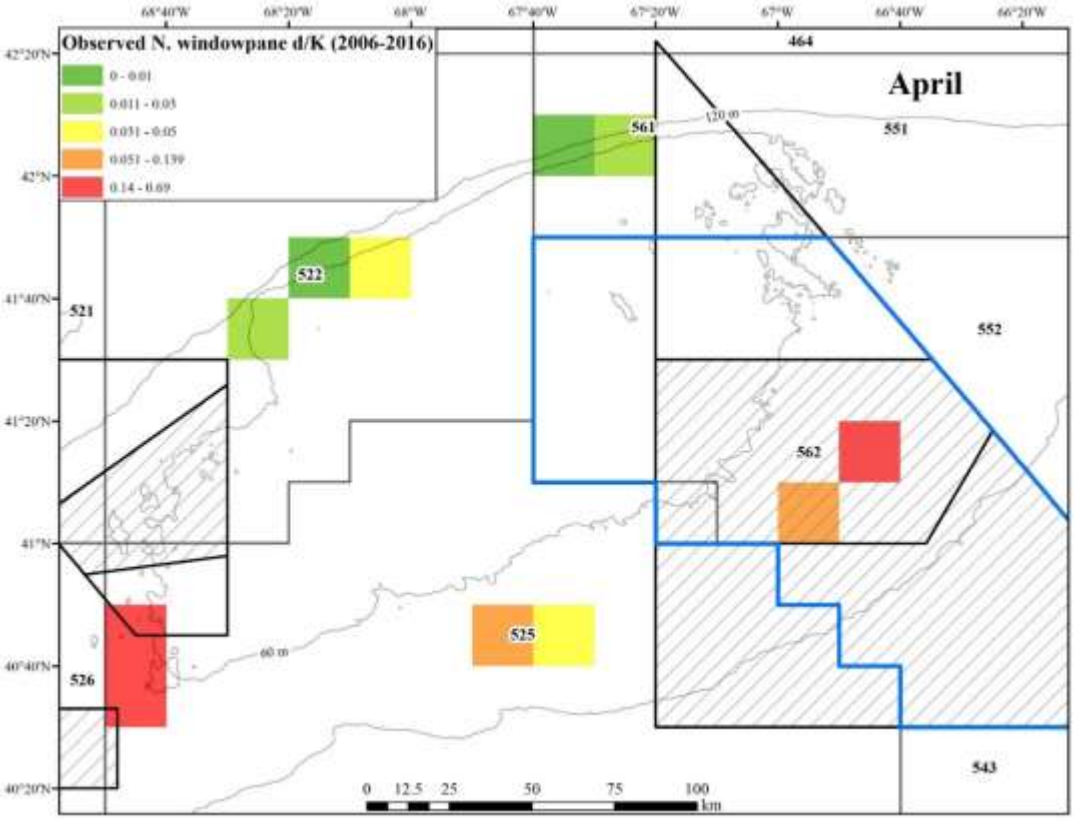
Where K_{round} = the weight of in shell scallops (lbs).

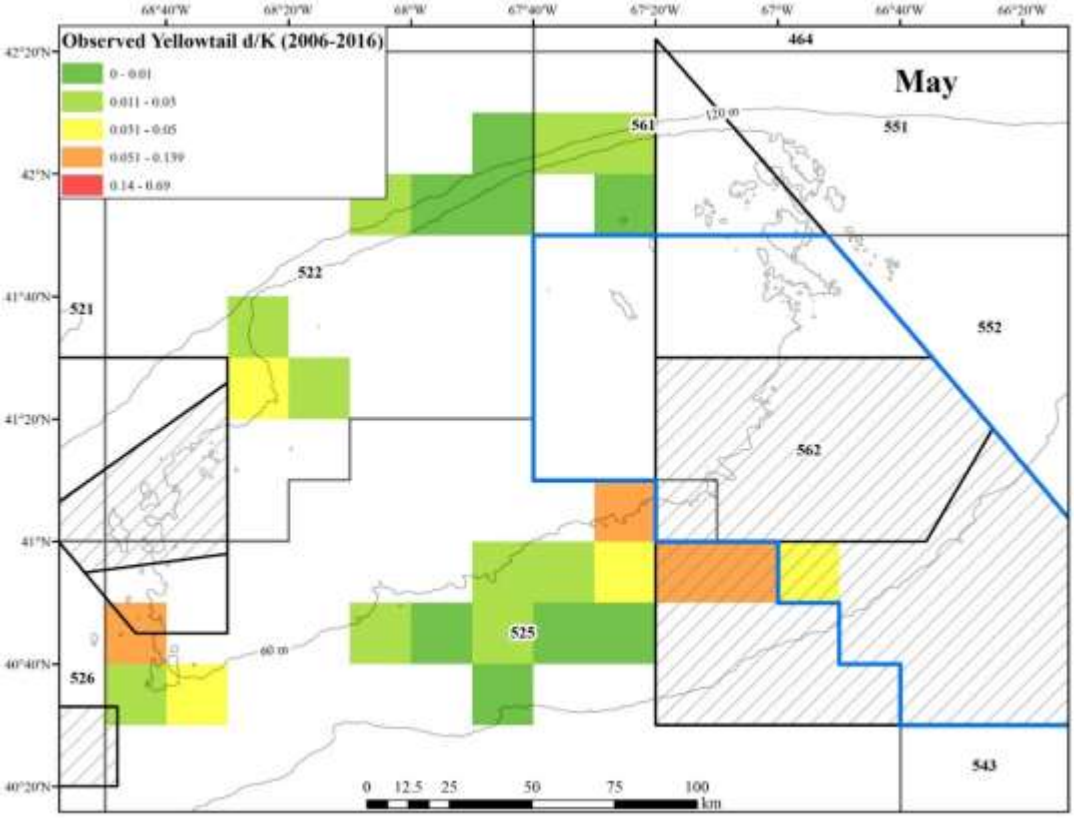
To comply with data confidentiality requirements, the following figures only display ten-minute squares with observed activity from 3 or more vessels for each month. The blue lines depict boundaries of the GB and SNE yellowtail flounder AM areas. The red line depicts the eastern boundary of the SNE/MA windowpane flounder AM gear restricted area (71° W).
The first group of figures depict both GB yellowtail and northern windowpane bycatch by month (one month per page, GB yellowtail as top figure, and northern windowpane as the bottom figure). The second grouping of figures is for SNE/MA yellowtail flounder only (each page contains two months).
The 'stoplight' scale for all figures is the same and represents the range of observed d/K ratio in ascending order (green is the lowest d/K and red is the highest).The scale for all figures was based loosely on a requirement that must be met by exempted fisheries, where incidental catch of regulated multispecies is less than 5% of the total catch of the fishery, by weight (CFR §648.80(a)(8)); green and yellow means approximately less than 5% of the total weight of observed catch was composed of the respective flatfish species, and orange and red means approximately 5% or more of the total weight of observed catch was composed of the respective flatfish species. One way to interpret these figures is as follows: Yellow squares indicate between 3-5 lbs of flatfish catch per 100 lbs of dressed scallops kept, orange squares indicate between 5-13 lbs of flatfish catch per 100 lbs of dressed scallops kept, and red squares indicate over 14 lbs of flatfish catch per 100 lbs of dressed scallops kept.

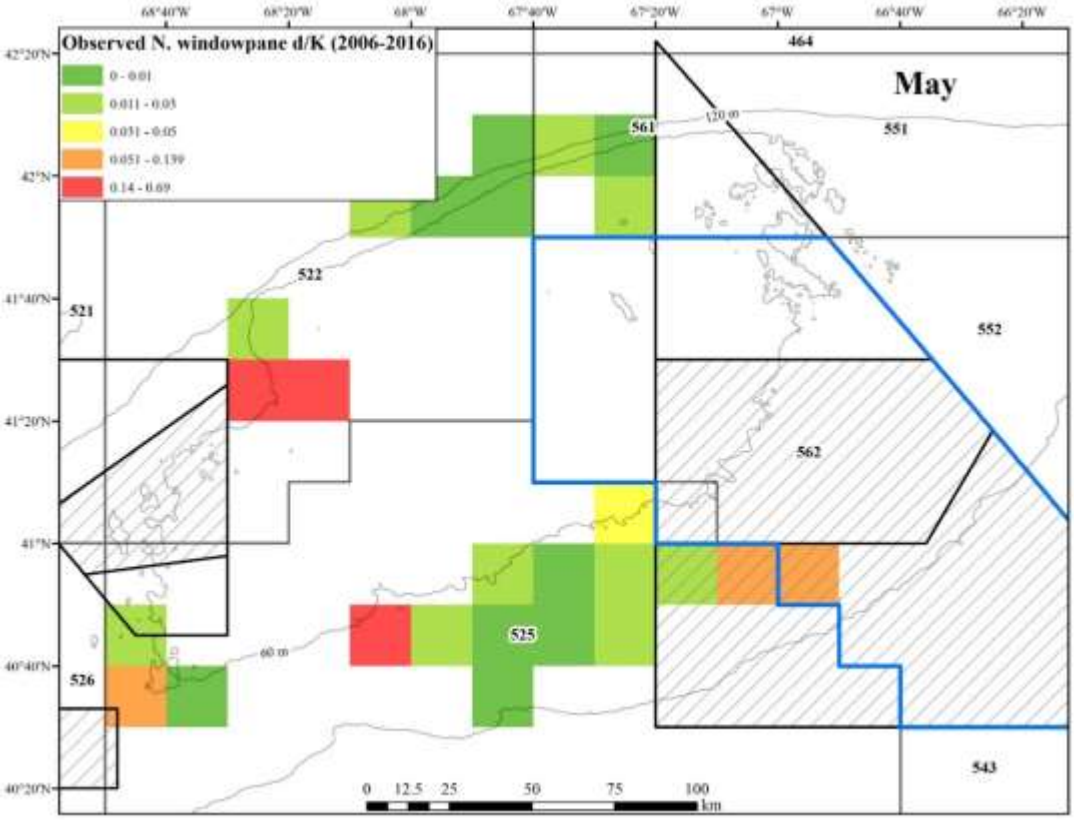

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
March
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

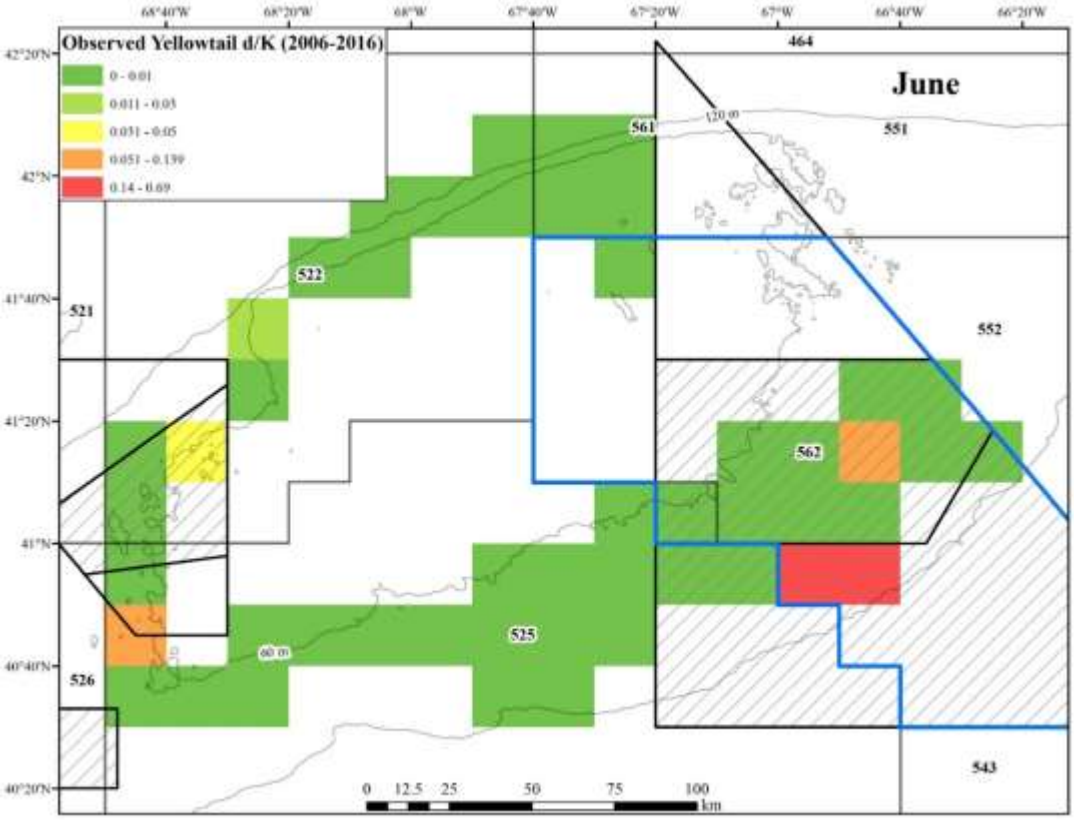

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
March
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

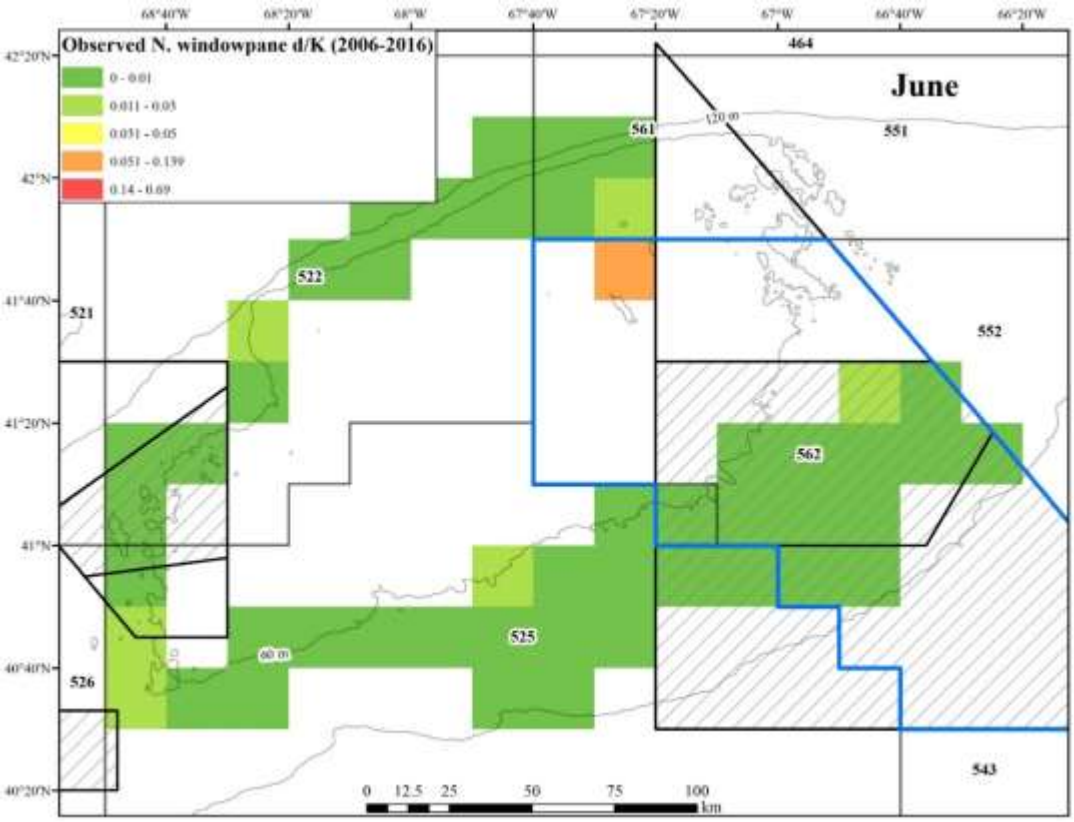

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
April
464
561
551
522
521
552
562
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

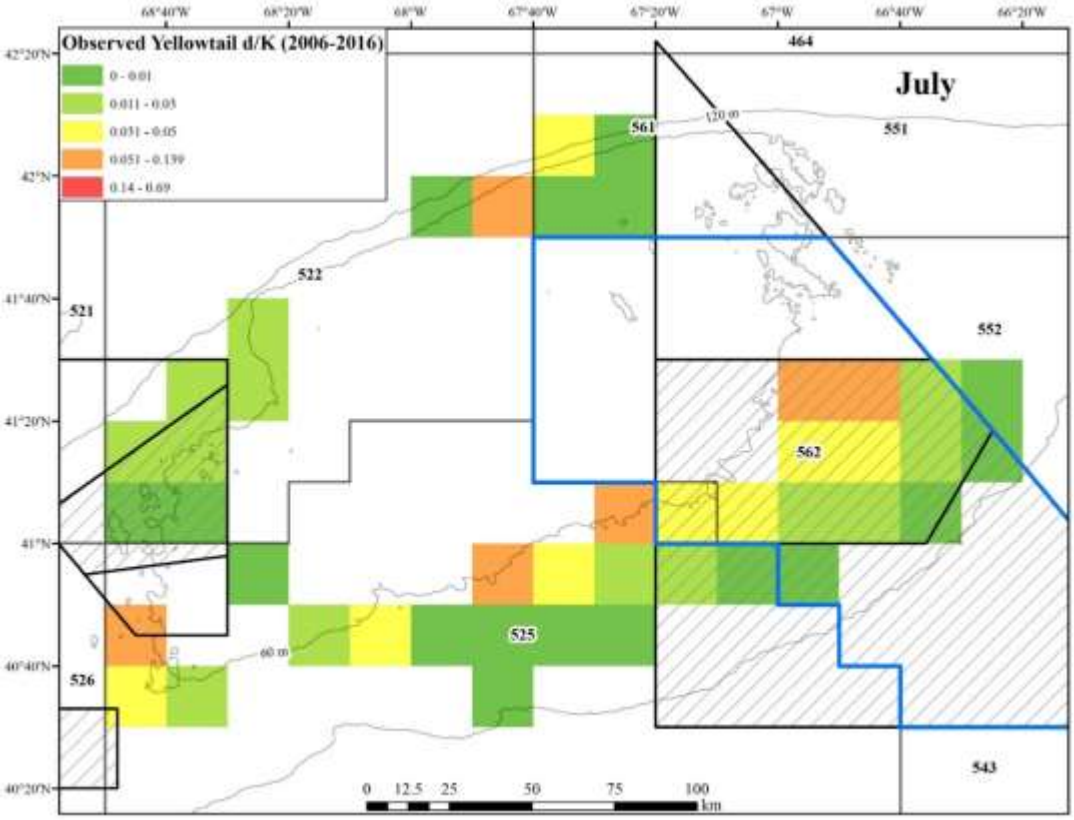

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
April
464
561
551
522
521
552
562
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

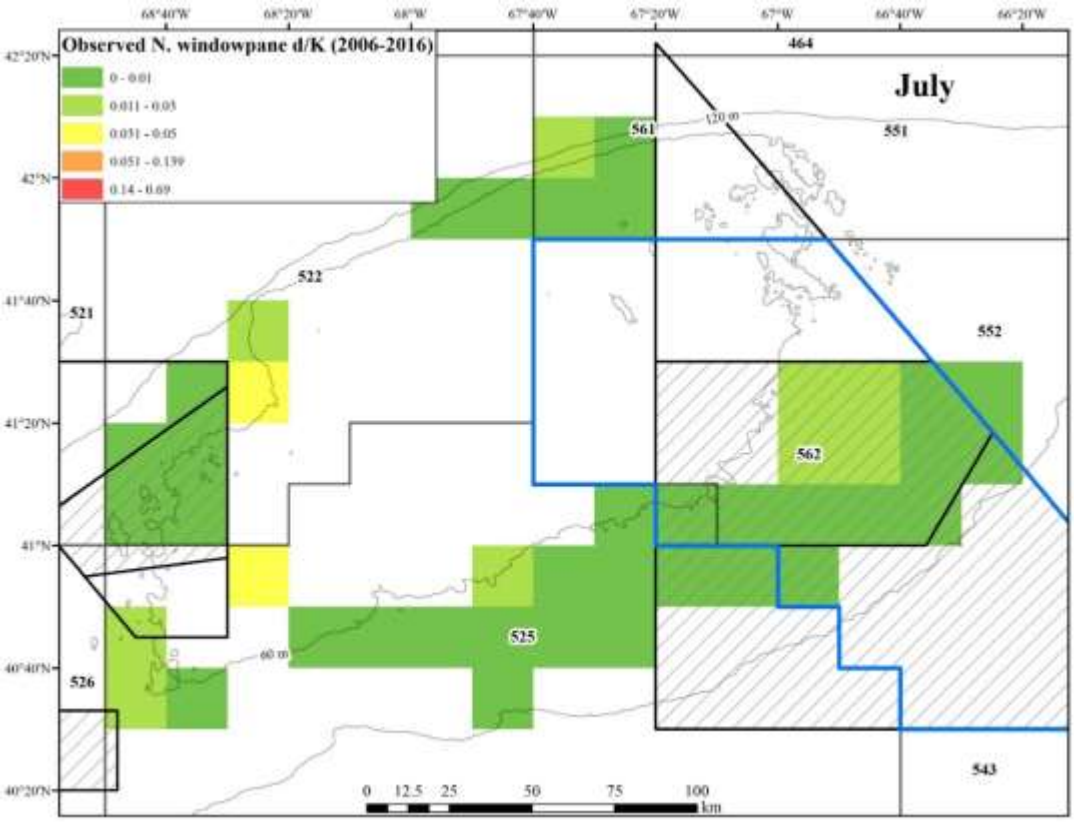

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
May
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

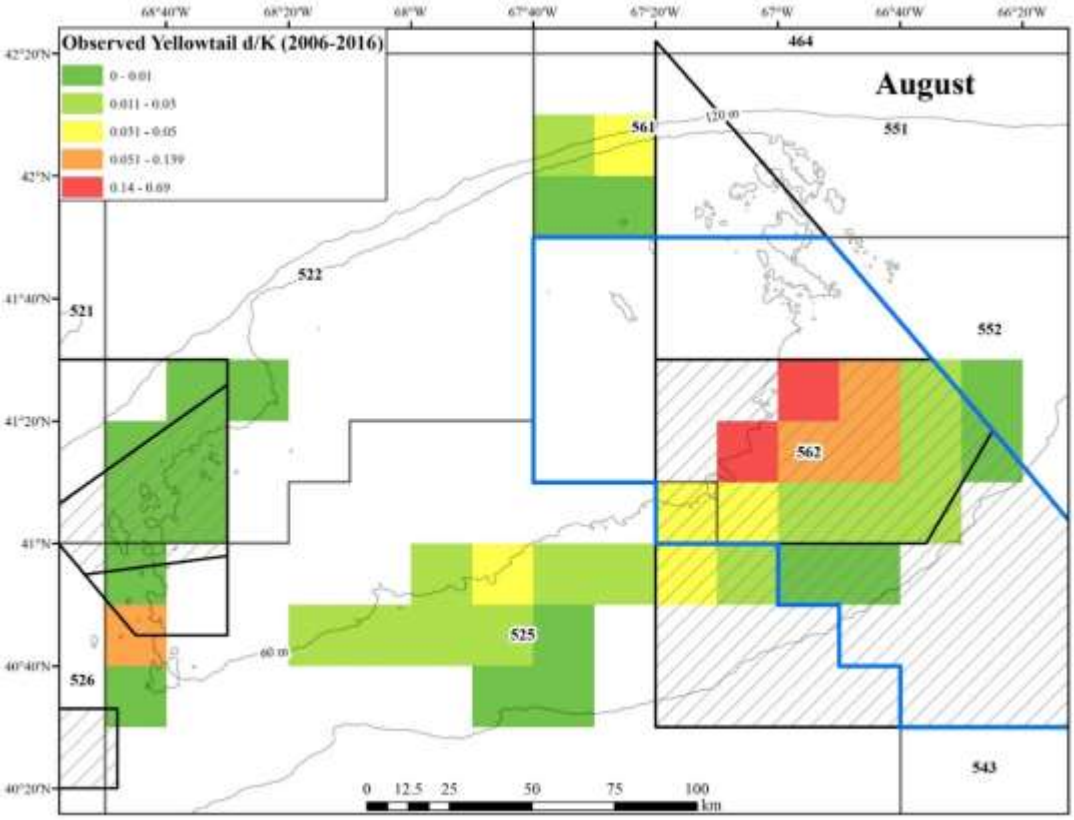

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
May
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

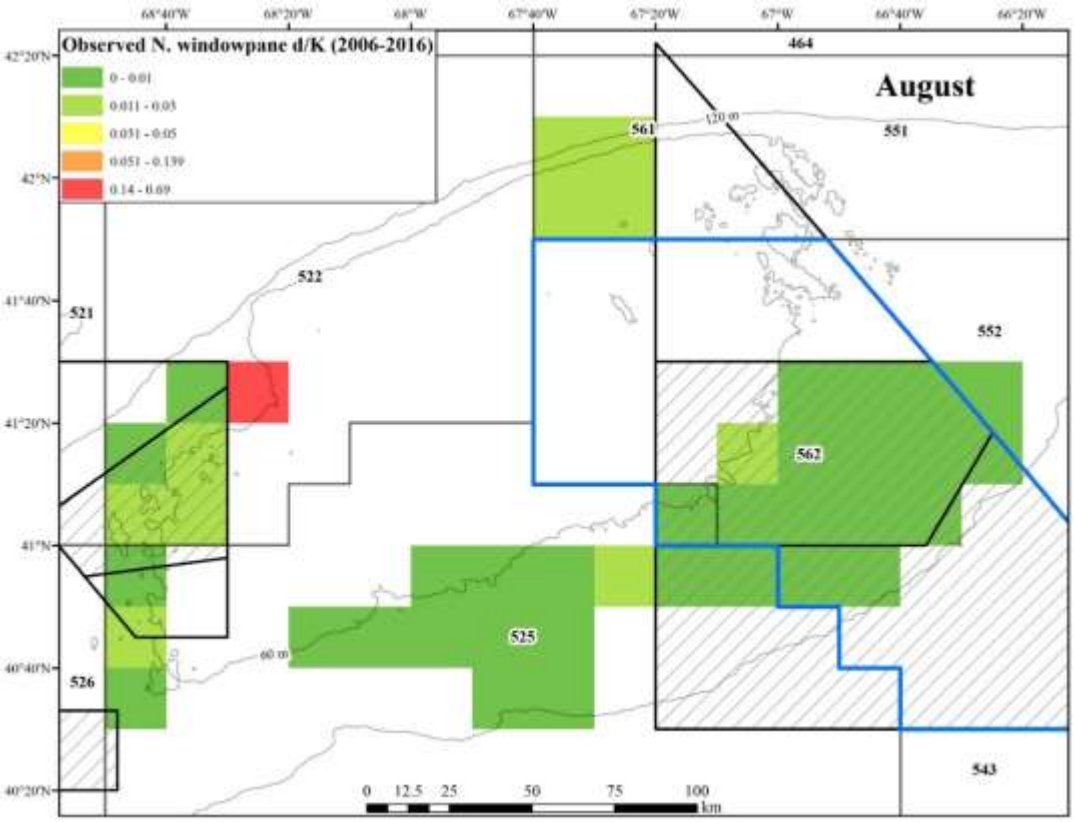

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
June
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

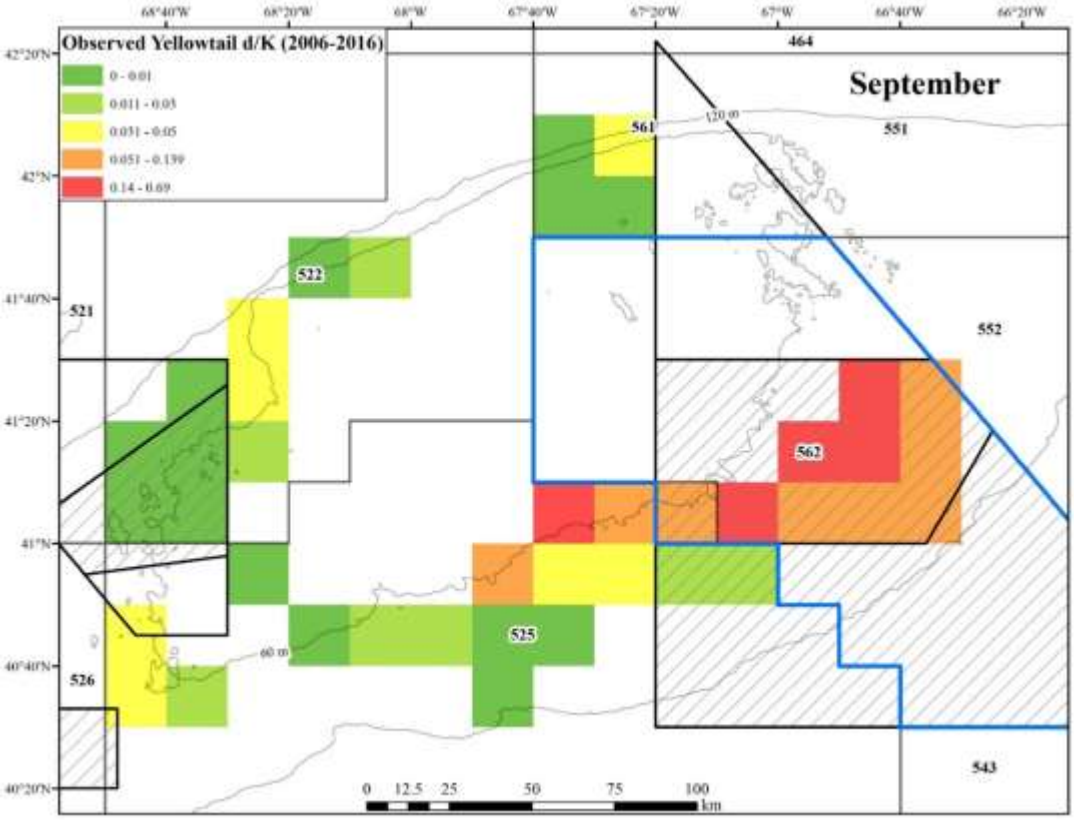

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
June
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

