OLSPS Marine

The relationship between the number of trawls and long line sets at different spatio-temporal resolutions

by

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11 November 2022

1 Summary

HAKE/BG1 argues that a number of scientific issues need to be settled before a comprehensive assessment of the impact of a proposed 52.6% increase (see Government Gazette, 2021) in the allocation of the TAC to hake longlining can be said to have been carried out. One of these is the possibility that there is competition for space to fish at sea, between trawling and hake longlining operations, and that the outcome of this competition is to compromise trawl CPUE levels. Whether there is indeed such a process in effect must demonstrate a number of features in the spatio-temporal pattern of longline and trawl fishing, including the following:

1. An overlap in space of trawls and longline sets.
2. That at a certain operationally meaningful spatio-temporal scale there is a negative relationship between the number of trawls and the number of longline sets.

HAKE/P3 shows that there has, over the last 7 years, been a marked increase in the amount of hake longlining effort on the West Coast at depths and in locations typically fished by the deep-sea trawl sector. The demonstration in HAKE/P3 that this has occurred confirms that Condition 1 above is met. This document goes further and demonstrates that Condition 2 is met as well.

Results presented here show that (see Figure 1) hake trawl and longline operations have over the last 5-7 years taken place in the same locations when viewing these data over large temporal scales, in this case 2015 to 2020. Further results are presented (see Figure 6 and Table 1) which demonstrate that when the spatio-temporal resolution is attenuated to the spatial scale of 10 to 60 km, and to a temporal scale of a single day, then there is a negative relationship between the number of trawls and the number of longline sets. In aggregate, the analytical results presented here are consistent with a scenario in which on any day there is competition for access to some spatial areas (represented as a K-means cluster), resulting in a negative relationship between the number of trawls and sets, as shown in Figure 6 and Table 1.

2 Background

HAKE/P3 showed that there was a shift in longline effort onto the West Coast in 2014/2015, coupled with an increase in the depth and set length of hake longline fishing. The main question which follows is “Is there a negative interaction between the spatial distribution of longline sets and the spatial distribution of hake trawls”. This document focusses on this point.

3 Methods

3.1 Datasets

OLSPS Marine has received logbook data for both the hake longline fishery and the hake offshore trawl fishery. The former covers the period 1994 to 2022, with only partial data available for 2022. The latter covers the period 1983 to 2020, but only data from 2000 to 2020 was imported for the data preprocessing and quality checking purposes. This document is concerned only with the period following the escalation of hake longline fishing on the West Coast in depths comparable to those where offshore trawling is taking place. For the purpose of analysis results presented here, that period has been taken to be calendar years 2015 to 2020 inclusive.

Extensive data audits have already been carried out on the hake and longline data provided to OLSPS Marine by DFFE to ascertain the quality of the data, especially w.r.t. the completeness of date, latitude and longitude and fishing depth information. 2.2% of the hake longline data had to be discarded because of quality considerations, but 24.8% of the trawl data were unusable, expressed as % of trawl drags. In terms of Hake green weight, 0.3% of hake longline catches and 19.5% of hake trawl catches had to be discarded. The reasons for this relate, as just stated, to the completeness of date, longitude and latitude and fishing depth information. The year level data quality w.r.t. date, GPS and fishing depth information is described in Appendix A. That appendix shows that for the time period which is the focus of this study, 2015 to 2020, the data quality is close to 100%, so that problems of missing data is not a serious concern here.

3.2 Spatial location of fishing event

There are two types of fishing events, either a hake longline set, or an offshore trawl. A simple depiction of these might be a line segment spanning the start and end location of these two events. Both may be more complex than a straight line. However, for the purpose of this document, the location of an event is represented as a point, calculated as the mid-point of the line segment just described.

3.3 Basic Proposition

It is proposed that if indeed there is some sort of spatial interaction between trawling and longline operations, then there would most likely be a relatively high spatio-temporal resolution at which this would manifest as a negative correlation between the number of trawls and number of sets.

For the high spatio-temporal resolution referred to (implying a relatively short time scale and a relatively small spatial scale), day as the time resolution seems to be appropriate, since any displacement of trawling by the presence of static gear is linked to longline lines which are freshly reset each day and their potential impact on the location of trawls on that day. As regards an appropriate spatial resolution, this is more difficult to decide. For this document a number of different options were explored:

1. Clustering the merged longline and trawl datasets using either 200, 300 or 500 clusters produced by a K-means clustering algorithm. Intuitively one expects that the spatial scale at which negative interactions manifest is related to the scale of fishing events, where sets are typically and at present in the order of 20 km in length. A degree of longitude or latitude is roughly 100 km in length at Cape Town latitude, so given the length of coastline involved, 200, 300 to 500 clusters seems appropriate.

2. Using latitude and longitude bins of fixed width to define a grid of spatial locations. Bin lengths between 0.03 degrees and 0,2 degrees were explored. At the latitudes typical of these data 1 degree of either longitude or latitude corresponds to roughly 100 km in length.

The following data preprocessing and analytical steps were implemented:

1. Append the hake longlining dataset to the hake offshore trawl dataset. Provide a common field name for midpoints by latitude and longitude, day designation, depth and catch.
2. Select data for years 2015 to 2020 inclusive, to ensure a complete year of data for both longlining and trawling.
3. Eliminate the few depth outliers above 900 metres.
4. Execute K means with either 200, 300 or 500 clusters.
5. Aggregate the catch for each day into cluster level across all years 2015 to 2020 and both fishing methods. Sort by cluster from the cluster with the most catch to the least catch. Select the clusters for which the aggregate catch encompasses 95% of the total catch. Designate these clusters as Selection A.
6. Select the day/cluster/fishing method level data by application of Selection A.
7. Arrange the data so that each day/cluster is adjacent to its corresponding number of trawls and number of longline sets, making sure to include records where, if this is the case, the number of fishing events is 0 for either one or the other fishing method.
8. For the data in the format described above, examine the relationship between the number of trawls and sets, in particular to ascertain if there is a negative relationship. This possibility was also explored using GLM techniques.

4 Results

A series of outputs have been produced illustrating the relationship between the number of trawls (the terms **trawls** or **drags** are used here but refer to the same fishing activity) and the number of hake longline sets. These are as presented in the following subsections.

4.1 Spatial overlap of trawls and longline sets; 2015 to 2020

Figure 1. A scatter plot of the location of offshore trawls and hake longline sets according to the mid-point of fishing events (either sets in red or drags in light blue), for 2015 to 2020 only, following a run of the K-means algorithm with 500 clusters, **and trimming away clusters which all contribute less than any other clusters and collectively less than 5% of the total cumulative hake catch 2015 to 2020**. The colour shown here distinguishes only sets from trawls and are not intended to depict individual clusters. This figure shows the extent of overlap between hake trawling operations and hake longline operations.

Figure 2. A scatter plot of the location of offshore trawls and hake longline sets by the mid-point of the fishing event, for 2015 to 2020 only, following a run