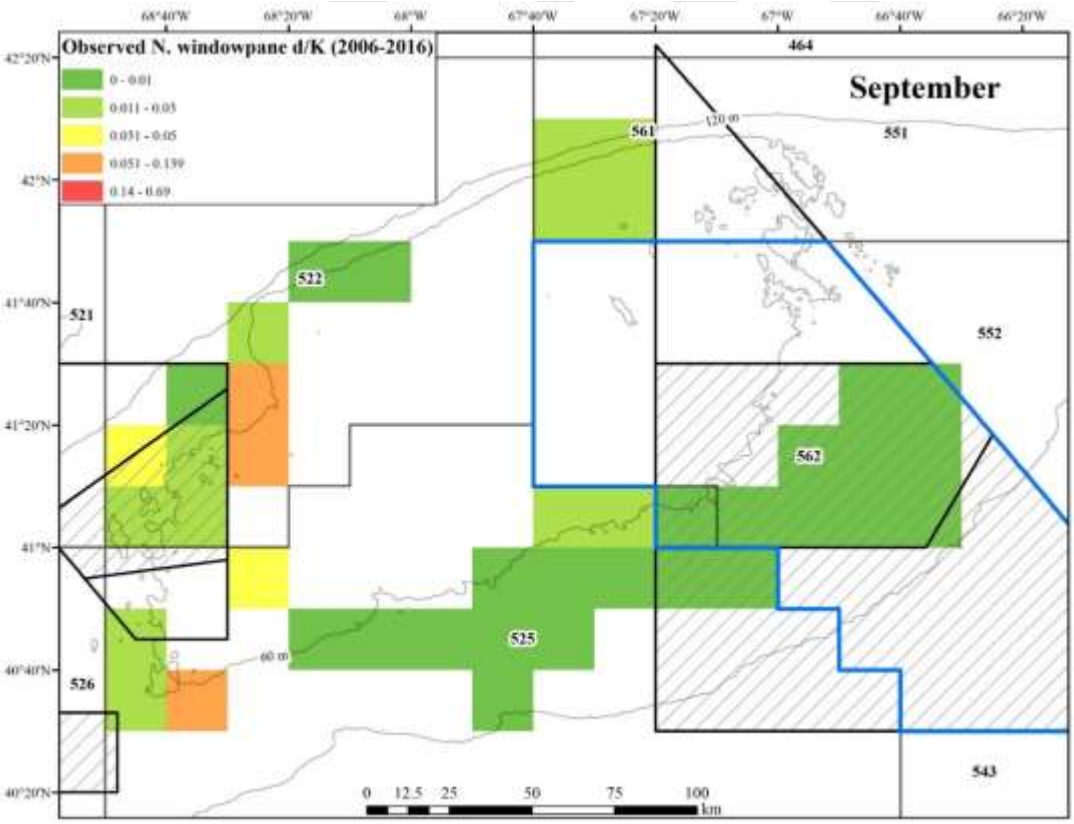

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
July
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

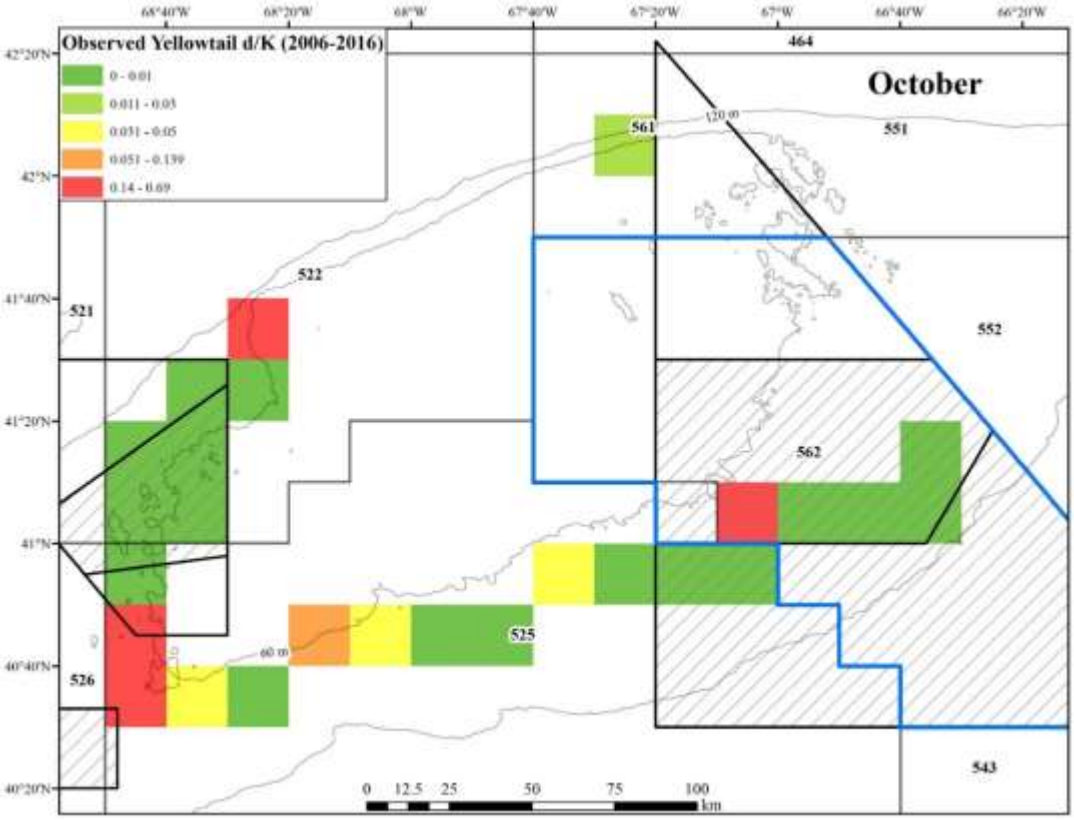

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
July
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

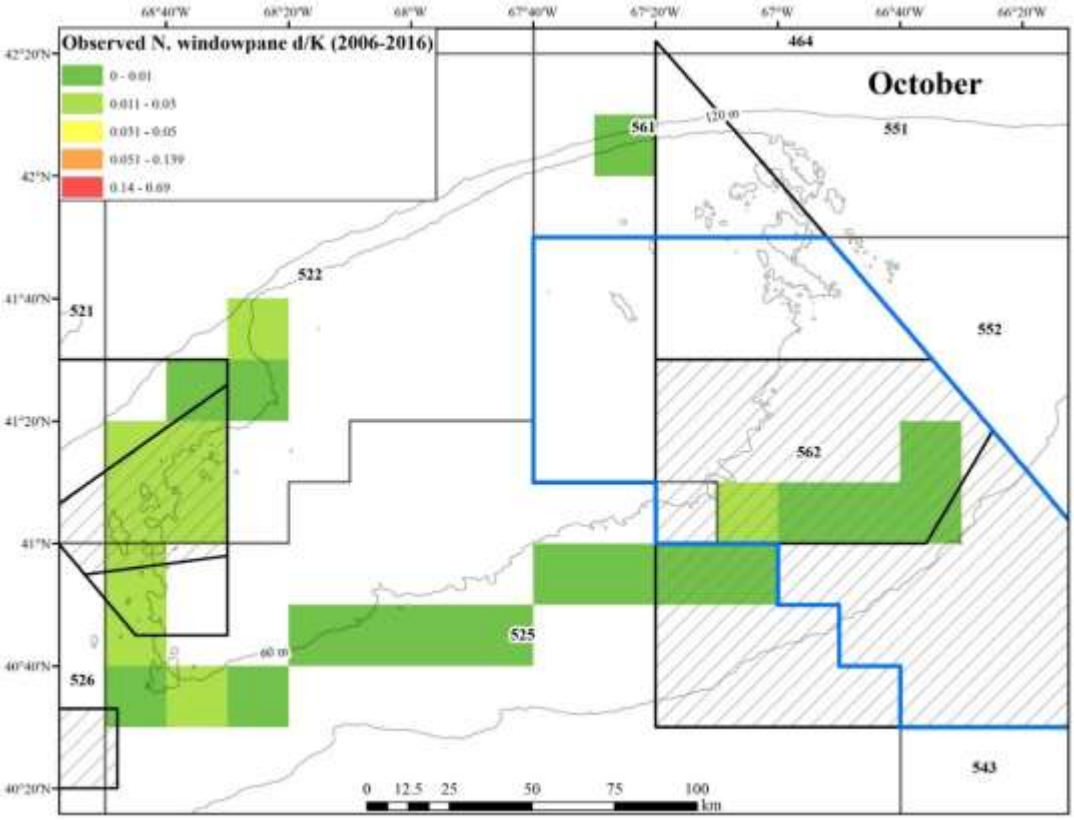

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
August
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

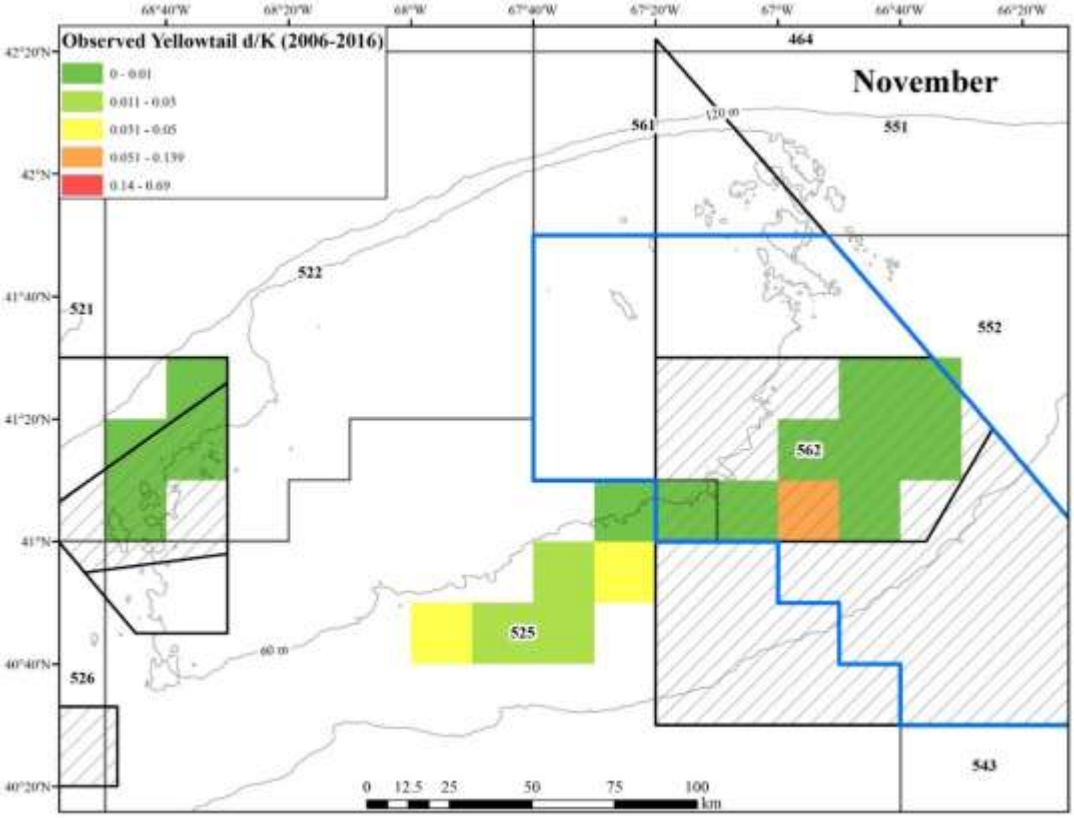

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
August
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

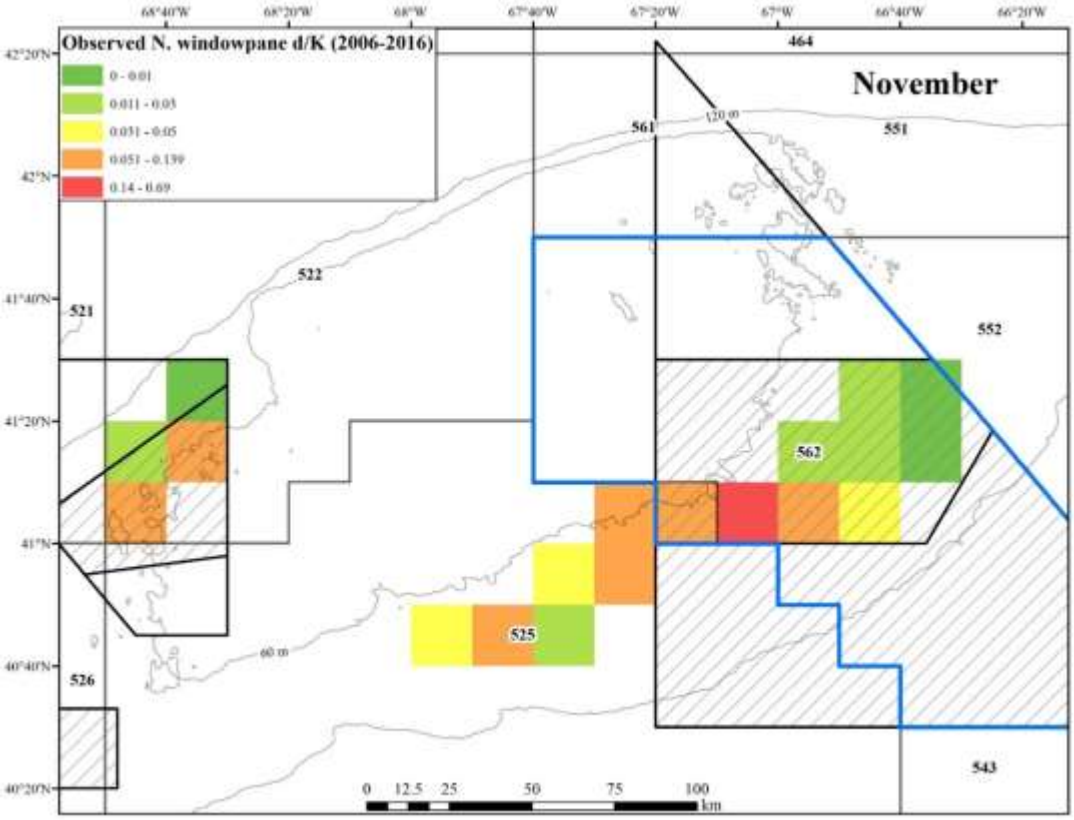

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
September
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

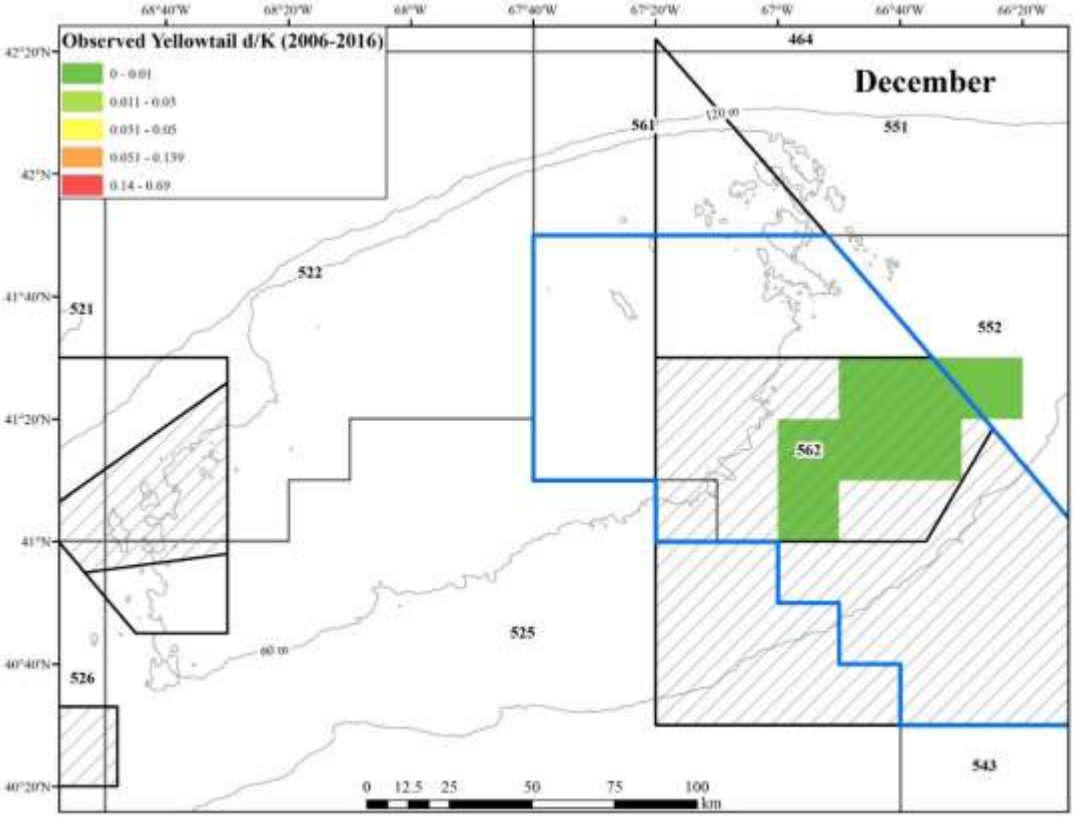

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
September
464
561
551
522
521
552
562
525
526
543
120 m
60 m
68°40'W
68°20'W
68°W
67°40'W
67°20'W
67°W
66°40'W
66°20'W
42°20'N
42°N
41°40'N
41°20'N
41°N
40°40'N
40°20'N
0 12.5 25 50 75 100
km

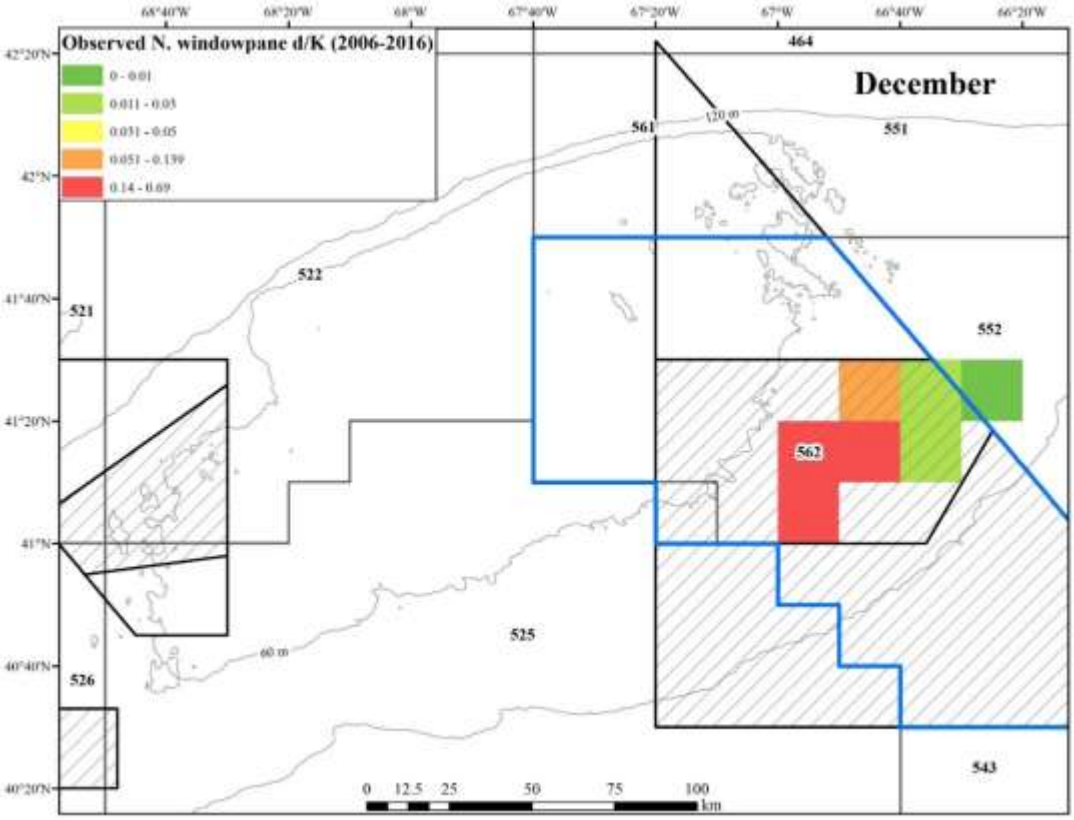

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
October
464
561
551
522
521
552
562
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

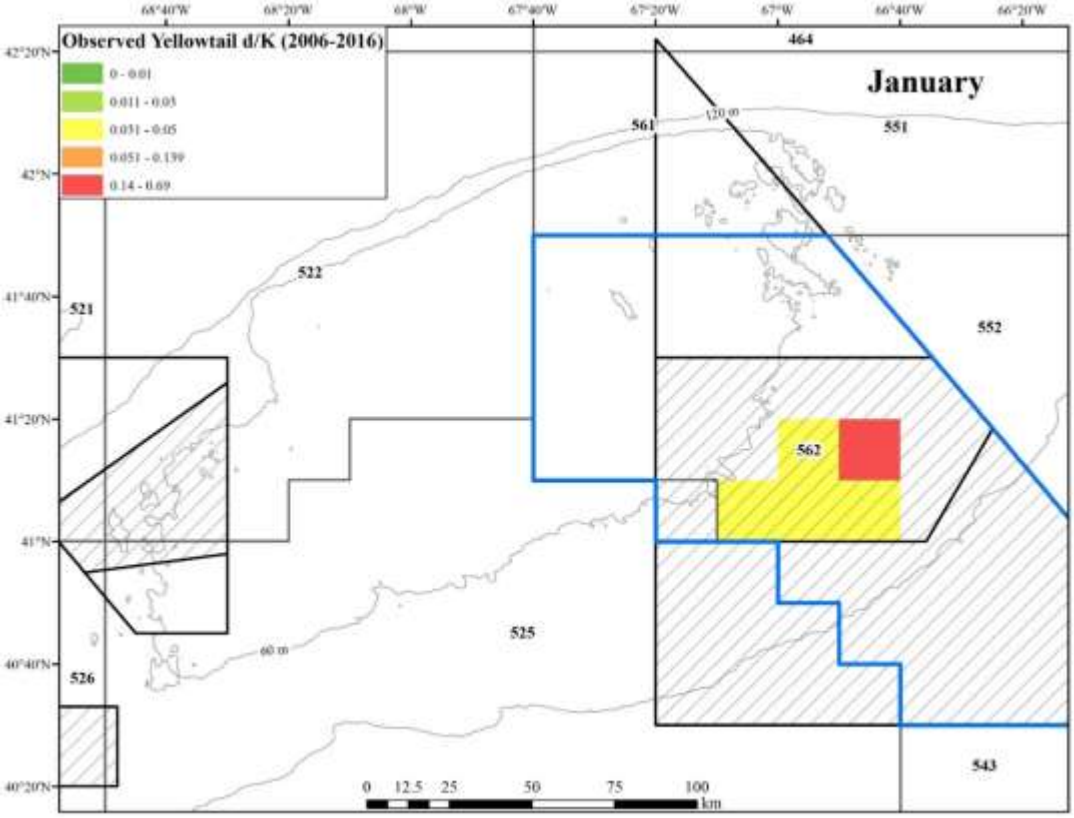

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
October
464
561
551
522
521
552
562
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

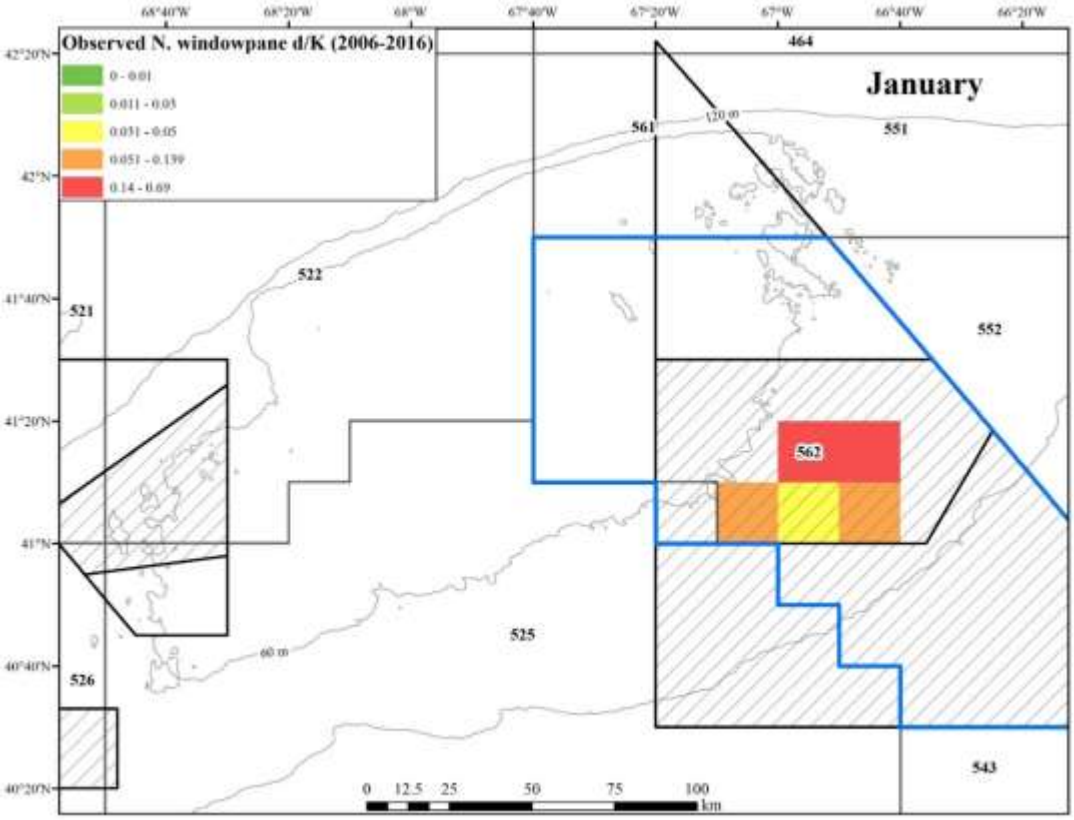

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
November
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

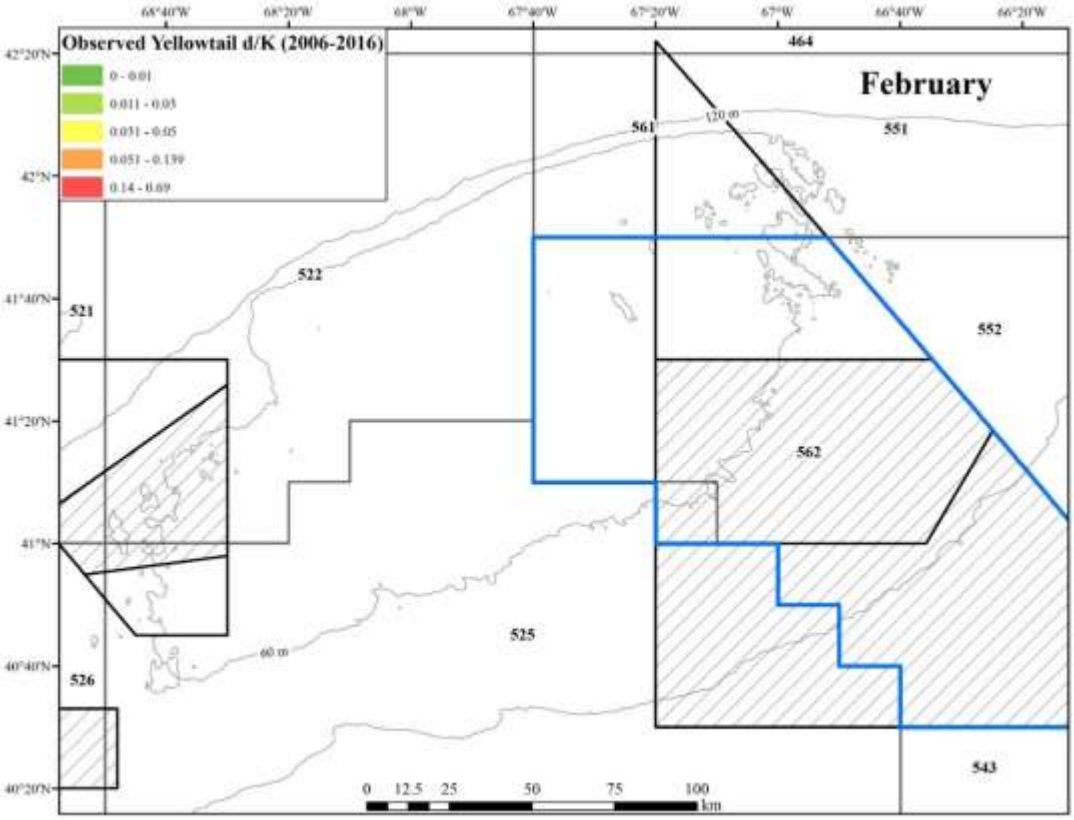

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
November
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

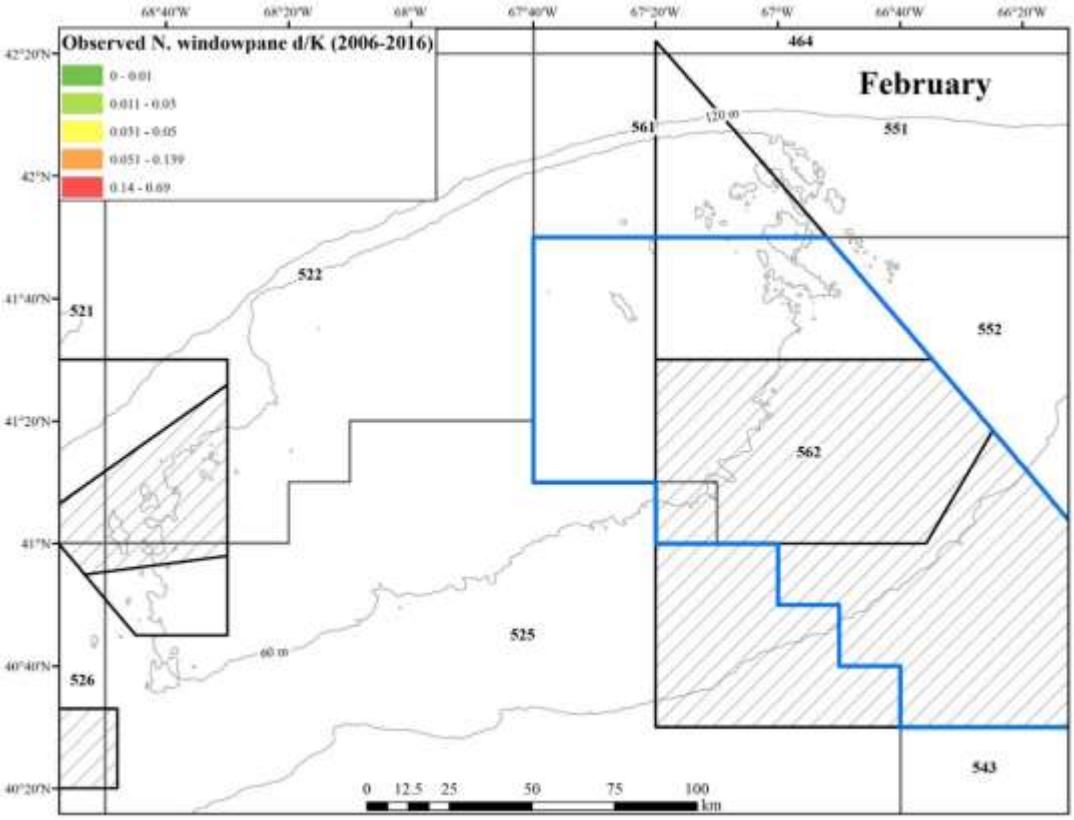

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
December
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

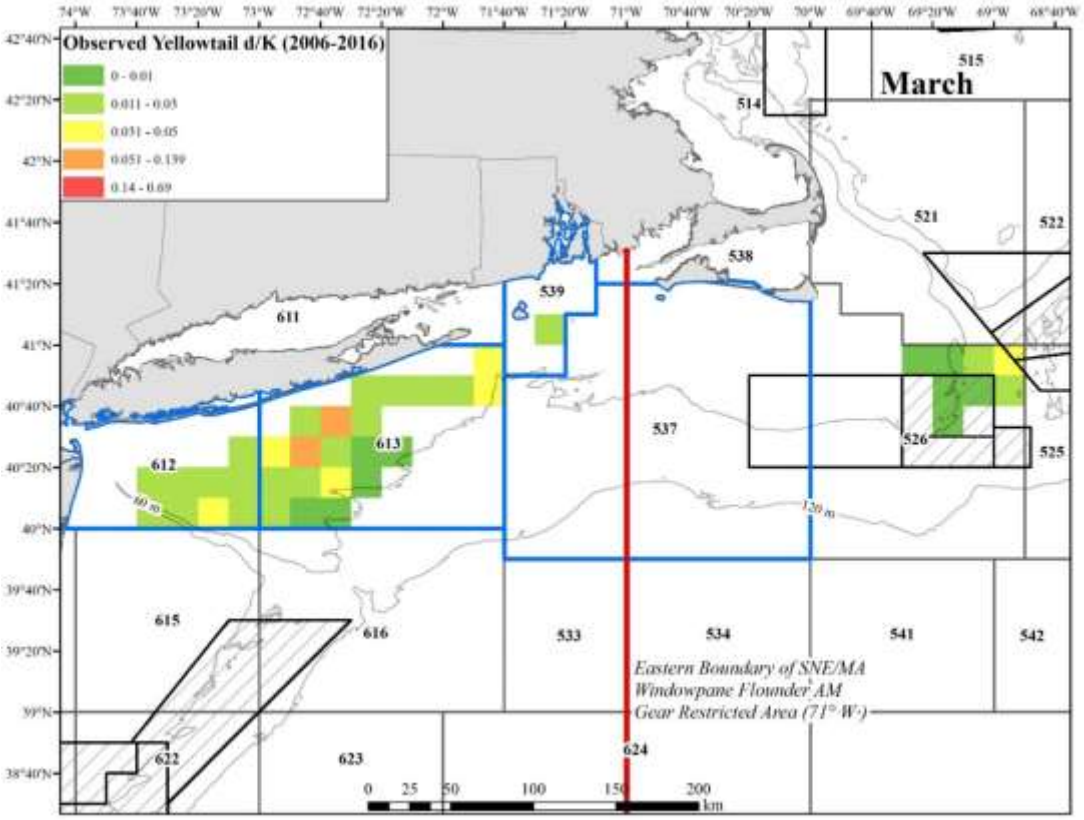

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
December
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

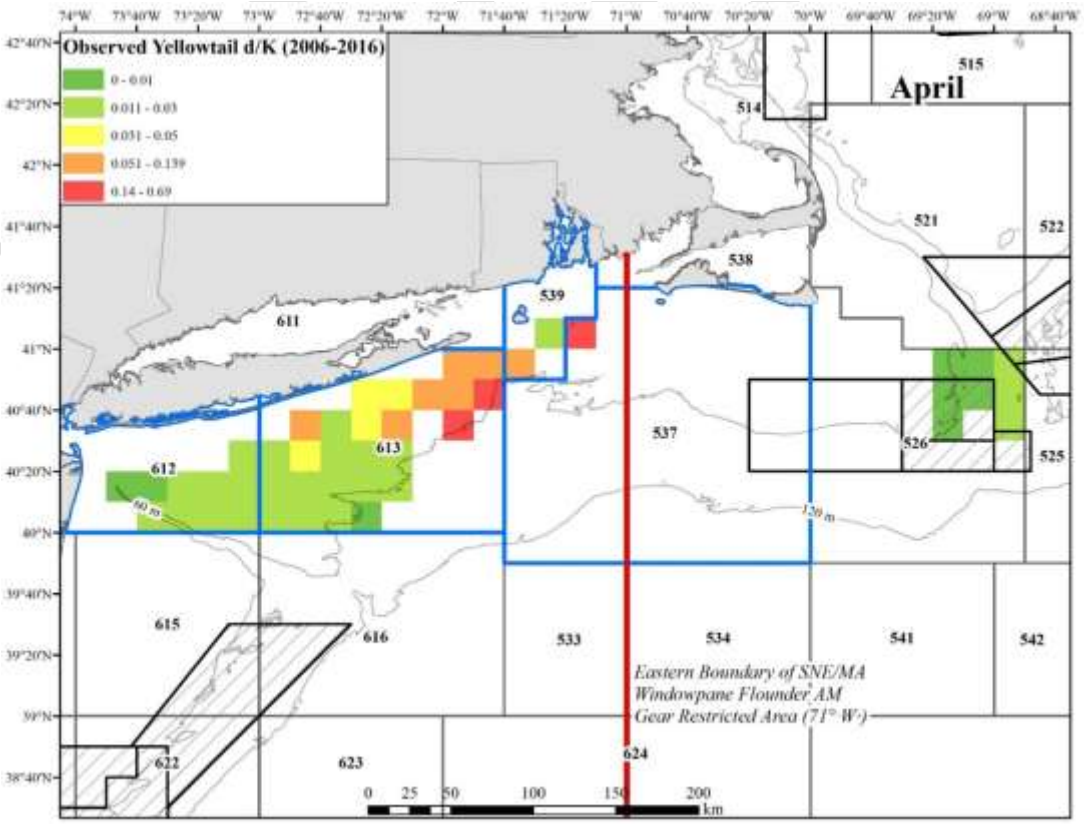

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
January
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

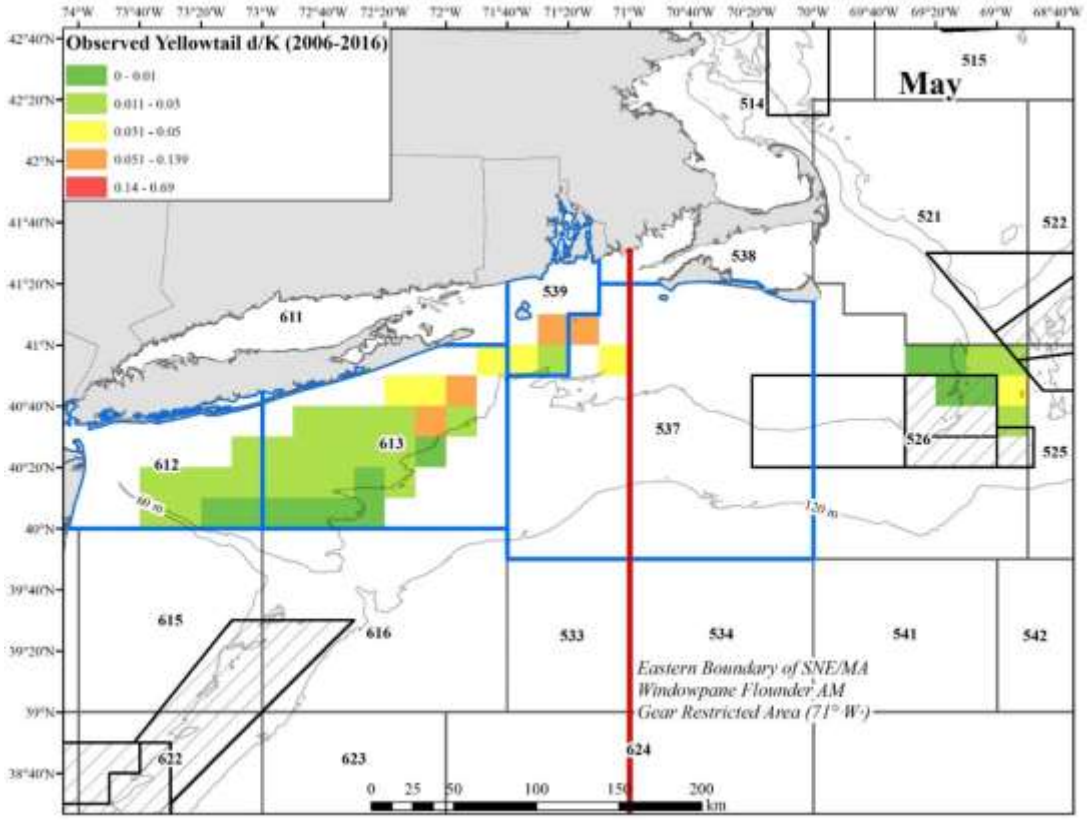

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
January
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

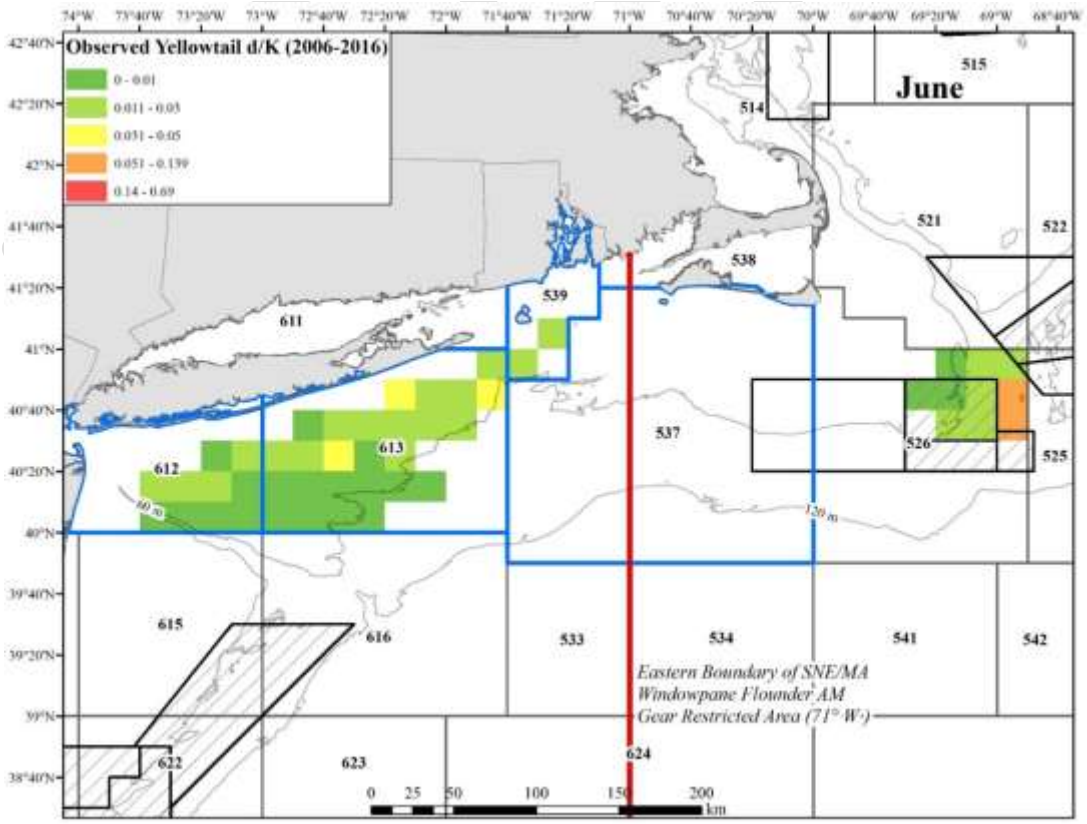

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
February
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

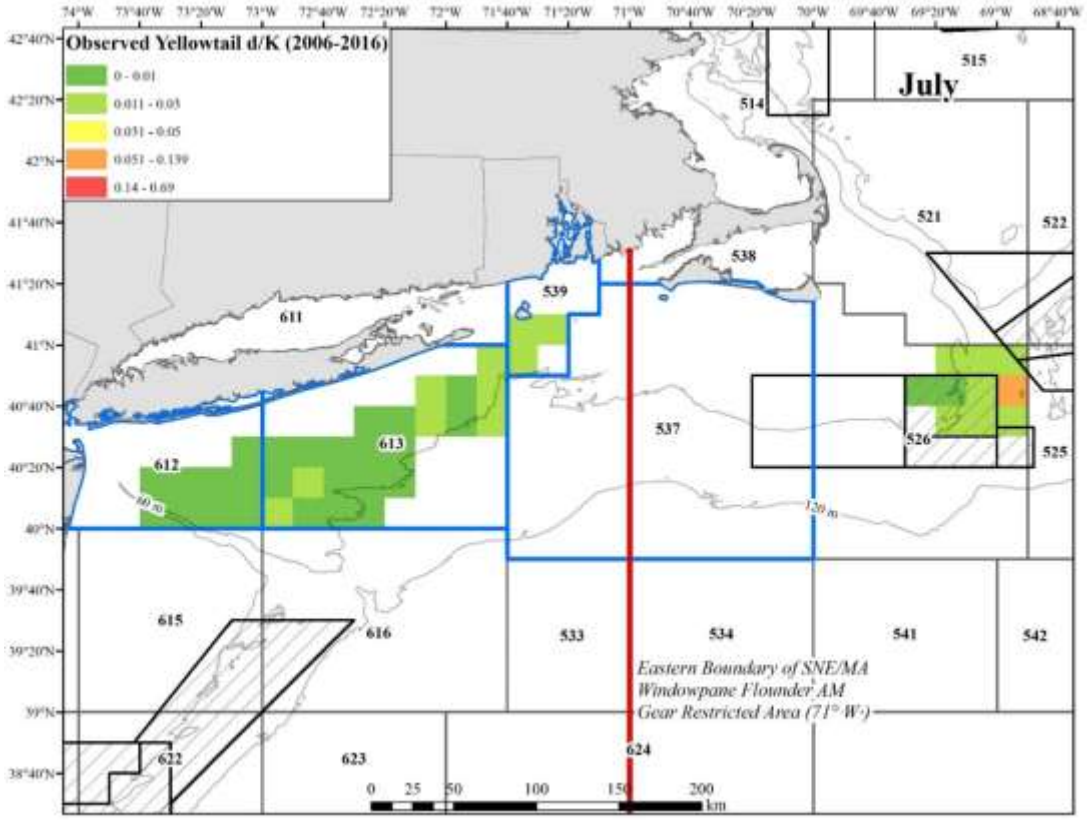

Observed N. windowpane d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
February
464
561
120 m
551
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

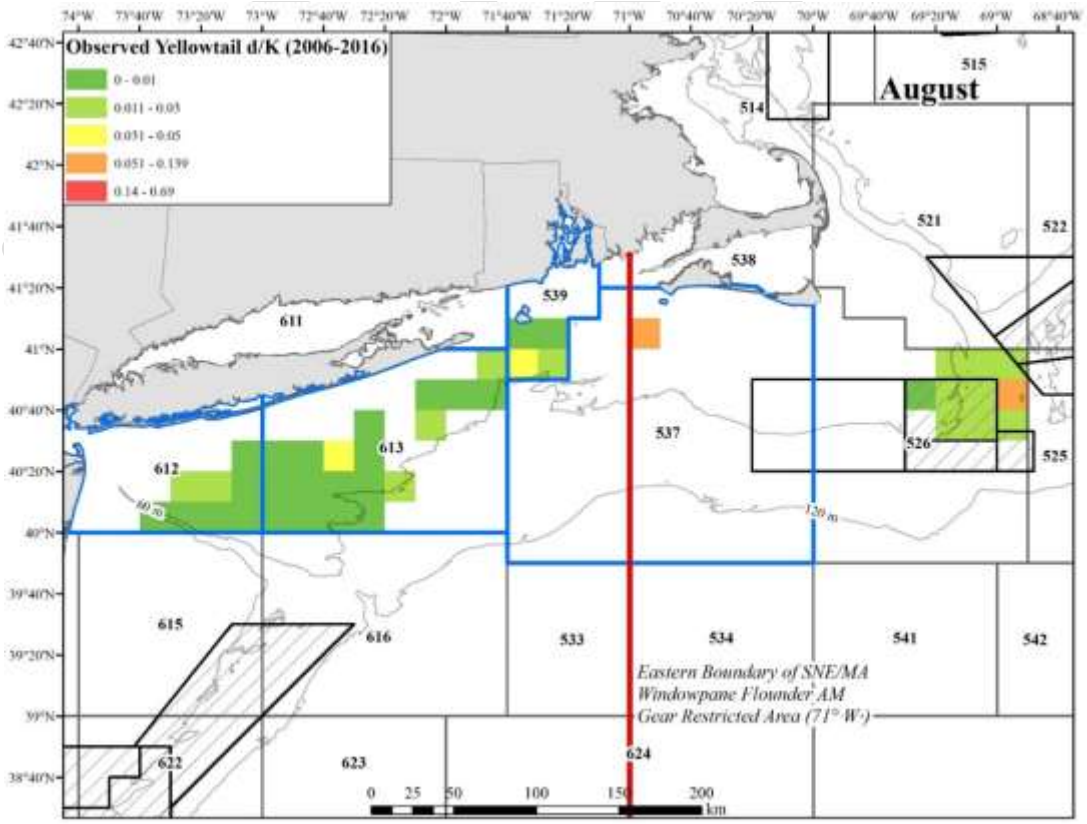

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
March
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
623
624
622
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

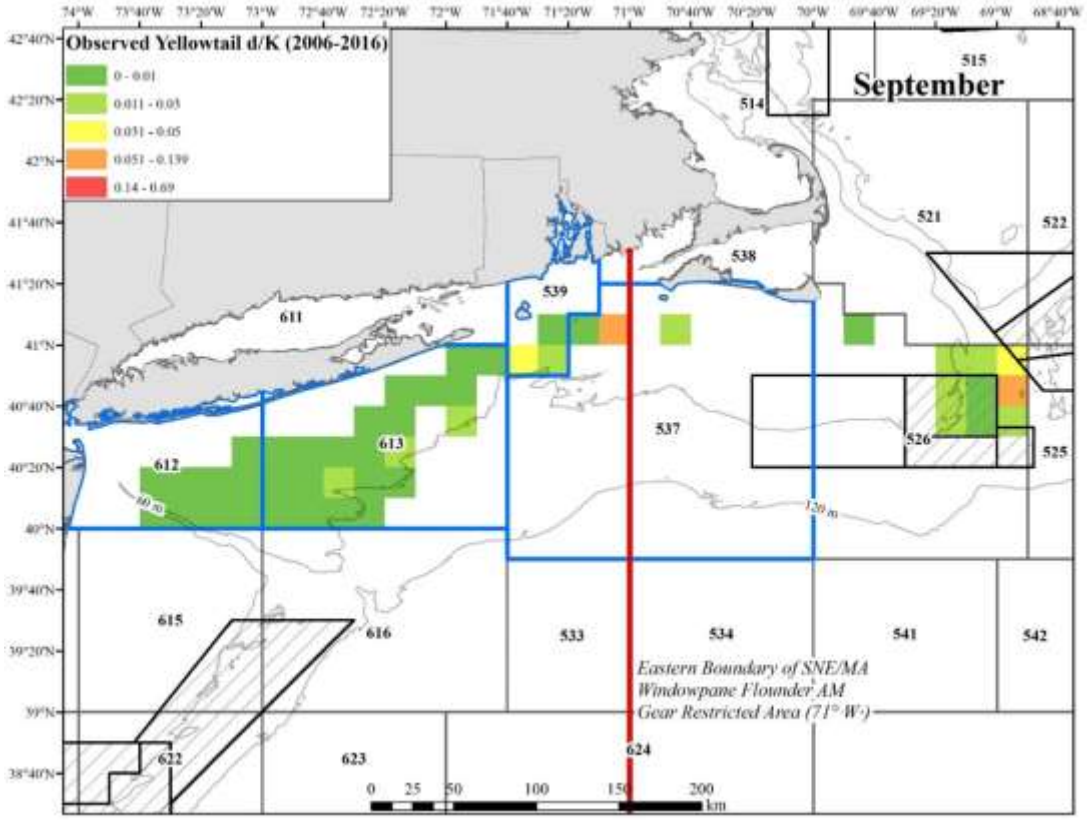

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
April
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
623
624
622
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

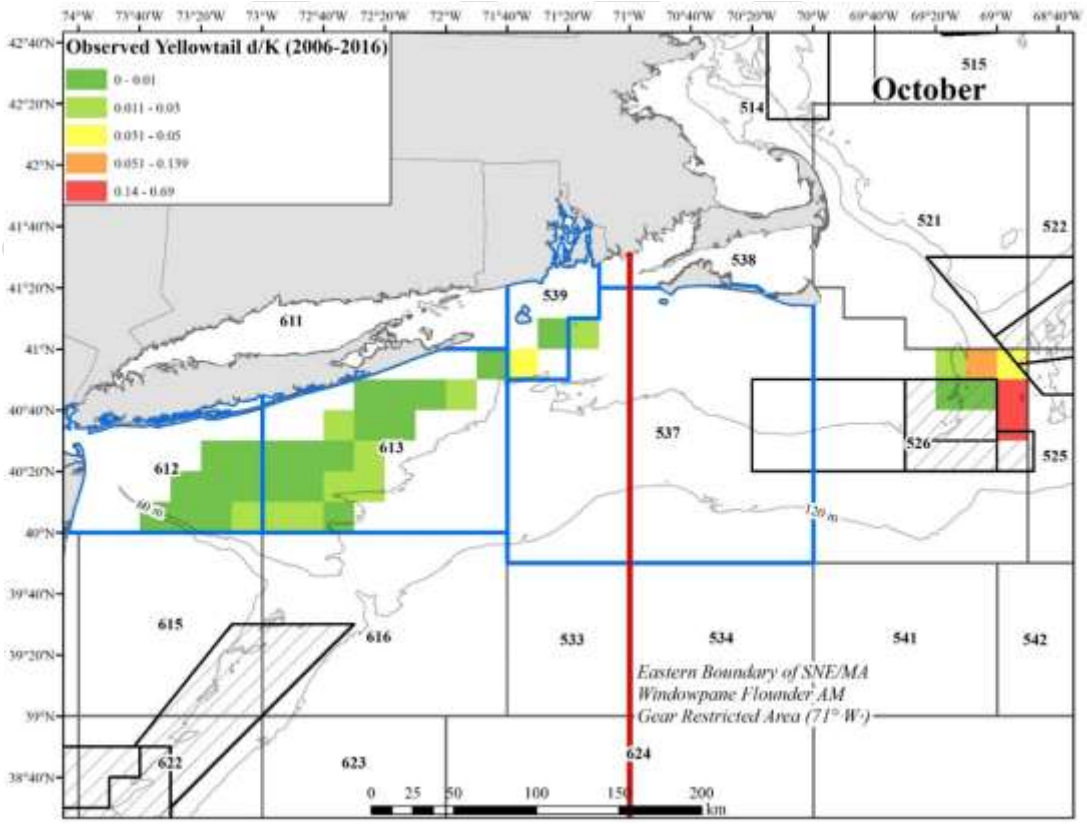

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
May
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
623
622
624
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

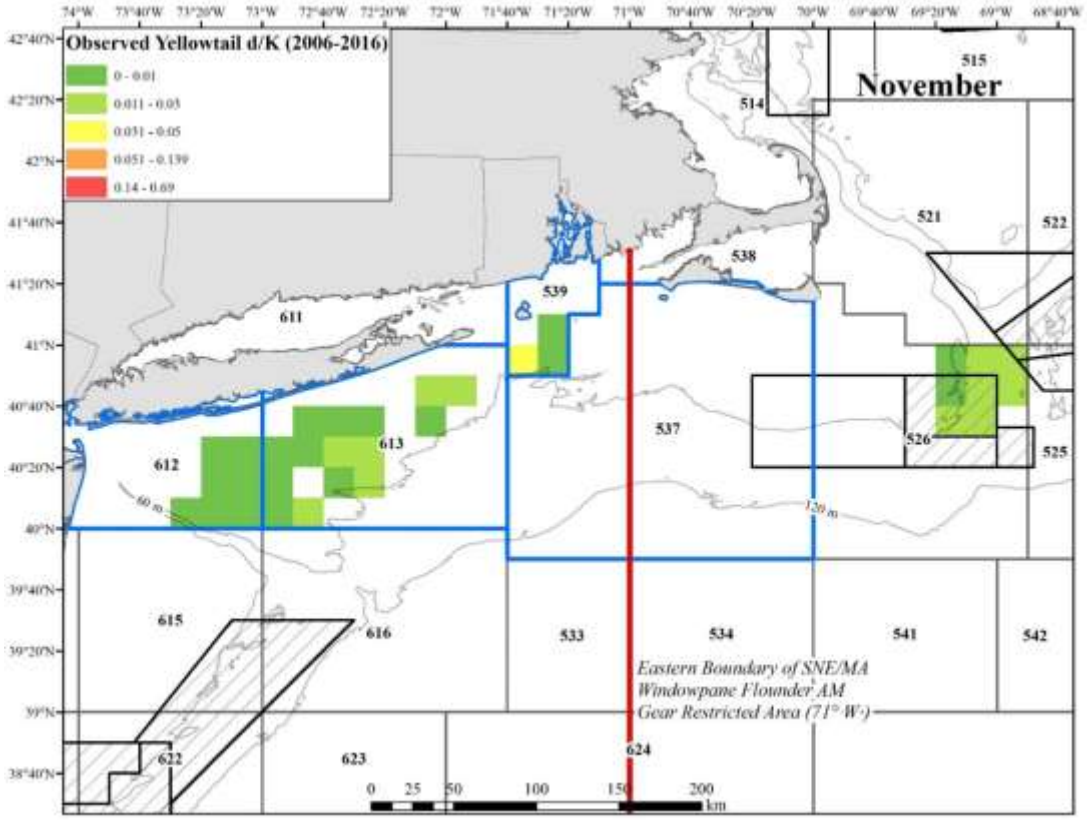

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
June
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
623
622
624
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

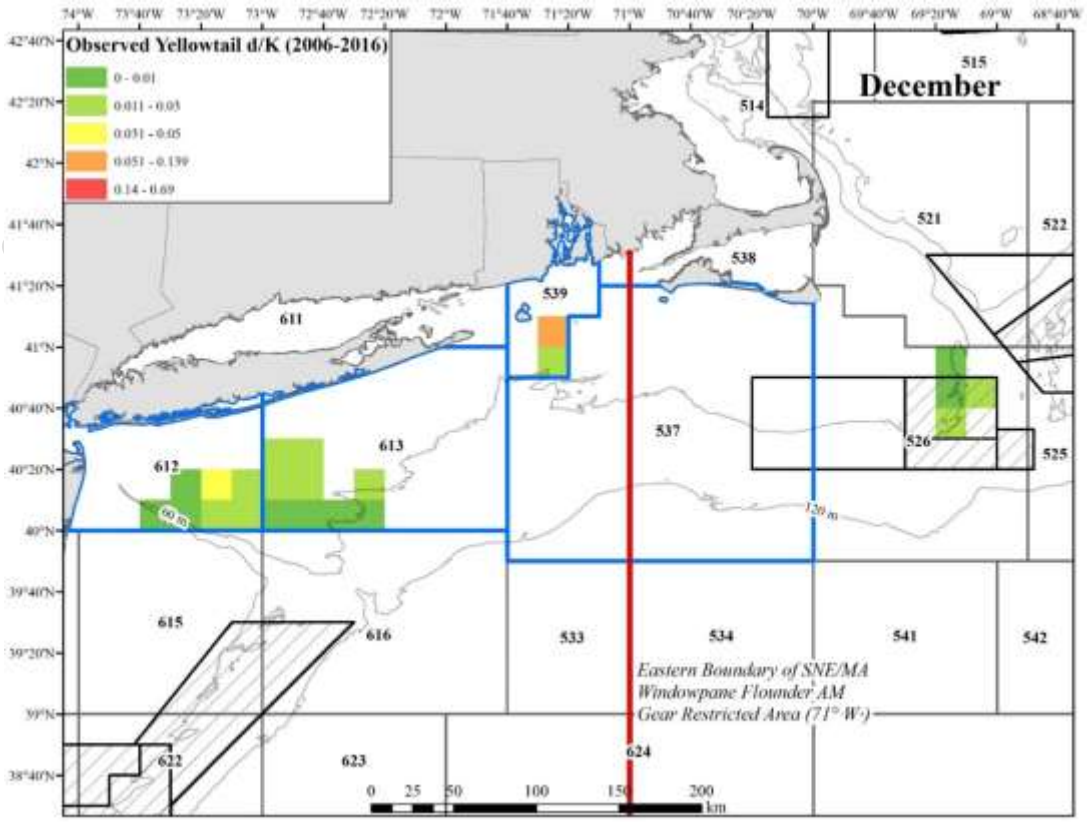

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
July
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
623
622
624
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

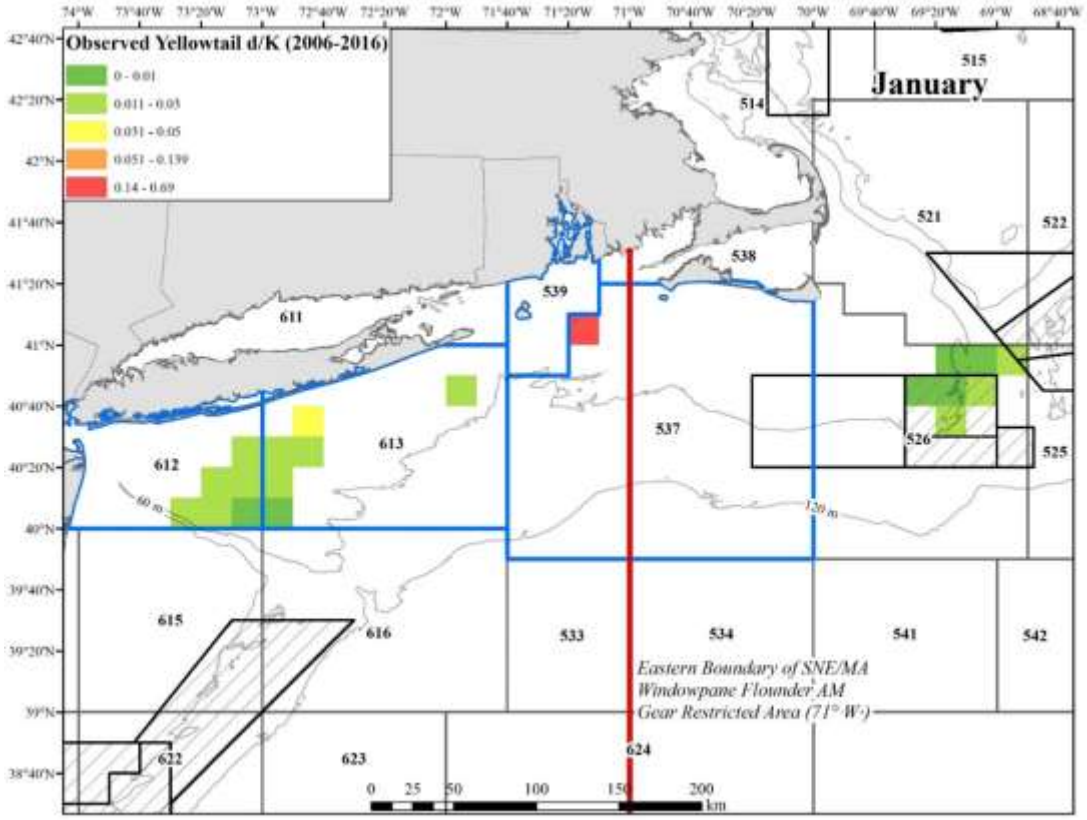

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
August
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
623
622
624
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

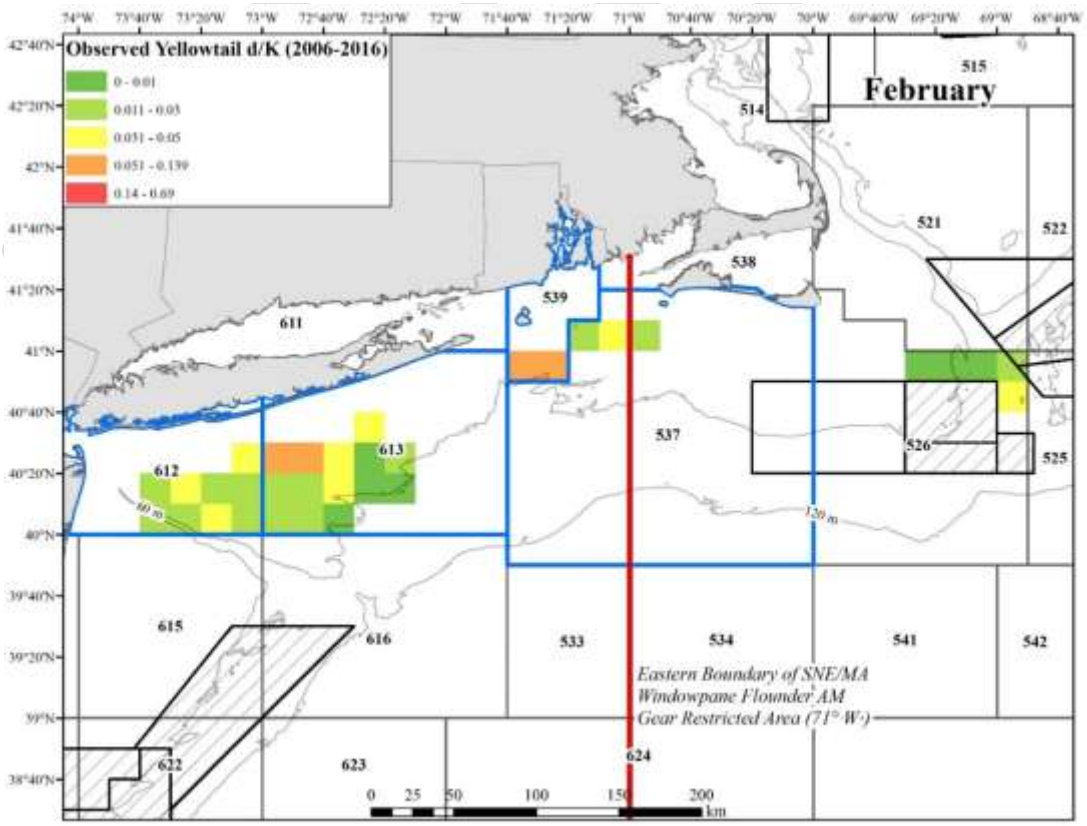

Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
September
611
612
613
615
616
622
623
624
514
515
521
522
525
526
533
534
537
538
539
541
542
120 m
60 70
Eastern Boundary of SNE/MA
Windowpane Flounder AM
Gear Restricted Area (71° W)
0 25 50 100 150 200
km


Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
October
611
612
613
615
616
622
623
624
514
515
521
522
525
526
533
534
537
538
539
541
542
120 m
60 70
Eastern Boundary of SNE/MA
Windowpane Flounder AM
Gear Restricted Area (71° W)
0 25 50 100 150 200
km


Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
November
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
622
623
624
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km


Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
December
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
622
623
624
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km


Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
January
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
622
623
624
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km


Observed Yellowtail d/K (2006-2016)
0 - 0.01
0.011 - 0.03
0.031 - 0.05
0.051 - 0.139
0.14 - 0.69
February
515
514
521
522
538
539
611
537
526
525
613
612
615
616
533
534
541
542
622
623
624
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

2.0 OBSERVED MONTHLY FLATFISH D/K RATIO BY STATISTICAL REPORTING AREA

2.1 Background

PDT discussion focusing on the observed monthly flatfish d/K ratio by ten minute square analyses (described in Section 1.0) suggested that standardizing the 'stoplight' scale used in the figures could aid in the interpretation of said analyses. It was also noted that identifying flatfish bycatch hotspots for the purpose of seasonal closures may not be feasible at the fine-scale of ten minute squares, and that there could be utility in looking at observed d/K ratio's on the larger scale of statistical reporting areas. These discussion points were addressed using a similar approach as Section 1.0, and is described in the following section.

2.2 Methods

The following figures display observed monthly d/K ratios of GB yellowtail, SNE yellowtail, and N. windowpane to scallop meats kept by statistical reporting area (SRA). Data included in analysis were observed hauls from standard observer trips on Limited Access and Limited Access General Category dredge/trawl vessels between FY2006 and FY2016. For each month, data were aggregated by SRA.
The d/K ratios for each SRA were estimated using the following equation:

$$\frac{(d_{2006} + d_{2007} + d_{2008} + \cdots d_{2016})}{(K_{2006} + K_{2007} + K_{2008} + \cdots K_{2016})}$$

Where d = observed weight of discarded flatfish (lbs) and K = observed weight of kept scallops (lbs). For observed hauls where only round weights of scallops were recorded, lbs of round scallops were converted to lbs of dressed scallops using the equation:

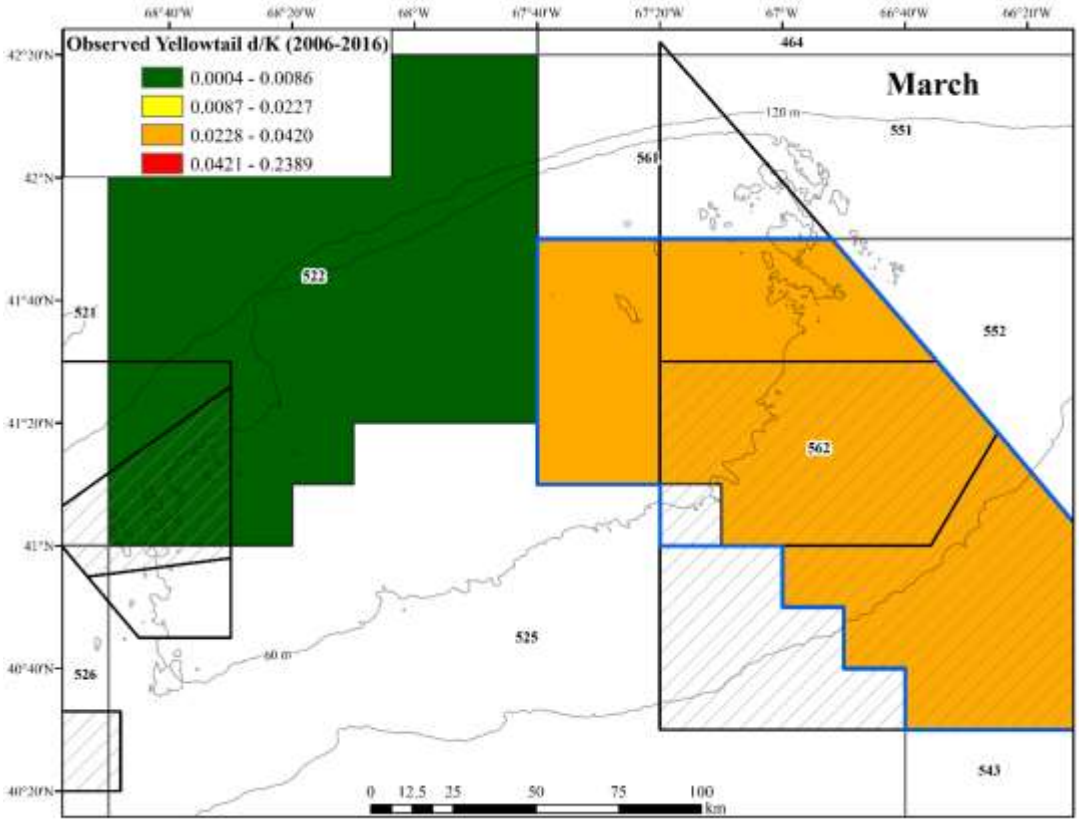
$$\frac{K_{round}}{8.33}$$

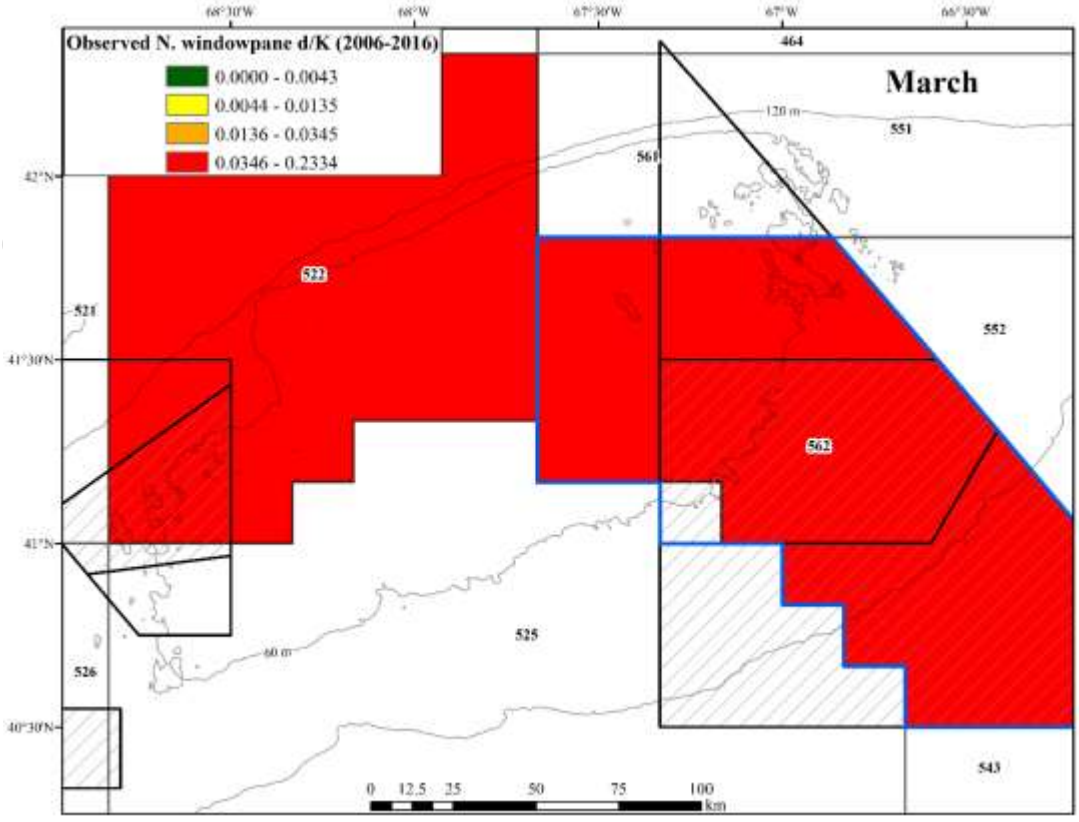
Where K_{round} = the weight of in shell scallops (lbs).

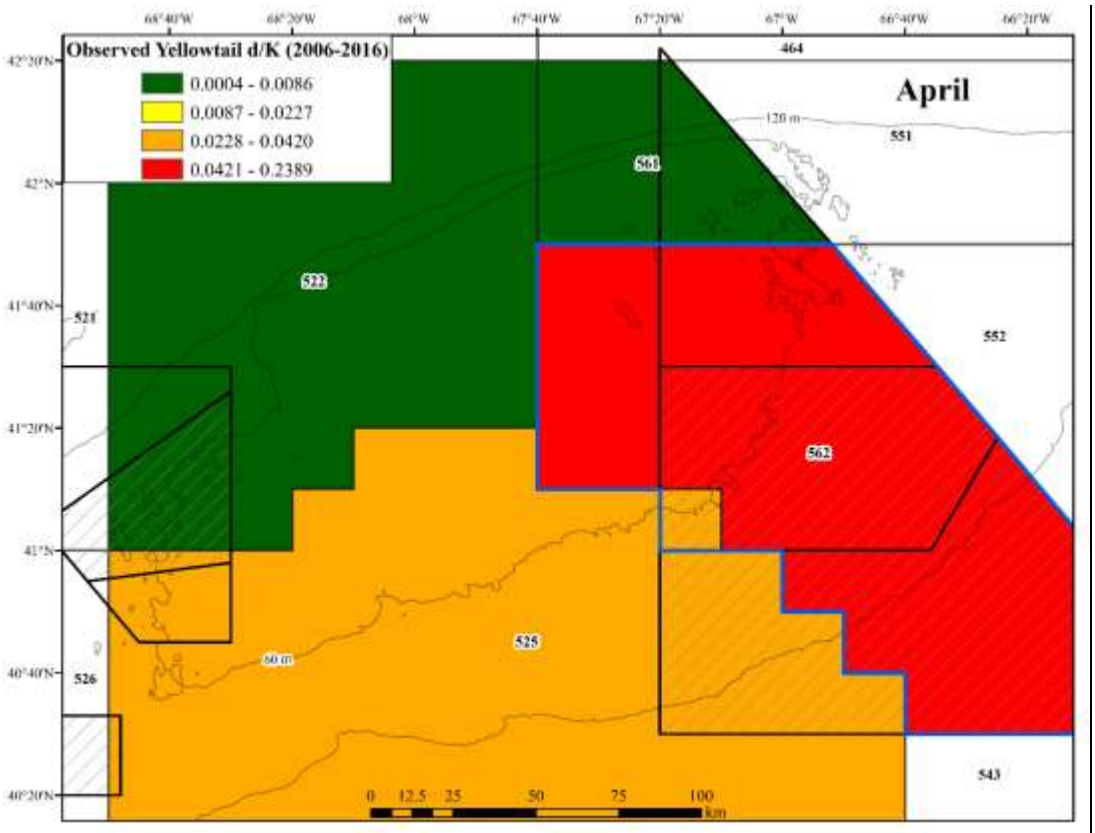
To comply with data confidentiality requirements, the following figures only display SRAs with observed activity from 3 or more vessels for each month. The blue lines depict boundaries of the GB and SNE yellowtail flounder AM areas. The purple line depicts the eastern boundary of the SNE/MA windowpane flounder AM gear restricted area (71° W).
The first group of figures depict both GB yellowtail and northern windowpane bycatch by month (one month per page, GB yellowtail as top figure, and northern windowpane as the bottom figure). The second grouping of figures is for SNE/MA yellowtail flounder only (each page contains two months).

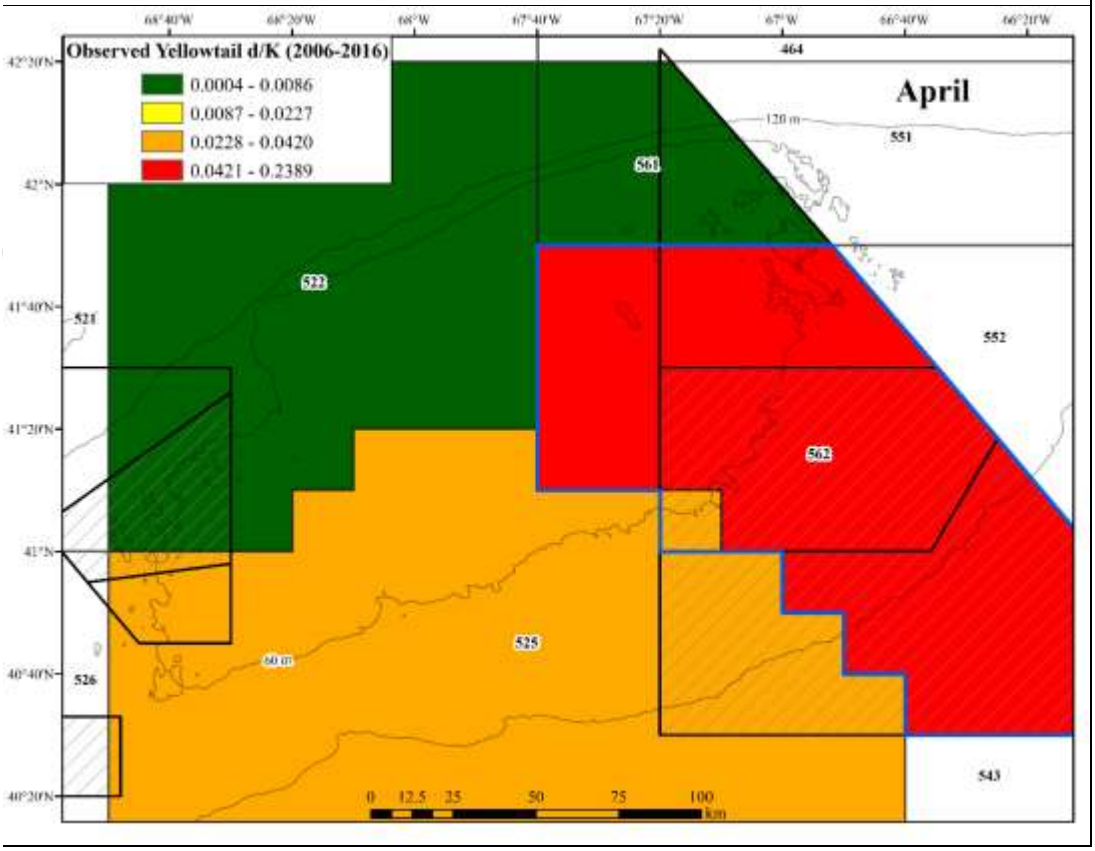
The 'stoplight' scale for all figures is specific to individual flatfish species and represents the percentile range of observed d/K ratio in ascending order (green is the minimum to 25th percentile d/K observed, yellow is 50th percentile d/K observed, orange is 75th percentile d/K

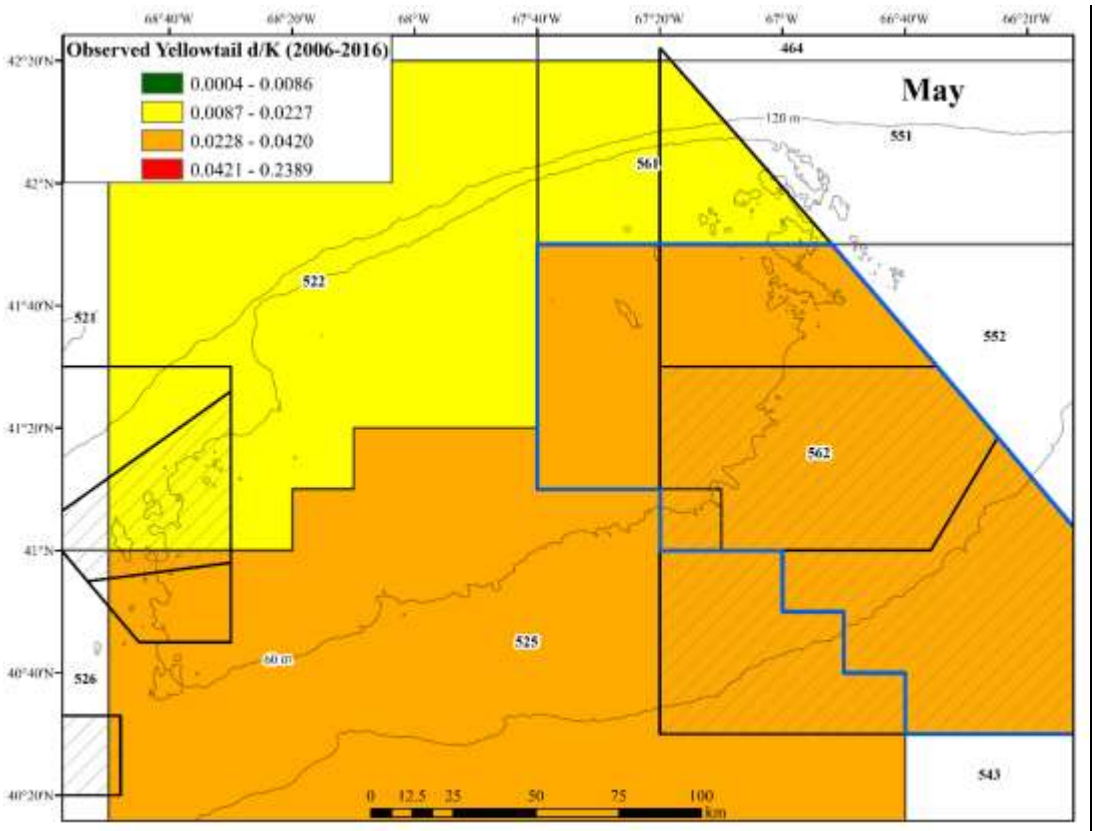
observed, and red is 100th percentile d/K observed). An example of how to interpret these figures is described here for SNE/MA yellowtail: Green squares indicated between 0.03-0.52 lbs of yellowtail catch per 100 lbs of dressed scallops kept, yellow squares indicate between 0.53-1.35 lbs of yellowtail catch per 100 lbs of scallops kept, orange squares indicate between 1.36-2.96 lbs of yellowtail catch per 100 lbs of scallops kept, and red squares indicate between 2.97-18.13 lbs of yellowtail catch per 100 lbs of scallops kept.

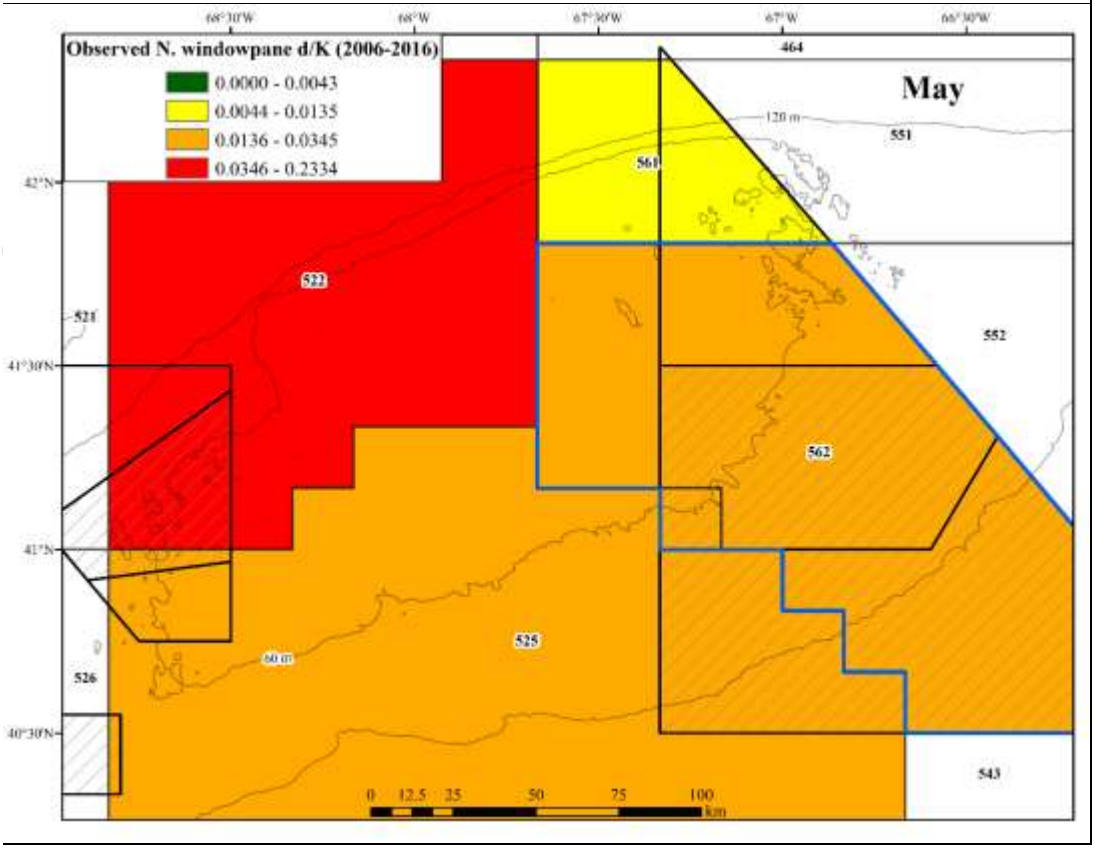

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
March
464
561
551
552
562
522
521
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

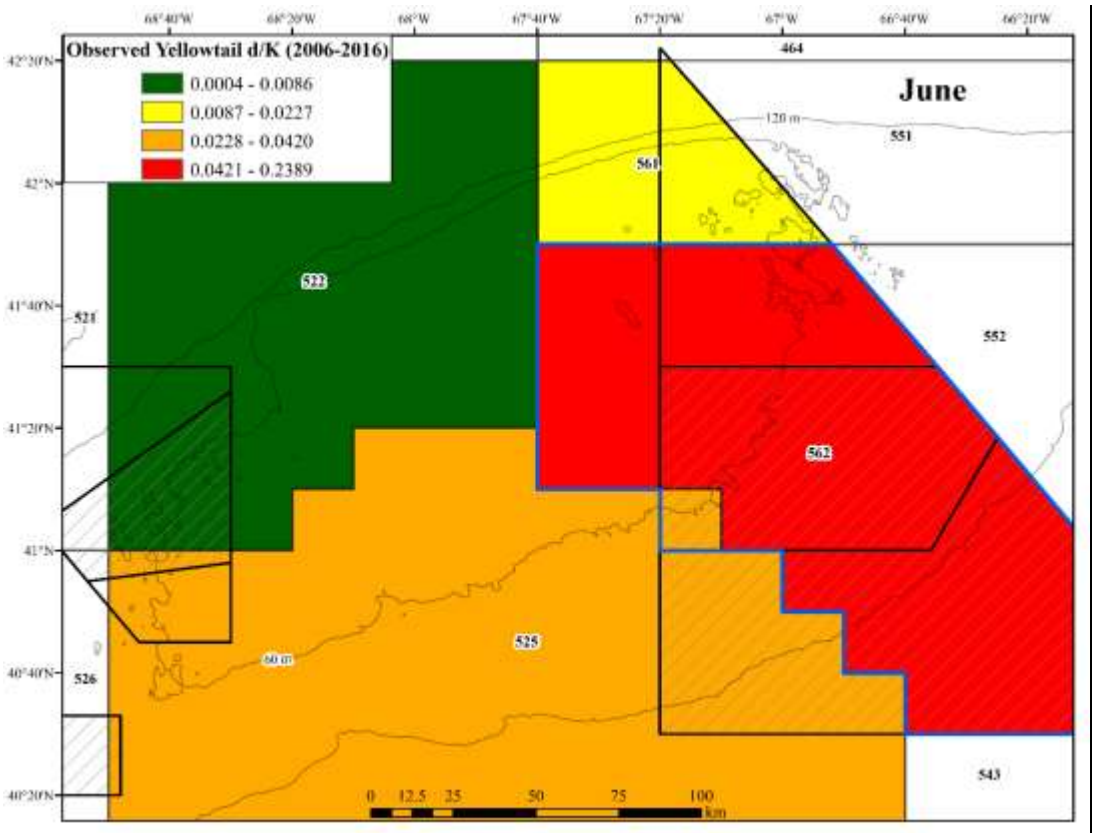

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
March
464
561
551
552
562
522
521
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

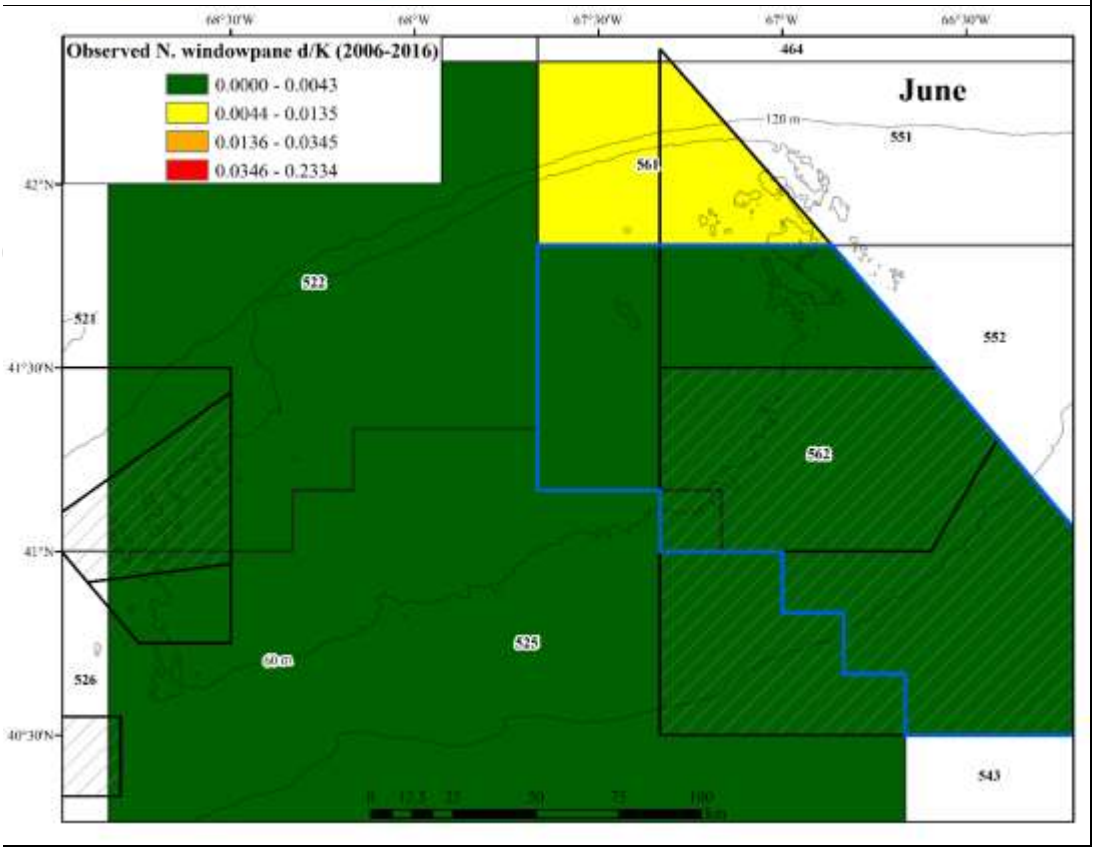

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
April
464
551
120 m
561
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

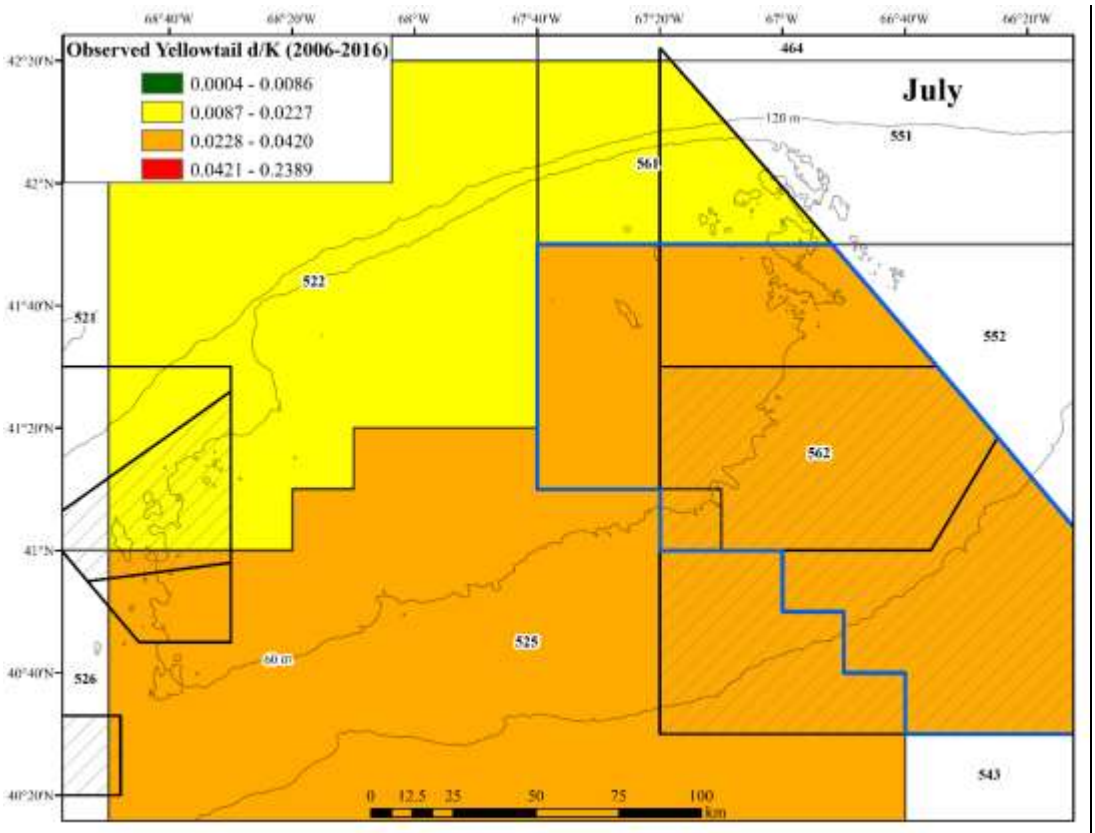

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
April
464
551
120 m
561
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

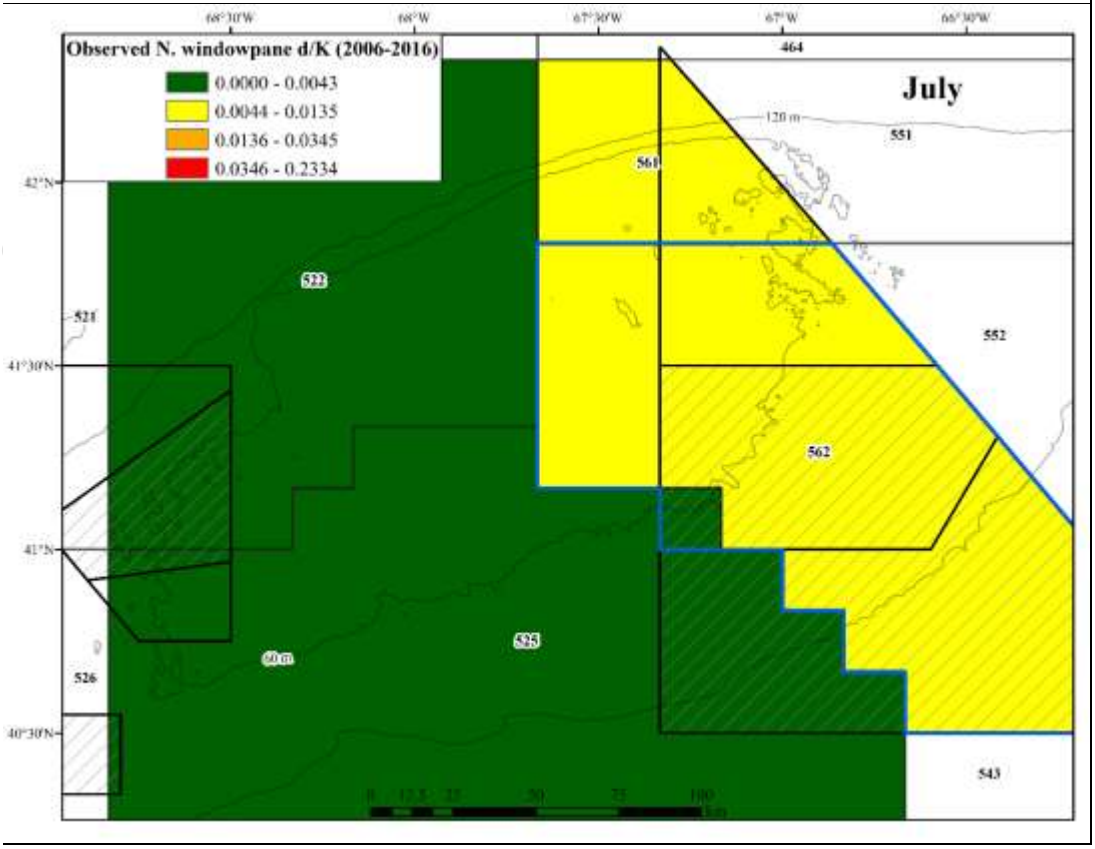

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
May
464
561
551
120 m
522
521
552
562
525
526
60 m
543
0 12.5 25 50 75 100
km

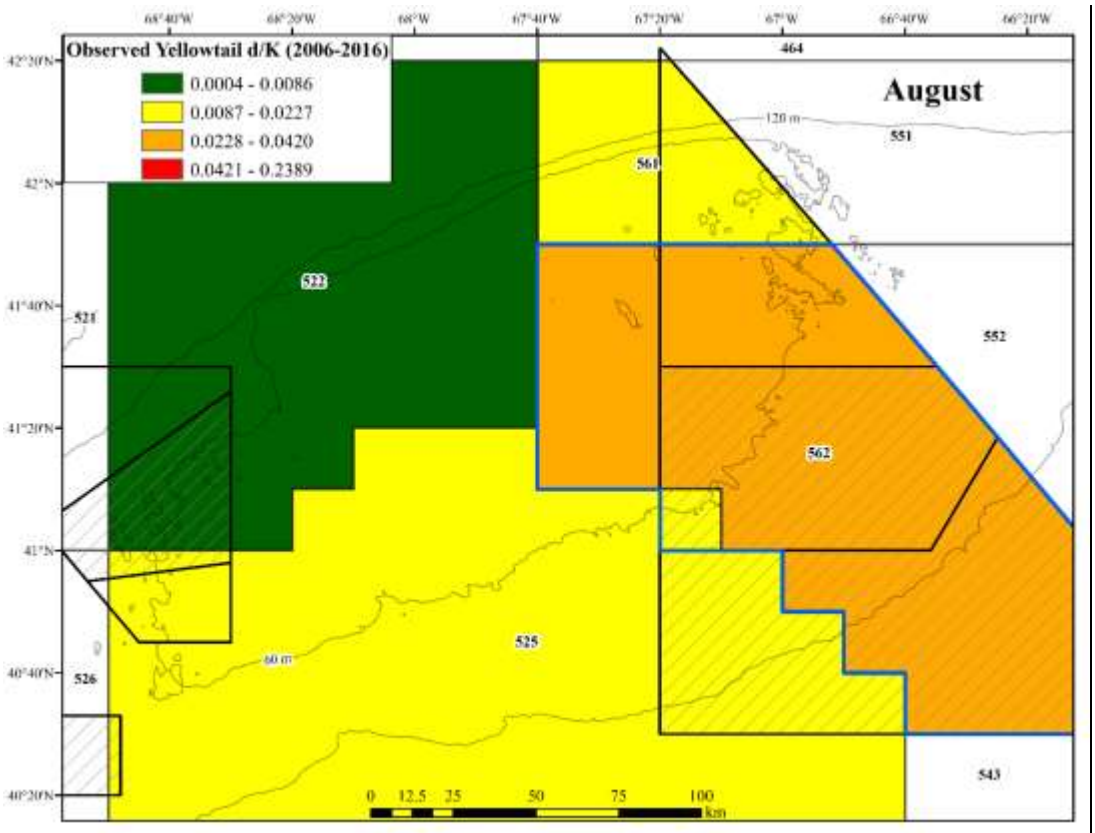

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
May
464
561
551
120 m
522
521
552
562
525
526
60 m
543
0 12.5 25 50 75 100
km

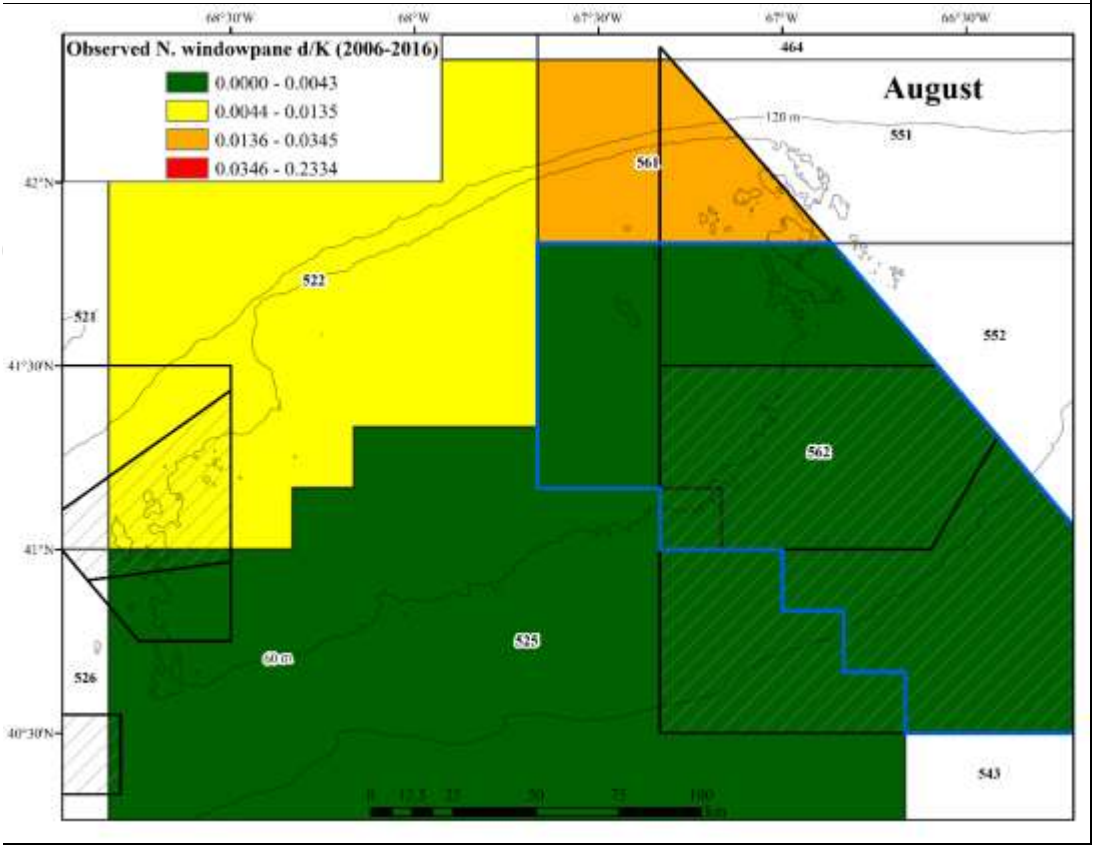

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
June
464
551
561
522
521
552
562
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

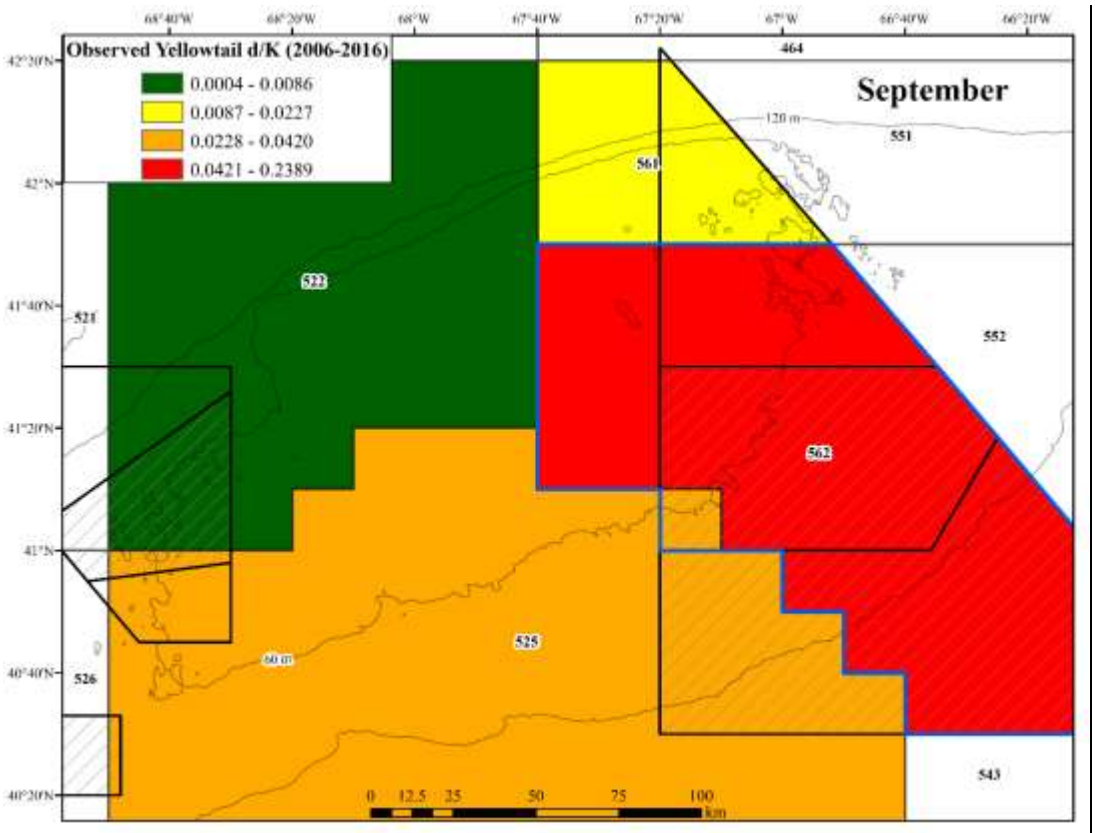

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
June
464
551
561
522
521
552
562
525
526
543
120 m
60 m

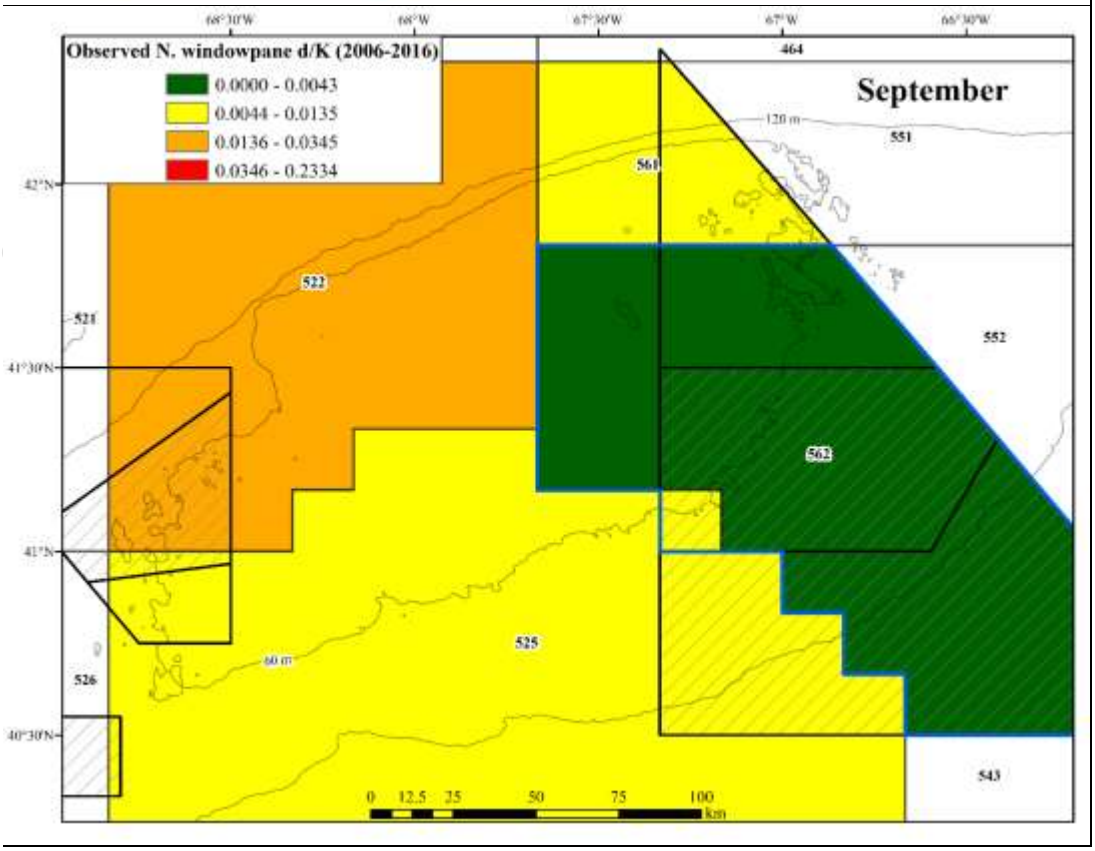

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
July
464
561
551
120 m
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

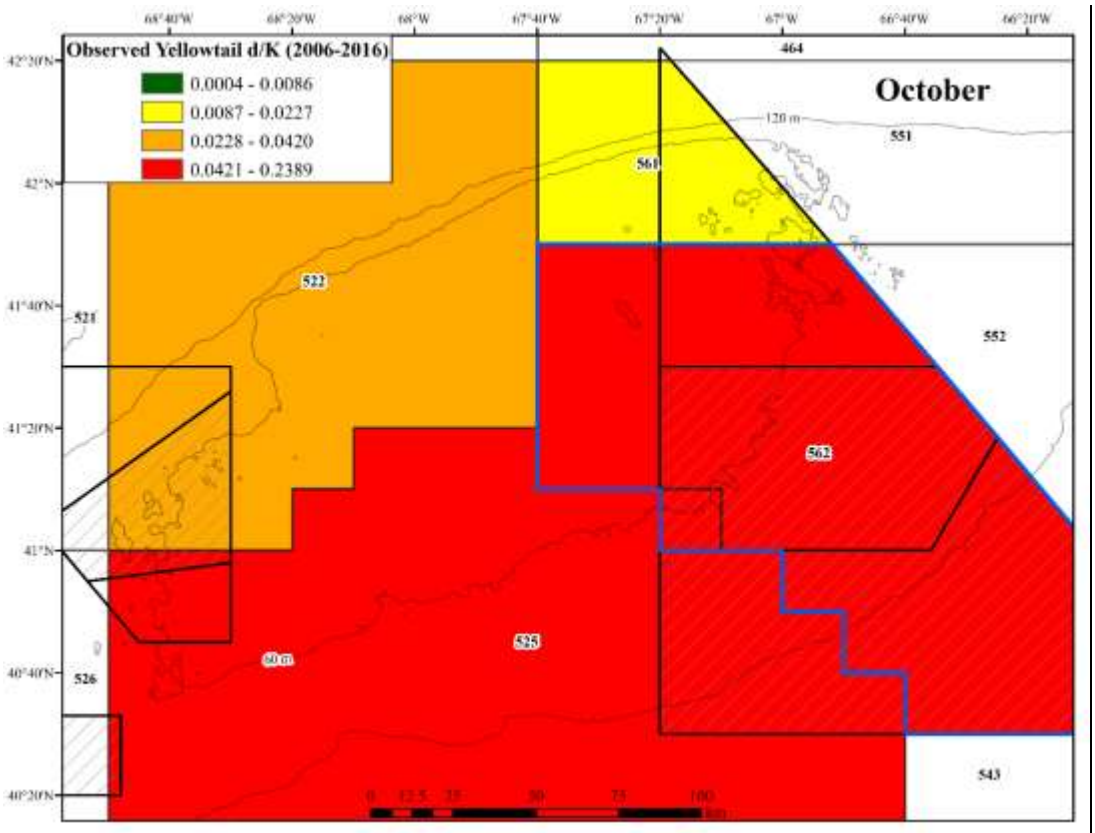

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
July
464
561
551
120 m
522
521
552
562
525
60 m
526
543

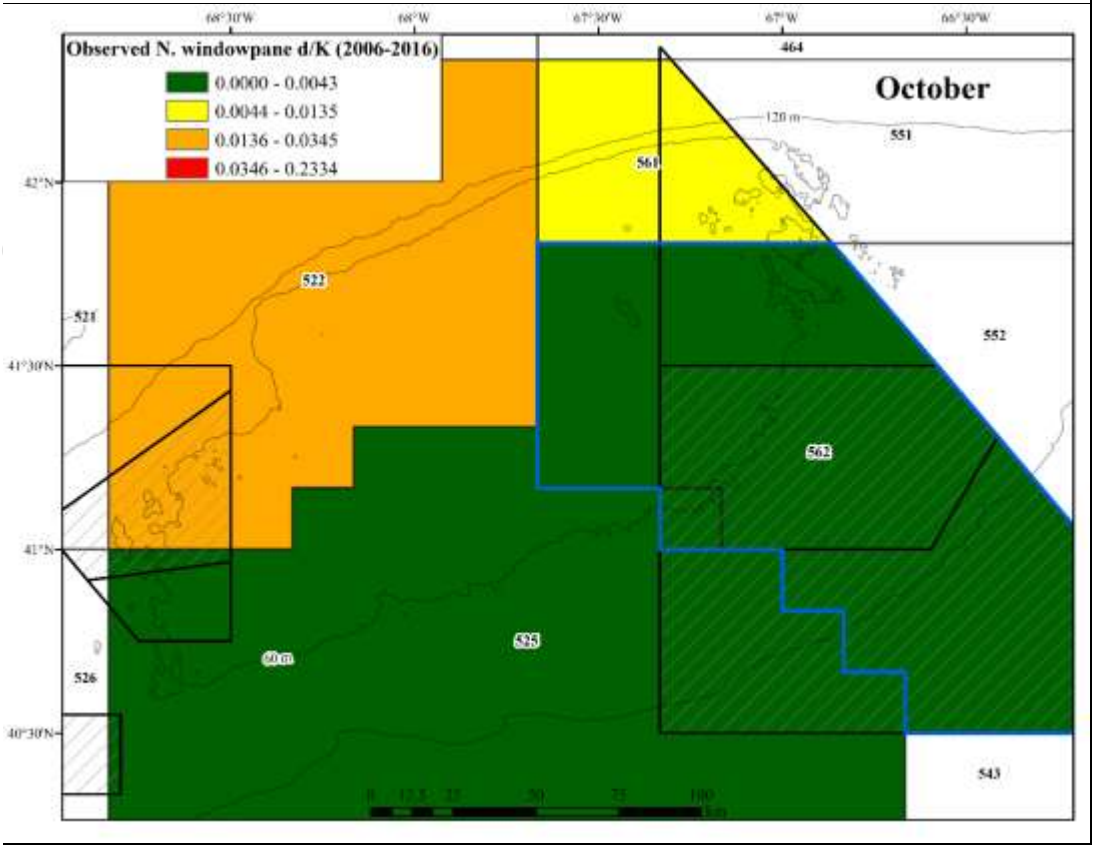

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
August
464
561
551
120 m
522
521
552
562
525
60 m
526
543
0 12.5 25 50 75 100
km

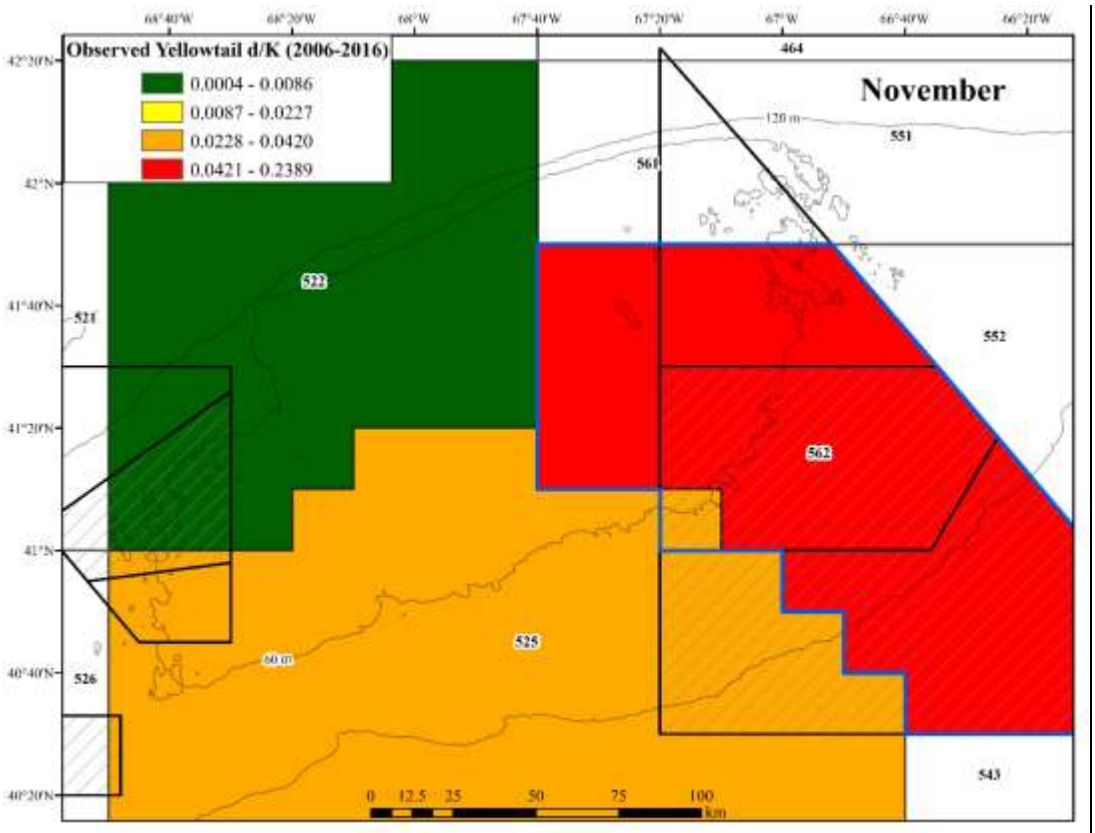

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
August
464
561
551
120 m
522
521
552
562
525
60 m
526
543

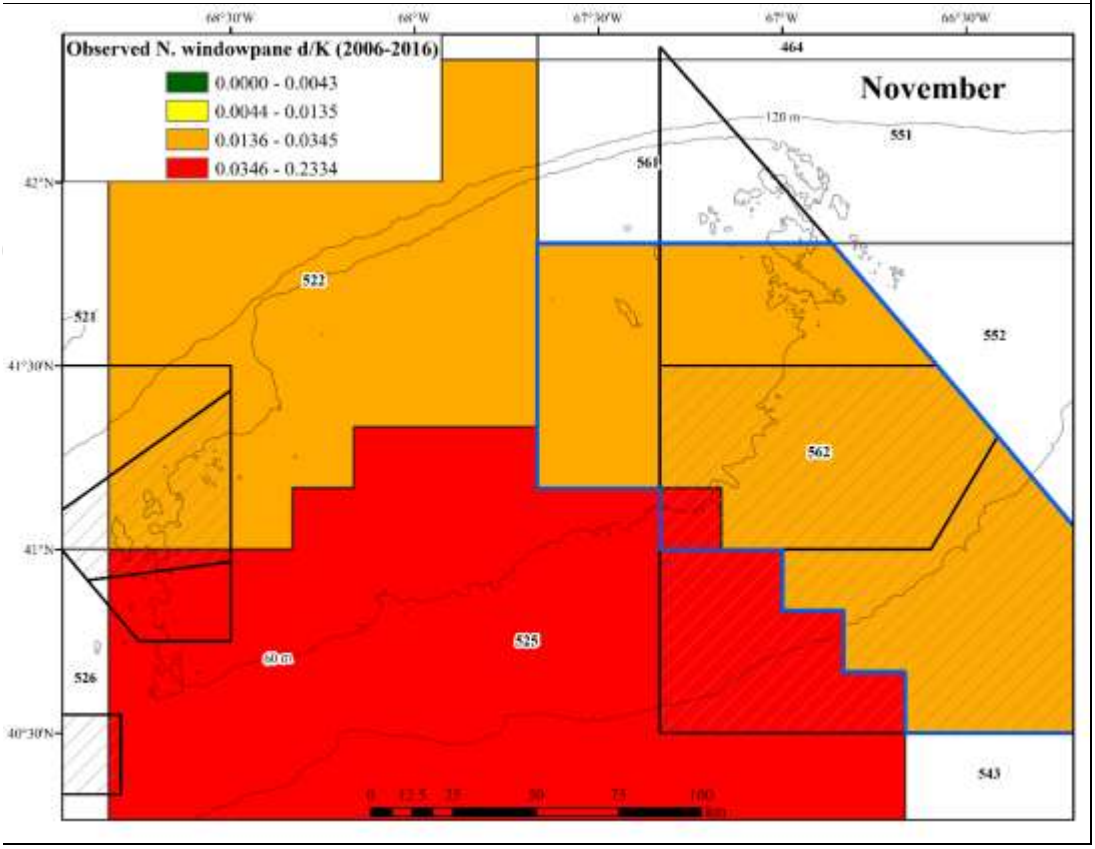

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
September
464
561
551
522
521
552
562
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

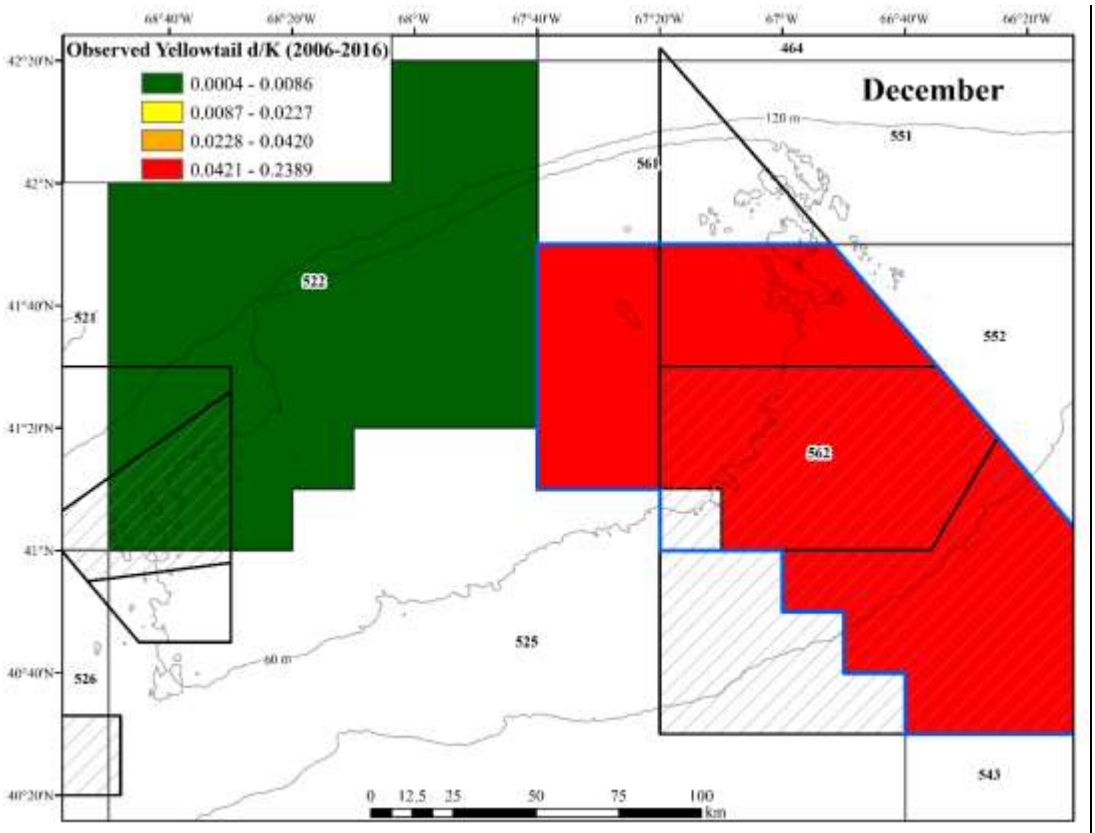

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
September
464
561
551
522
521
552
562
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

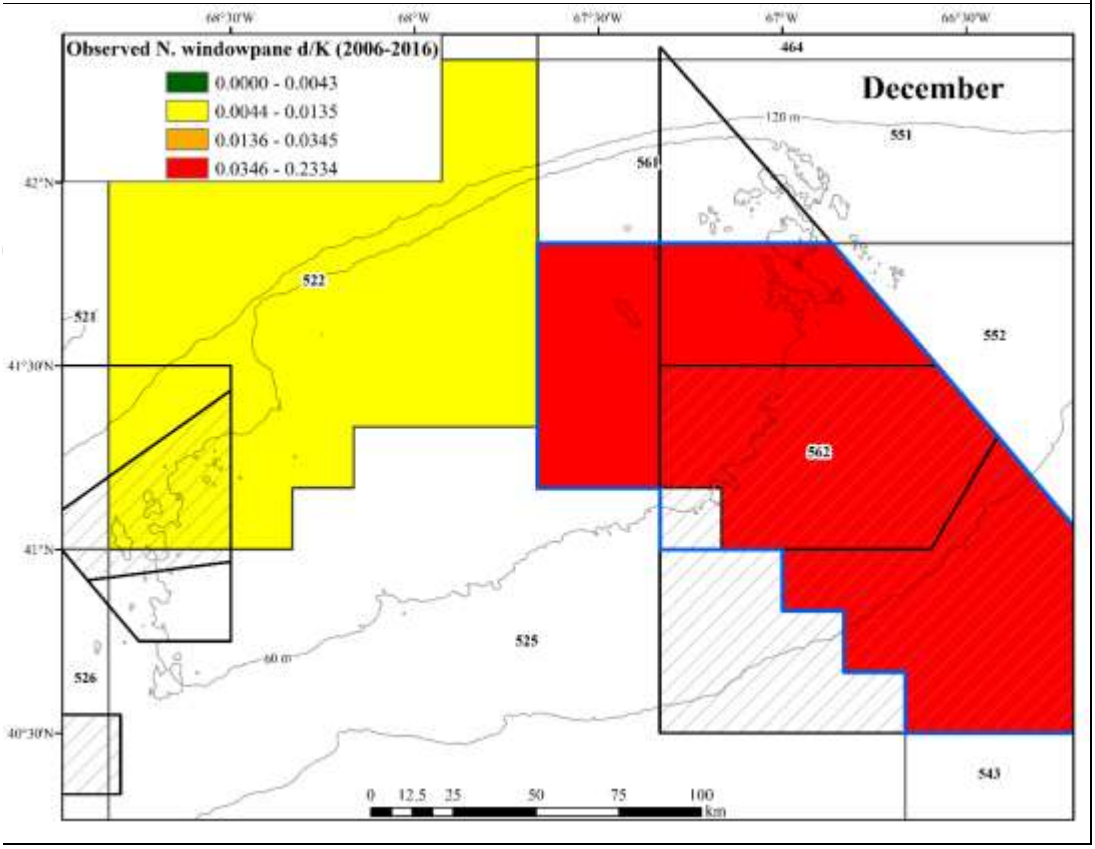

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
October
464
551
561
522
521
552
562
525
526
543
120 m
60 m

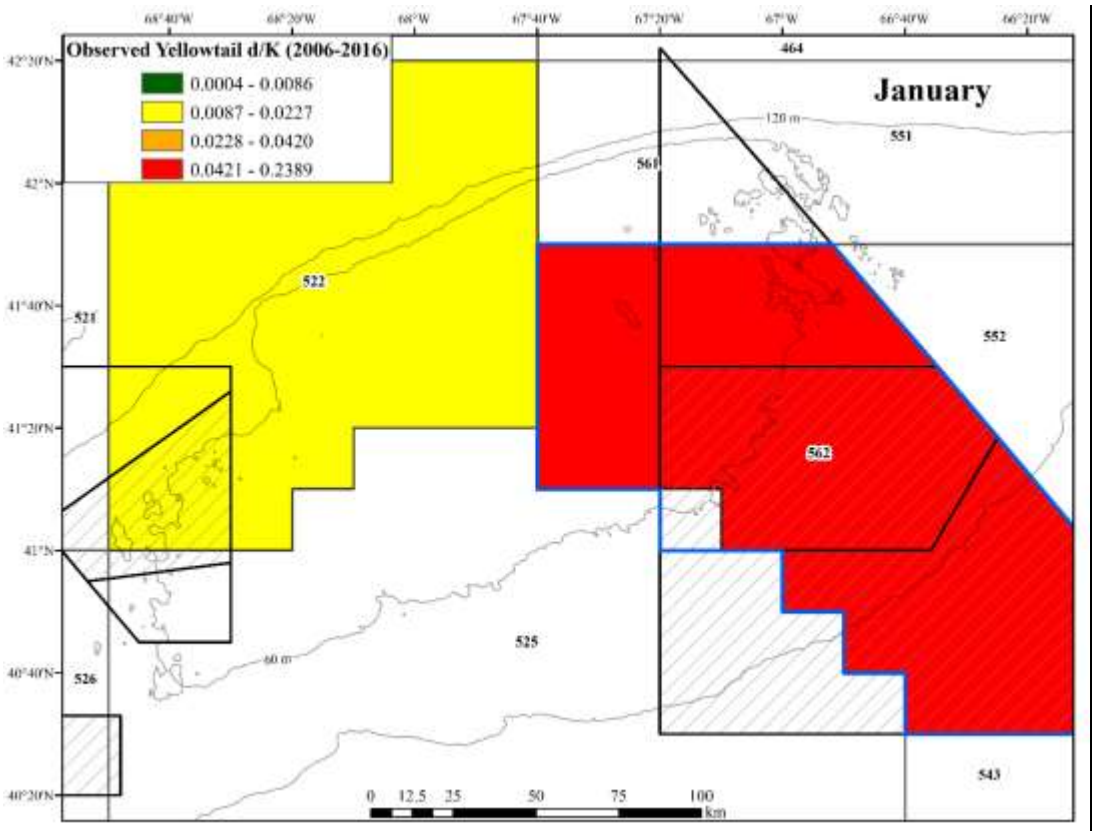

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
October
464
551
561
522
521
552
562
525
526
543
120 m
60 m

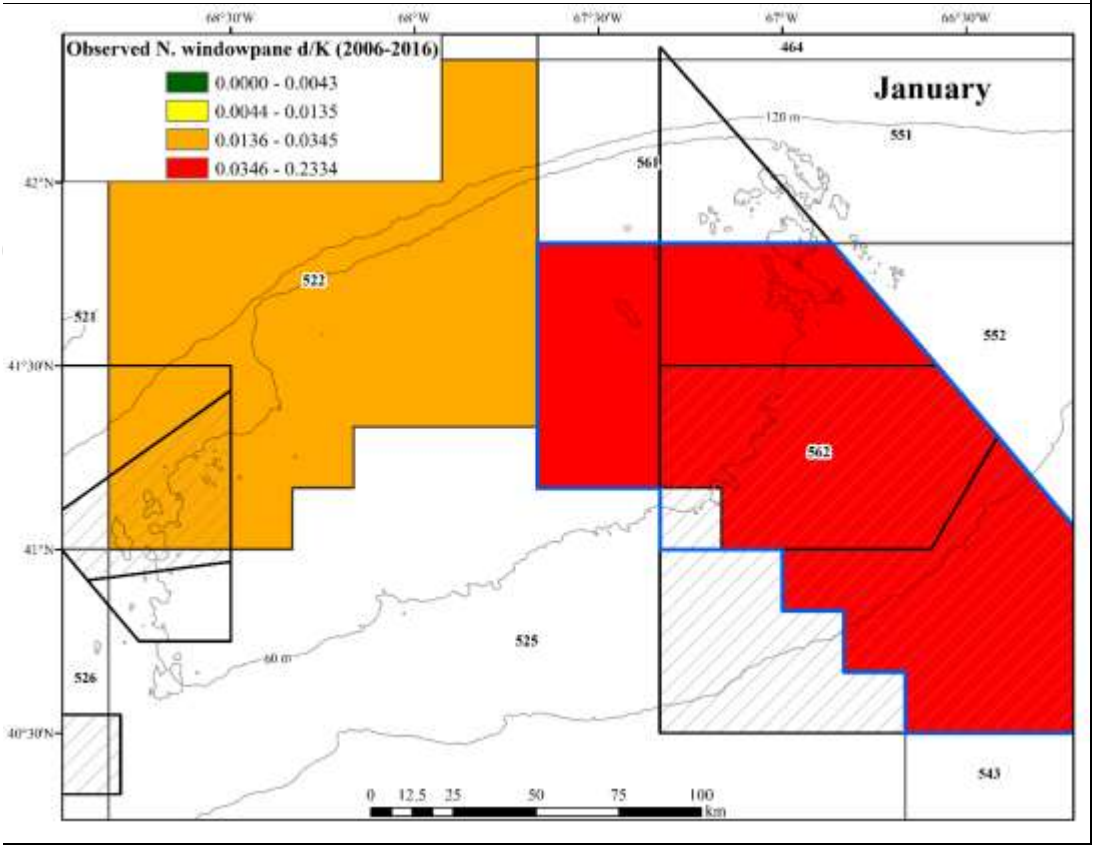

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
November
464
561
551
552
562
522
521
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

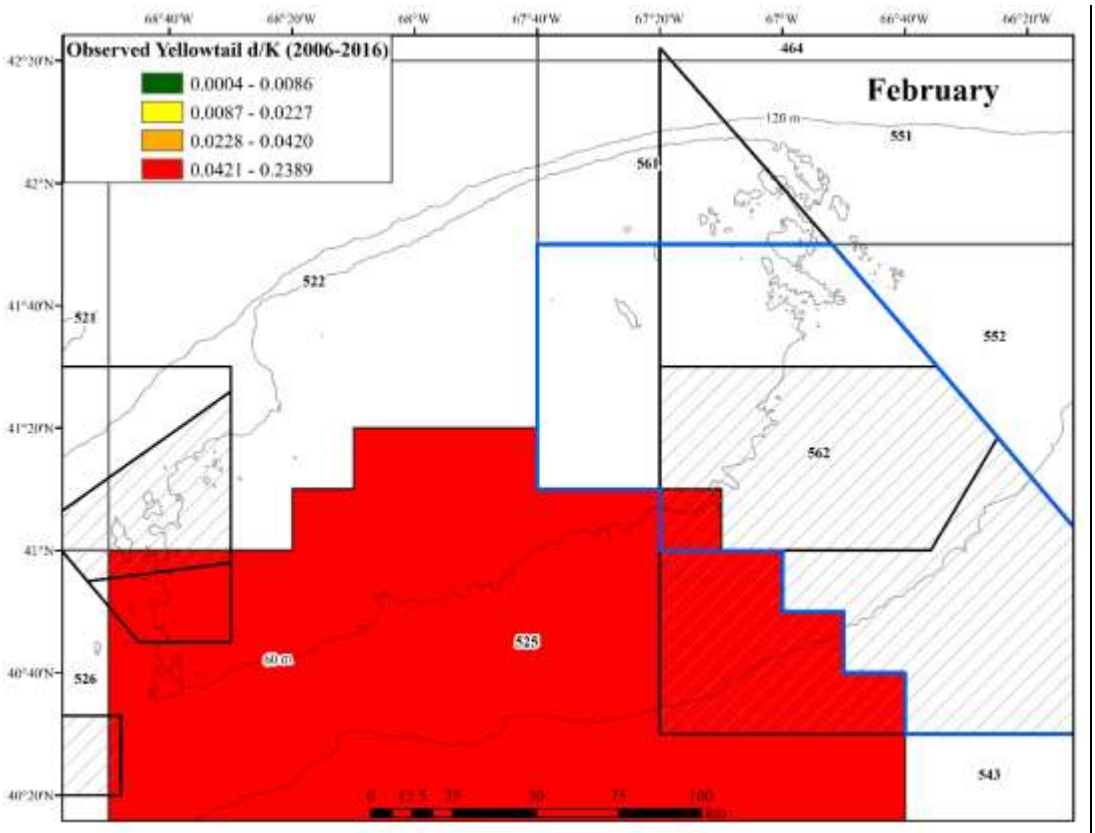

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
November
464
561
551
552
562
522
521
525
526
543
120 m
60 m

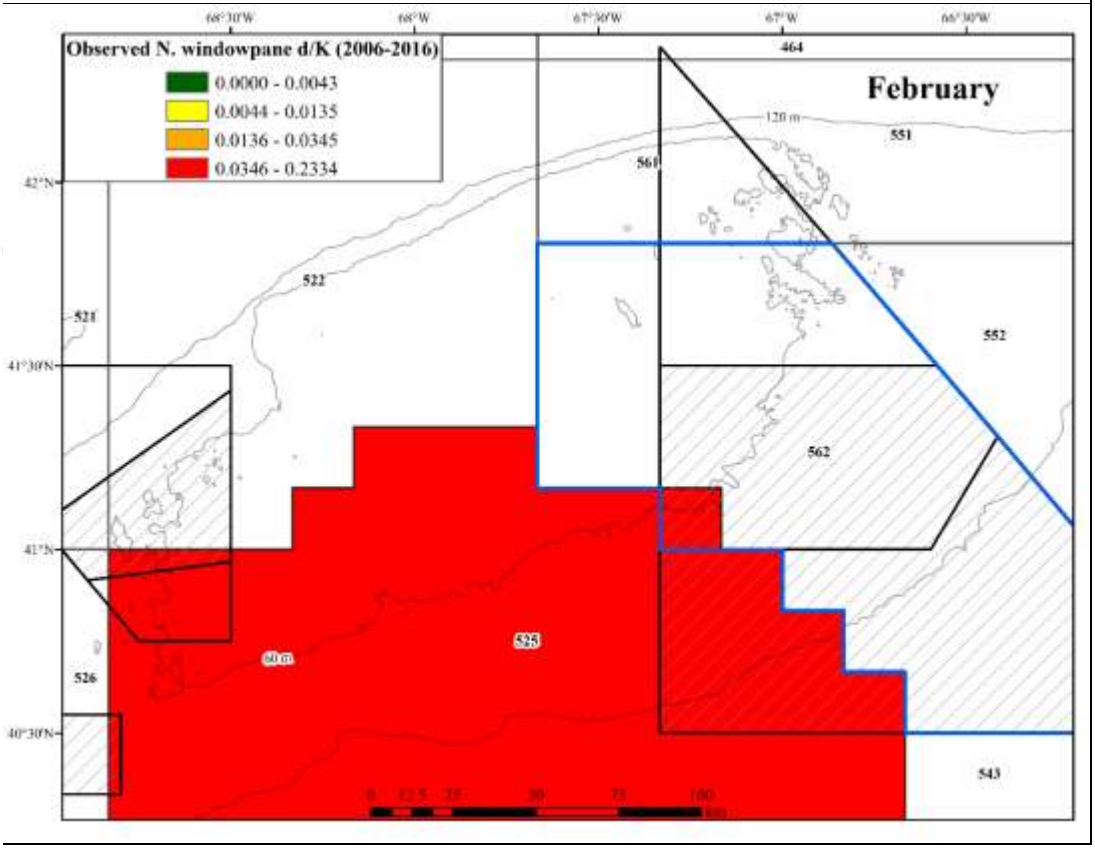

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
December
464
561
551
552
562
522
521
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

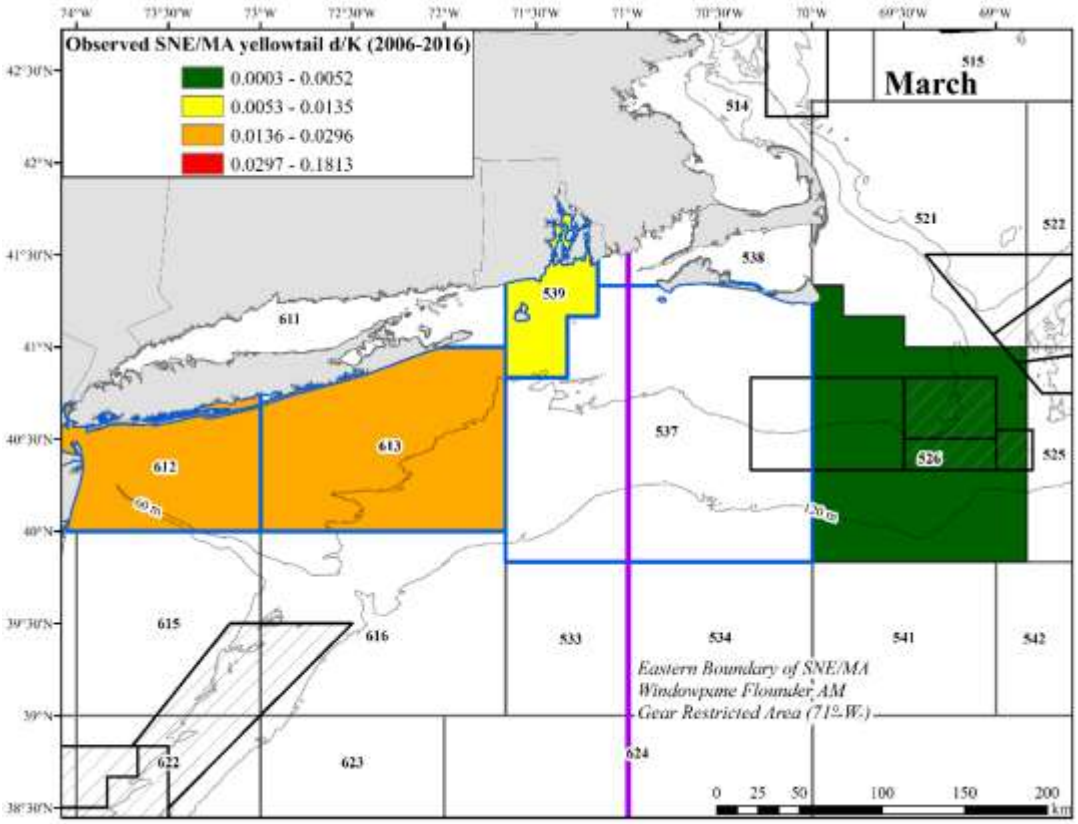

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
December
464
561
551
552
562
522
521
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

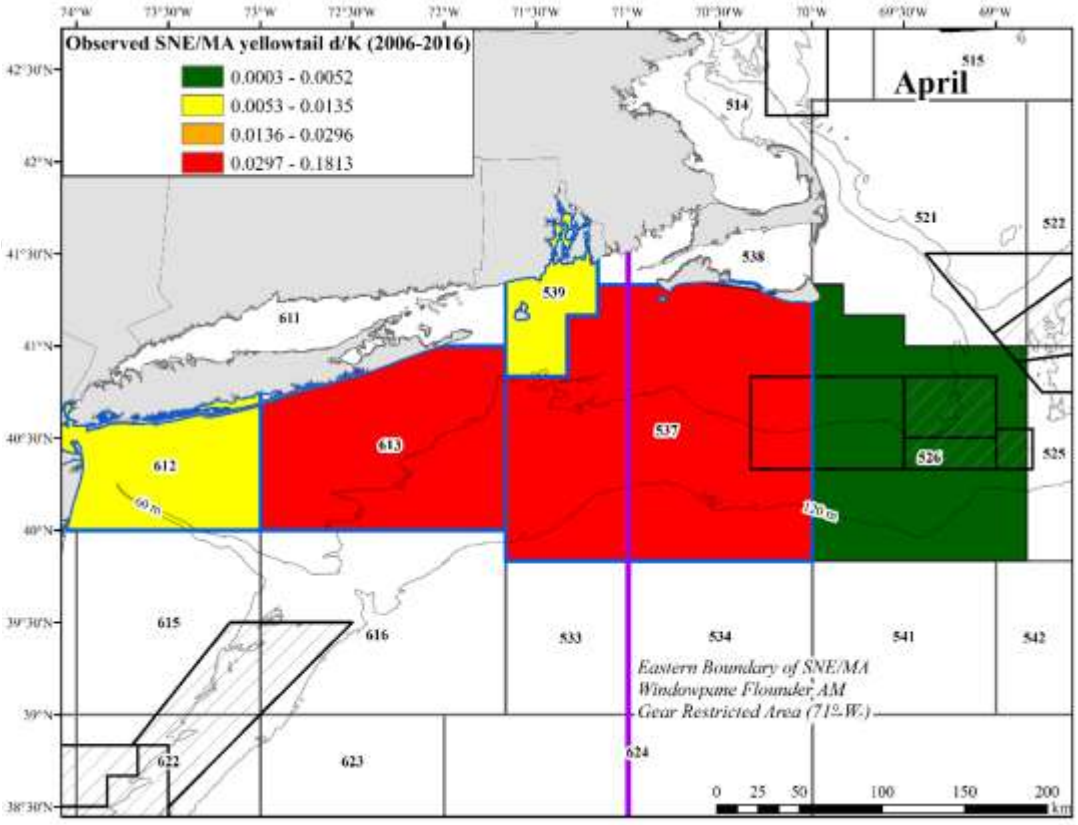

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
January
464
561
551
552
562
522
521
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

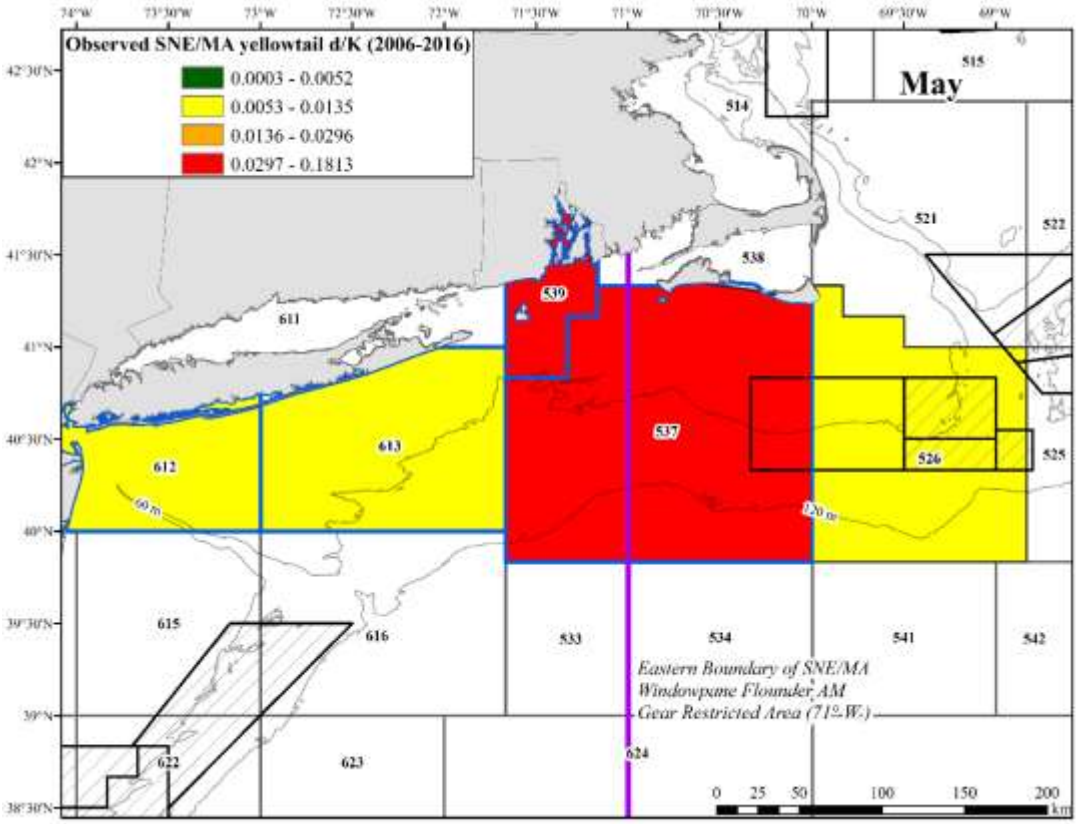

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
January
464
561
551
552
562
522
521
525
526
543
120 m
60 m
0 12.5 25 50 75 100
km

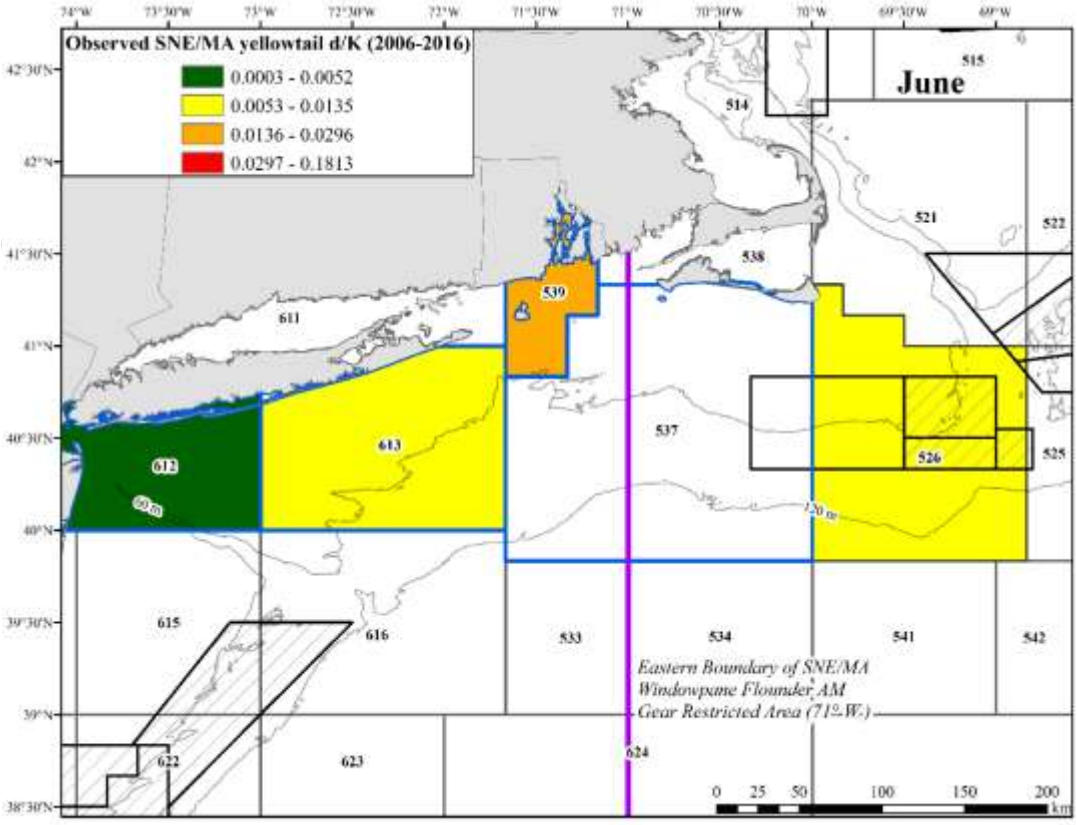

Observed Yellowtail d/K (2006-2016)
0.0004 - 0.0086
0.0087 - 0.0227
0.0228 - 0.0420
0.0421 - 0.2389
February
464
561
551
120 m
522
521
552
562
525
526
543
60 m

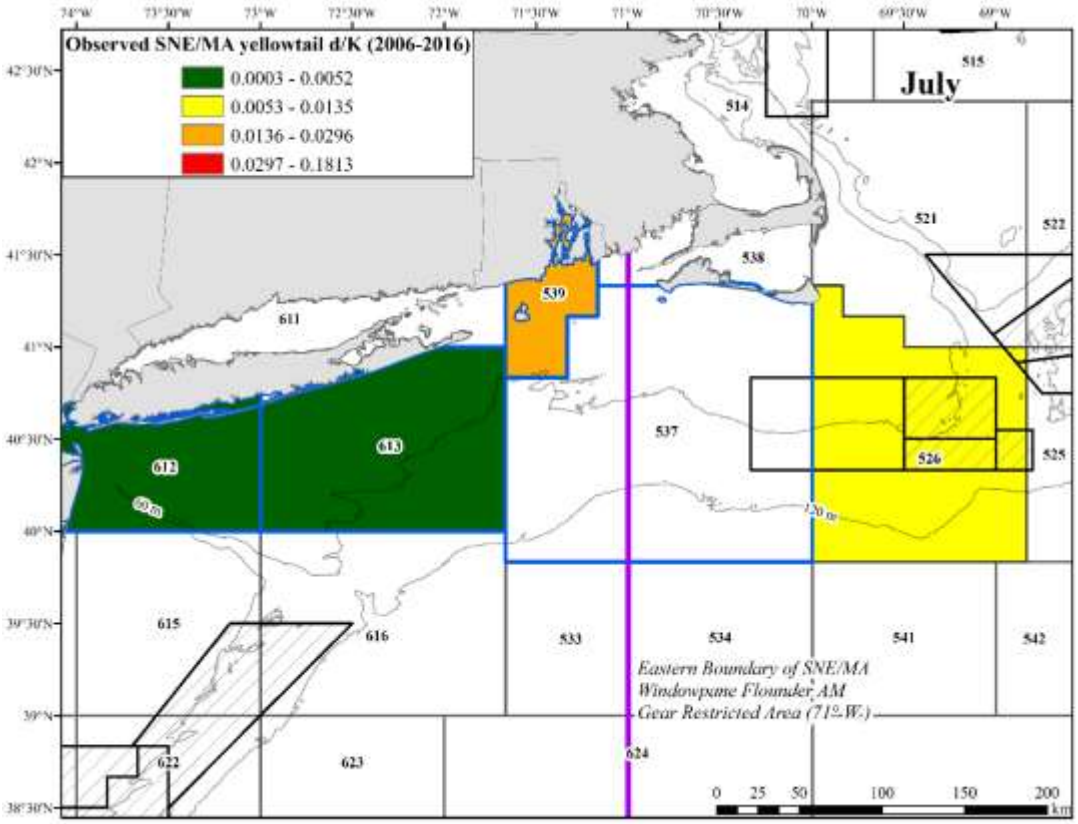

Observed N. windowpane d/K (2006-2016)
0.0000 - 0.0043
0.0044 - 0.0135
0.0136 - 0.0345
0.0346 - 0.2334
February
464
561
551
120 m
522
521
552
562
525
526
543
60 m

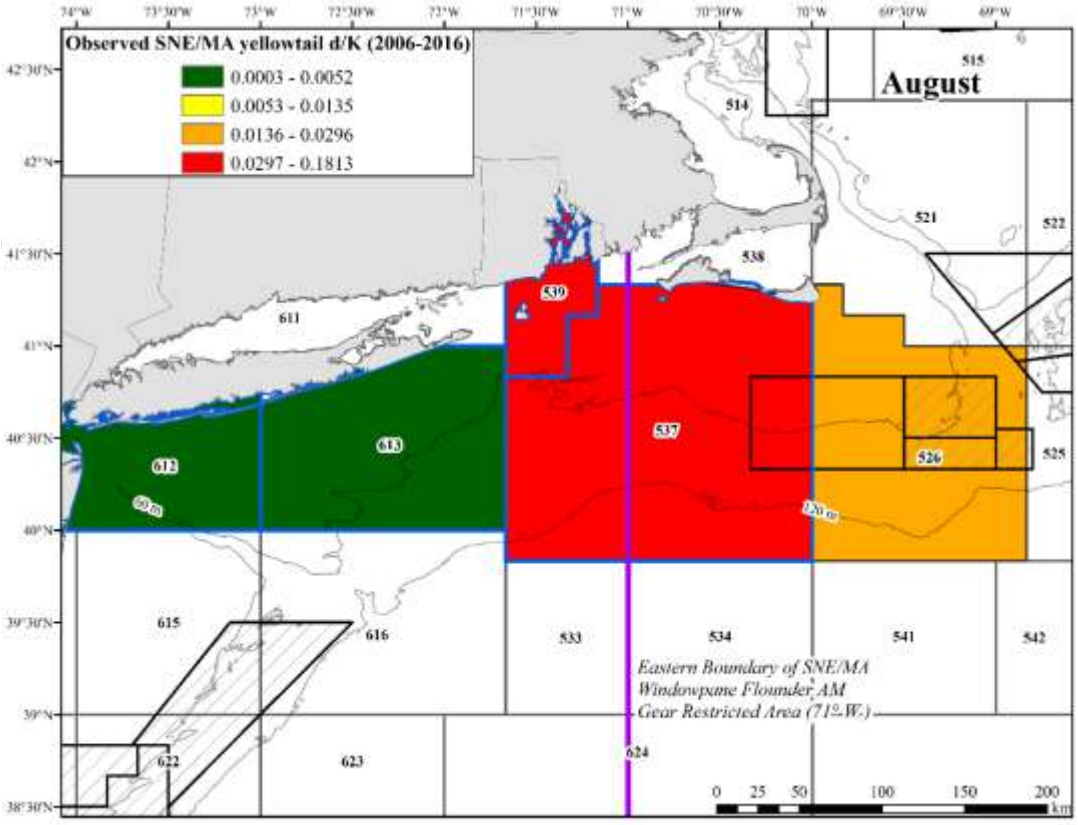

Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
March
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

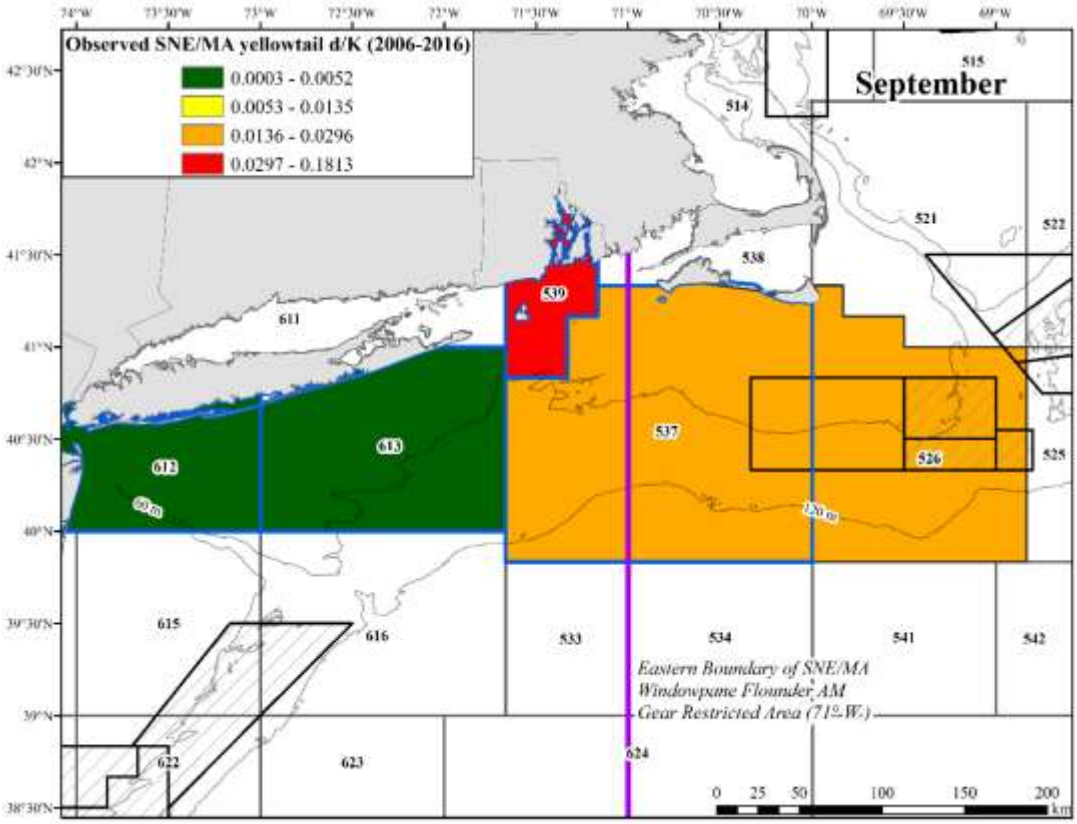

Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
April
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

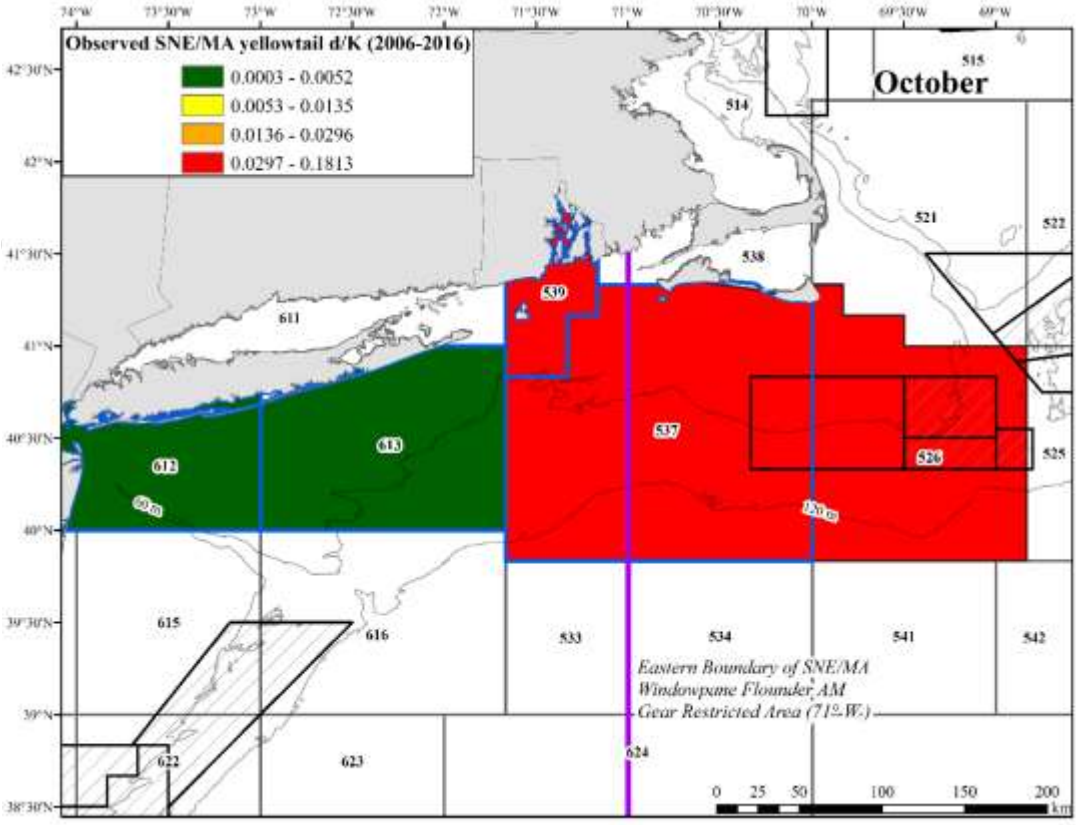

Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
May
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

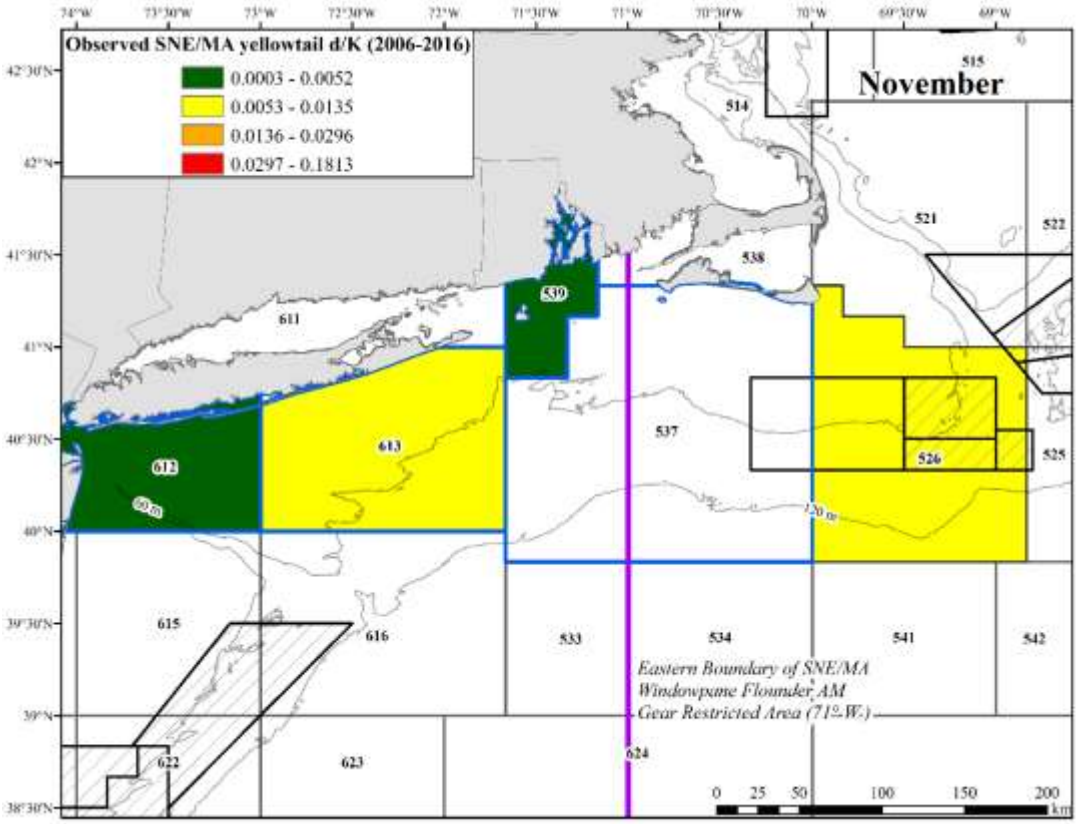

Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
June
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

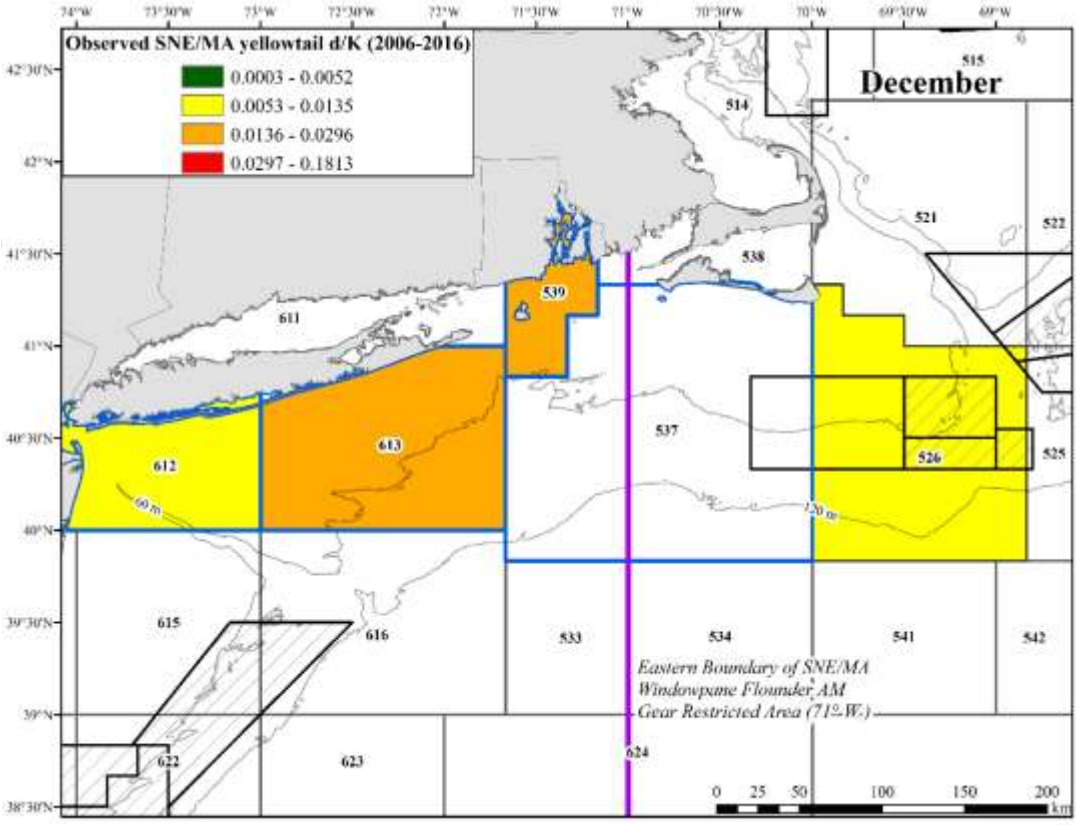

Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
July
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

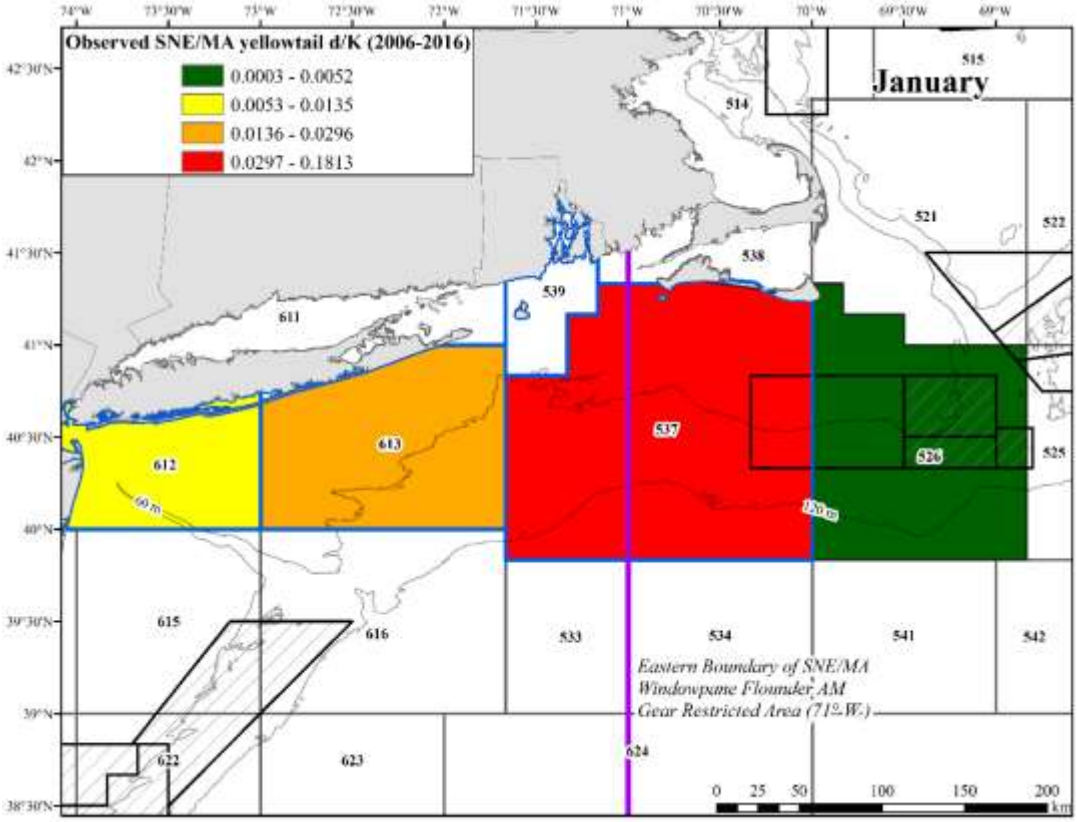

Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
August
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

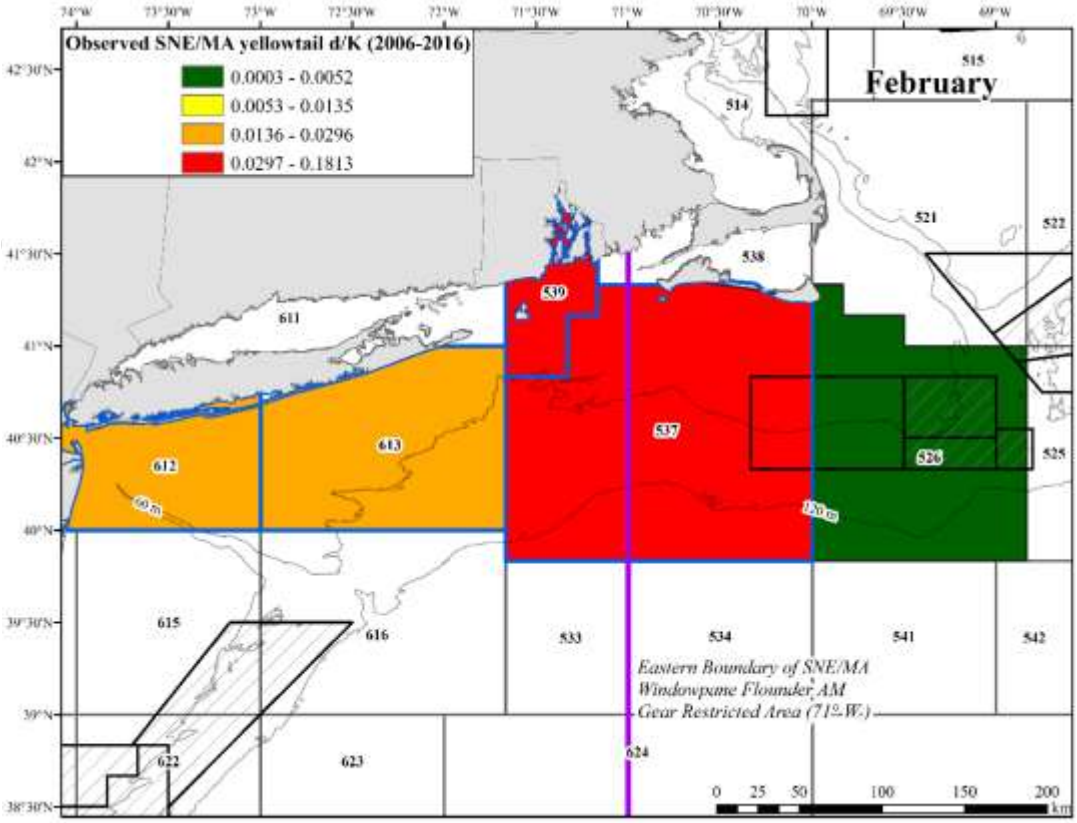

Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
September
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km


Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
October
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km


Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
November
515
514
521
522
538
539
611
537
526
525
612
613
60 m
120 m
615
616
533
534
541
542
Eastern Boundary of SNE/MA
Windowpane Flounder AM
Gear Restricted Area (71° W.)
622
623
624
0 25 50 100 150 200
km


Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
December
515
514
521
522
538
539
611
537
526
525
612
613
60 m
120 m
615
616
533
534
541
542
Eastern Boundary of SNE/MA
Windowpane Flounder AM
Gear Restricted Area (71° W.)
622
623
624
0 25 50 100 150 200
km


Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
January
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km


Observed SNE/MA yellowtail d/K (2006-2016)
0.0003 - 0.0052
0.0053 - 0.0135
0.0136 - 0.0296
0.0297 - 0.1813
February
Eastern Boundary of SNE/MA Windowpane Flounder AM Gear Restricted Area (71° W.)
0 25 50 100 150 200 km

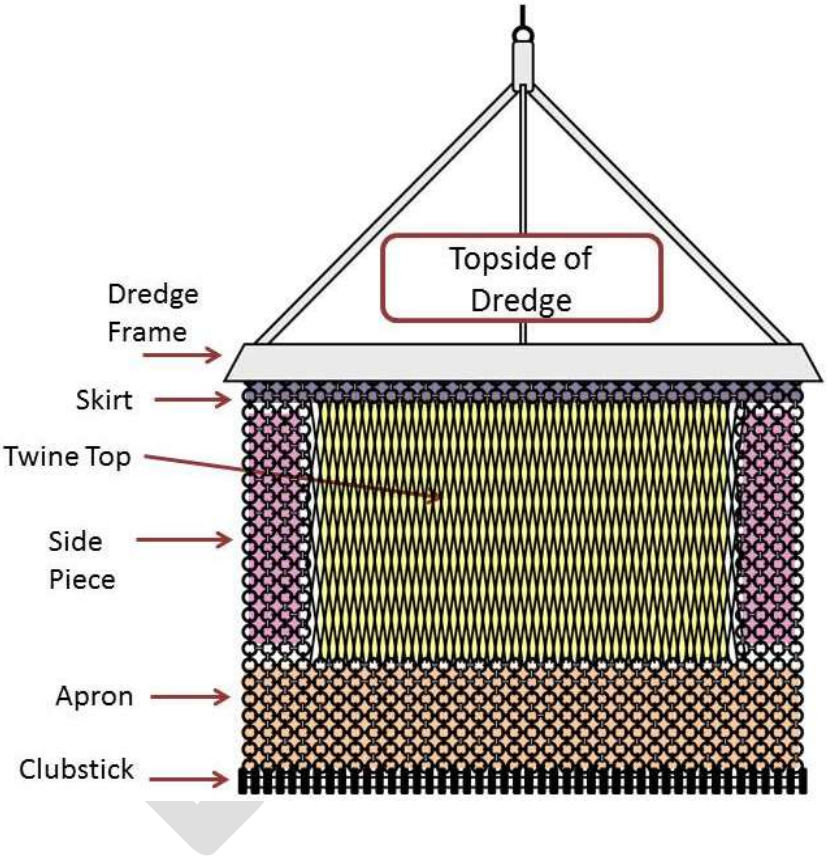
3.0 OBSERVED HANGING RATIO ANALYSIS

3.1 Background

At their June 1st, 2017 meeting, the Scallop Committee passed a motion which recommended flatfish AMs be developed consistent for all flatfish with the existing gear modifications for the SNE windowpane AM (5-row apron and 1.5:1 hanging ratio). Following this guidance, the PDT expressed interest in investigating what typical hanging ratio's are employed by the industry, and how hanging ratio's may be dictated by the mode and(or) geographical region of fishing.

Hanging ratio is defined as the number of twine top meshes connected to each ring on the dredge frame (see Figure 1).

Figure 1. Typical configuration of the topside of a New Bedford scallop dredge.[2]



[2] Source: Goff, K. D. 2002. Ring diameter and closed area scallop fisheries. Masters thesis, Virginia Institute of Marine Science, College of William and Mary. (Note: labels and colors added to original figure)

3.2 Methods

The Northeast Fishery Observer Program has recorded scallop dredge characteristics since 2008, including apron length, number of rings in the skirt, number of meshes in the twine top, and dredge frame type. Scallop dredge characteristics data from standard observer trips on Limited Access vessels between 2008-2016 were compiled at the trip level using the following query:

select distinct

a.link1,

a.program,

case when a.program in ('000', '010') then 'Open' when a.program = '201' then 'NL' when a.program = '202' then 'CAI' when a.program = '203' then 'CAII' when a.program = '204' then 'HC' when a.program = '205' then 'VB' when a.program = '206' then 'ET' when a.program = '207' then 'DMV' when a.program = '208' then 'MAAA' when a.program = '102' then 'TC_exc' else 'other' end as PROG,

b.fleet_type, case when b.fleet_type = '047' then 'LAGC' when b.fleet_type = '046' then 'LA' else 'Other' end as FLEET,

a.year,

a.month,

a.tripid,

--a.gearnum,

a.negear,

a.dredgesdeployed,

a.framewidp,

a.framewids,

a.mctwtopwidp,

a.mctwtopwids,

a.nringtwtopp,

a.nringtwtops,

a.nrowapronp,

a.nrowaprons,

a.frametypp, case when a.frametypp='1' then 'STANDARD' when a.frametypp='2' then 'TURTLE' when a.frametypp = '0' then 'NA' when a.frametypp = '9' then 'OTHER' end as PORT_DREDGE,

a.frametyps, case when a.frametyps='1' then 'STANDARD' when a.frametyps='2' then 'TURTLE' when a.frametyps = '0' then 'NA' when a.frametyps = '9' then 'OTHER' end as STBRD_DREDGE,

```
c.area, -- case when c.area < 599 then 'GB' when c.area >=599 then 'Mid_Atl' else 'OTHER' end
as REGION,
round(a.mctwtopwidp/a.nringtwtopp, 1) as hangratio_p,
round(a.mctwtopwids/a.nringtwtops, 1) as hangratio_s--,
--c.gis_lathbeg, c.gis_lonhbeg
from
OBSDGH a, obtrp b, obhau c
where a.link1 = b.link1 and b.link1 = c.link1 and a.year between 2008
and 2016
--and round(a.mctwtopwidp/a.nringtwtopp, 1) is not NULL
--and round(a.mctwtopwids/a.nringtwtops, 1) is not NULL
--and c.area < 599
and b.fleet_type = '046' --and a.program = '000'
order by year desc , month desc
;
```

Hanging ratio's calculated in the above query were rounded to the nearest half integer (1:1, 1.5:1, 2:1, 2.5:1, etc.). To account for observed trips with differing hanging ratios between dredges, the maximum hanging ratio was used. The following bubble plots show the proportion of observed trips by maximum hanging ratio between 2008-2016 for LA vessels, by broad stock area, year, statistical reporting area (SRA) for both open-area and access area trips. All values displayed in the following figures have been edited to comply with confidentiality requirements.

Figure 2. The annual proportion of limited access Georges Bank open-area observed trips by hanging ratio from 2008 to 2016.

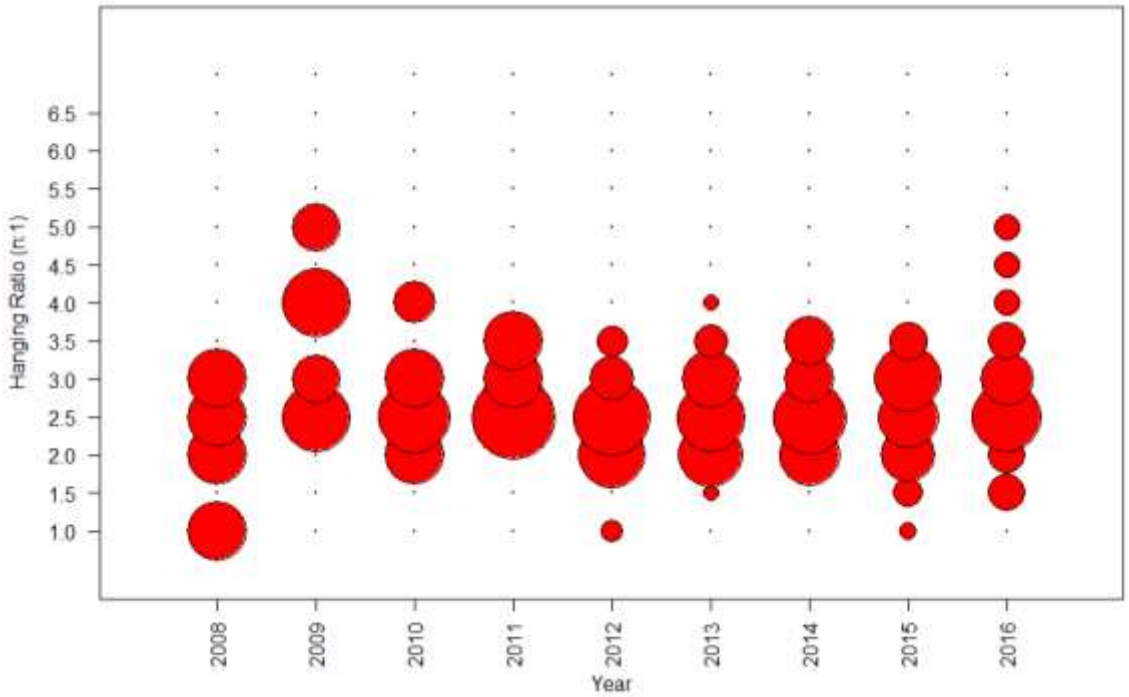


Figure 3. The proportion of hanging ratios for open-area observed trips on Georges Bank by SRA (2008-2016).

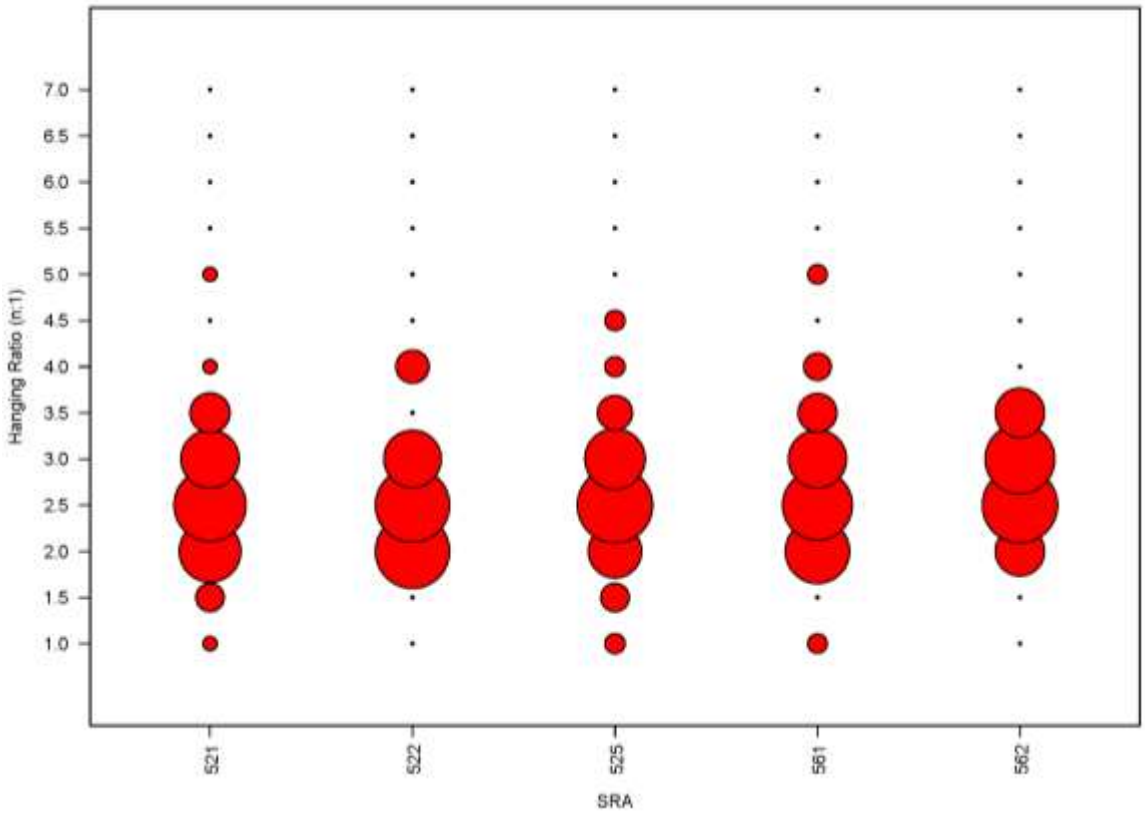


Figure 4. The annual proportion of limited access SNE/MA open-area observed trips by hanging ratio from 2008 to 2016.

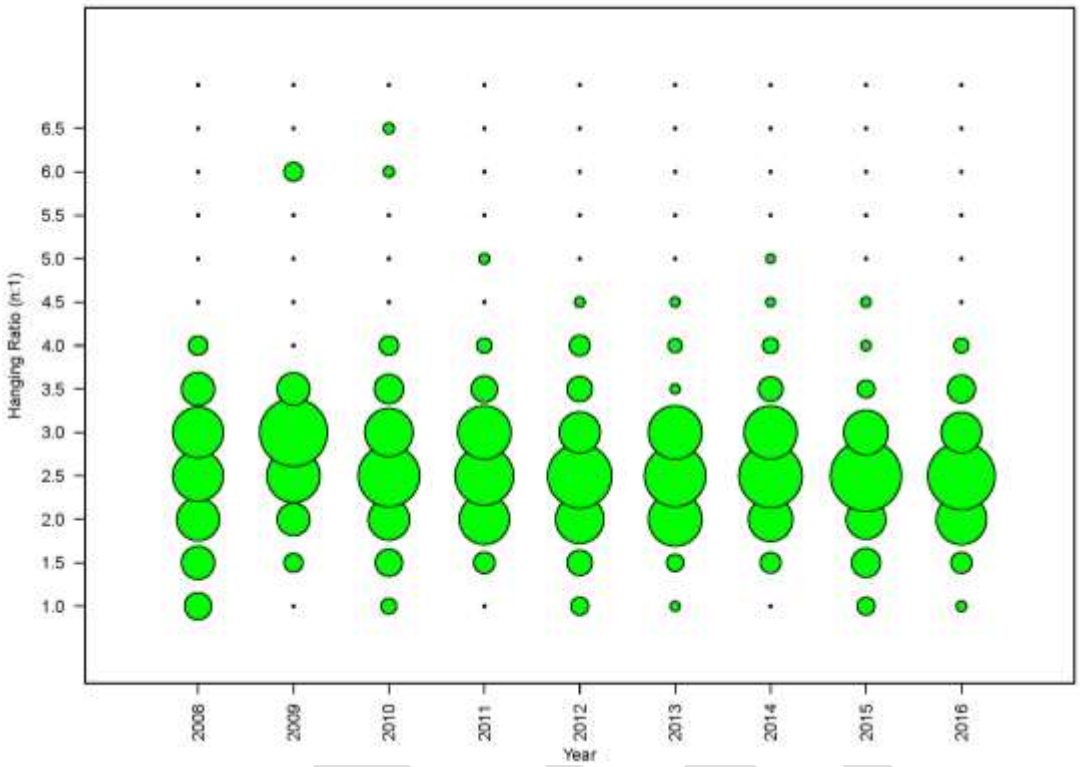


Figure 5. The proportion of hanging ratios for open-area observed trips in SNE/MA by SRA (2008-2016).

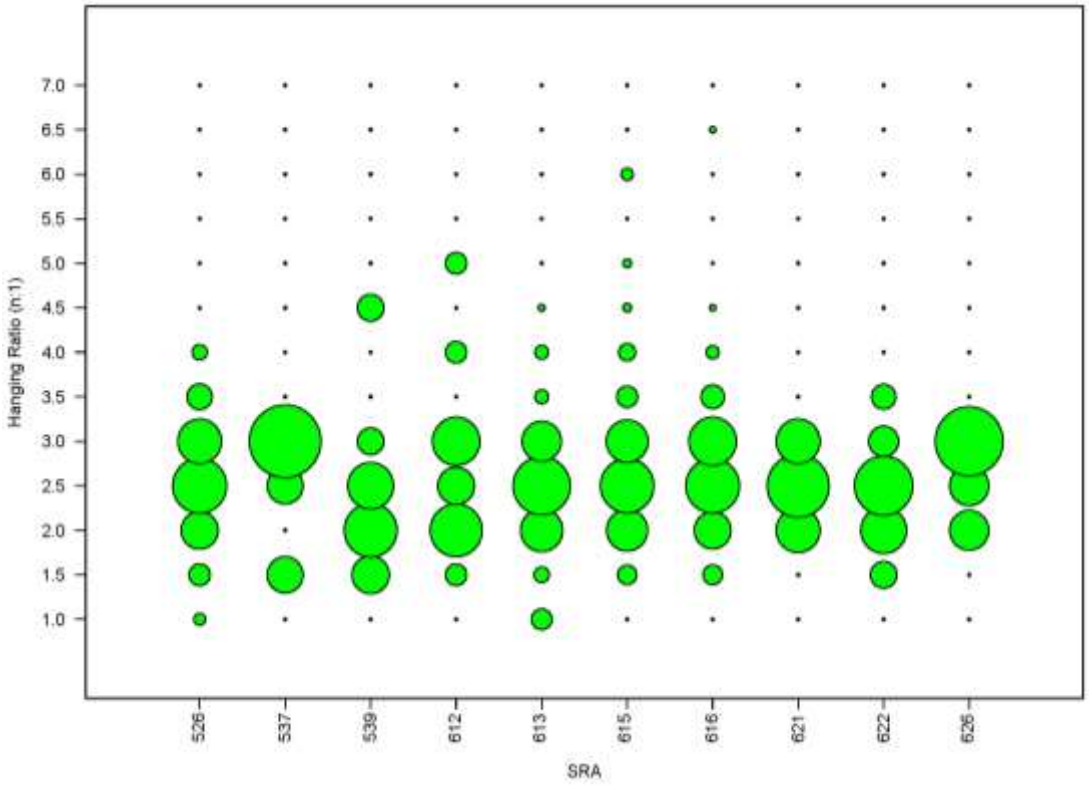
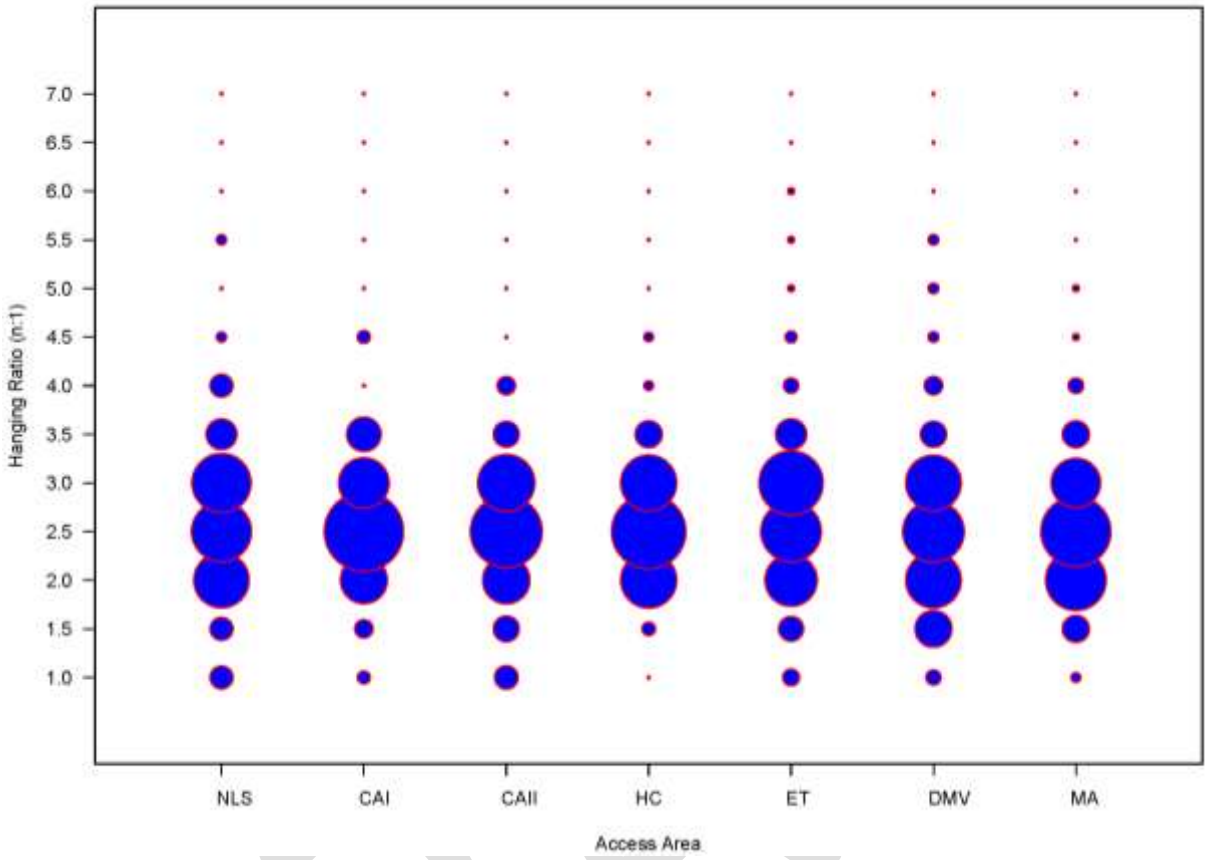


Figure 6. The proportion of observed access area trips by hanging ratio (2008-2016).



4.0 OBSERVED DREDGE TYPE ANALYSIS

4.1 Background

The current AM for SNE windowpane flounder is a gear modification where all dredges used west of 71° W must be compliant with a 5-row apron and 1.5:1 hanging ratio regulatory standard. This AM was based on an bycatch reduction project performed by Coonamessett Farm Foundation (final report here), which measured flatfish bycatch rates of a control dredge (turtle deflector dredge with 8-row apron, 60 mesh twine top) vs. an experimental dredge (turtle deflector dredge with 5-row apron, 45 mesh twine top).

The use of turtle deflector dredges (TDDs) is a regulatory requirement when fishing west of 71° W from May 1st to November 30th. This requirement does not include the stock boundaries of Georges Bank yellowtail and Northern windowpane flounder. In light of this, and because the Scallop Committee passed a motion recommending flatfish AMs be developed consistent for all flatfish with the existing gear modifications for the SNE windowpane AM, the PDT expressed interest in investigating whether the Coonamessett Farm Foundation experimental TDD was representative of industry behavior (i.e. do fishermen use TDDs on Georges Bank).

4.2 Methods

The Northeast Fishery Observer Program has recorded scallop dredge frame type since 2011 (i.e. standard/New Bedford, TDD). This data (compiled using the query described in section 3.2) was used here to describe typical dredge types used by the Limited Access (LA) component of the fishery from 2011-2016. The following figures display the number of observed LA trips using either a standard/New Bedford dredge or a TDD by broad stock area, year, statistical reporting area (SRA), and by fishing mode (open-area vs. access area trips). The figures only display trips which used a consistent dredge frame type (i.e. could not have fished one TDD and one New Bedford dredge in same trip).

Figure 7. The number of observed limited access open-area trips in SNE/MA by dredge frame type from 2011 to 2016.

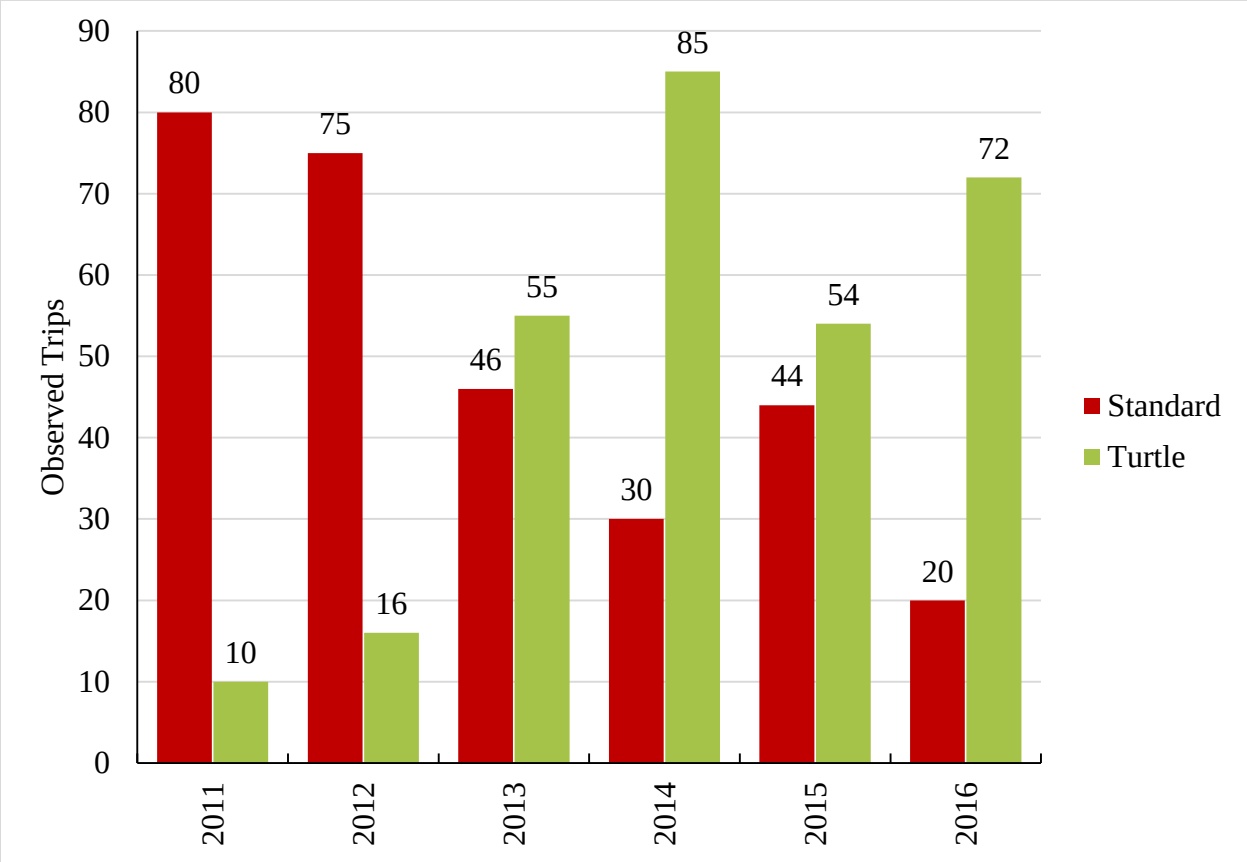


Figure 8. The number of observed limited access open-area trips on Georges Bank by dredge frame type from 2011 to 2016.

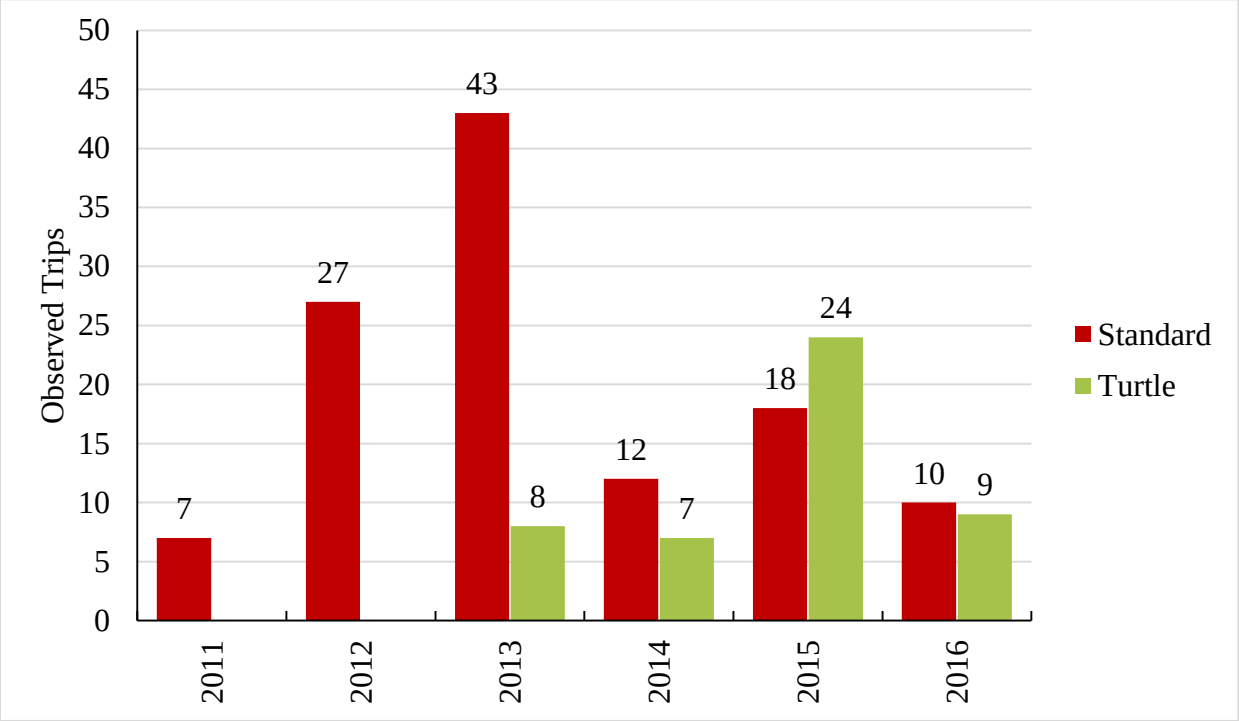


Figure 9. The number of observed limited access trips to Closed Area II access area by dredge frame type.

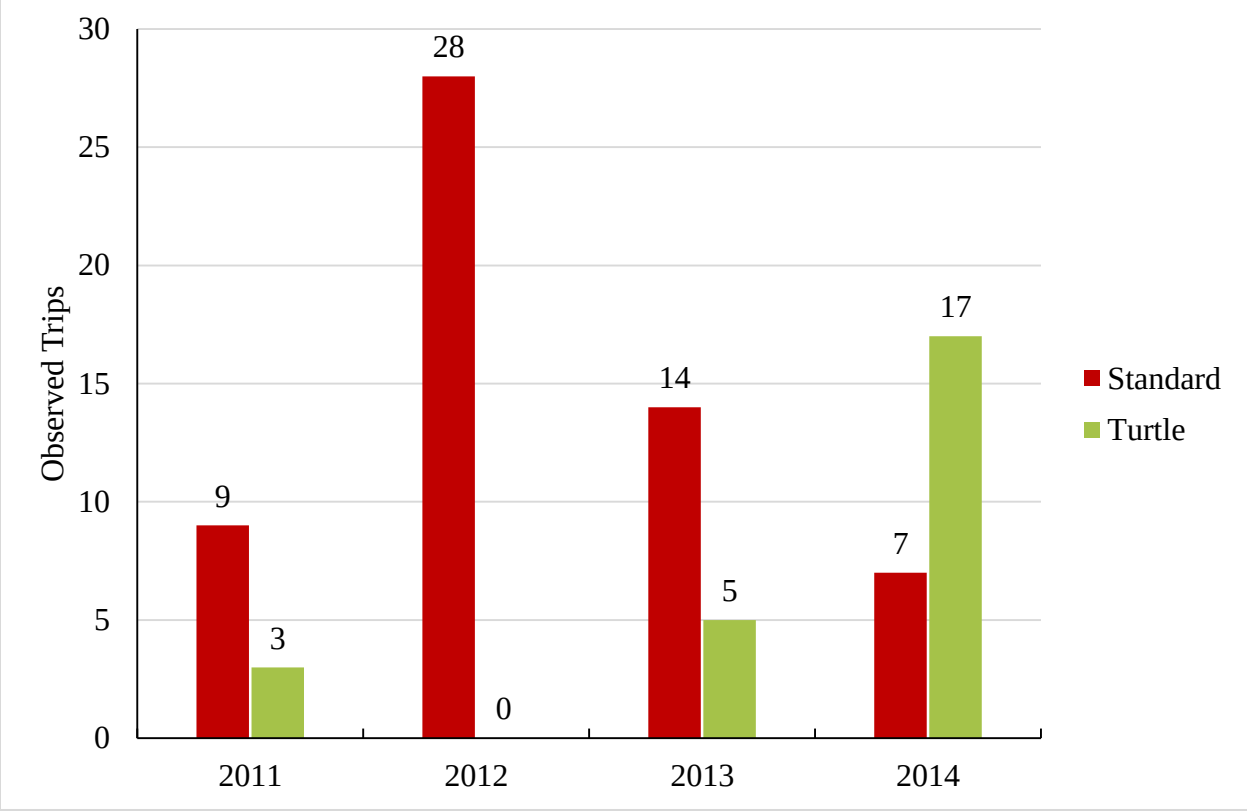


Figure 10. The percentage of dredge frame types used on observed access area trips from 2011-2016.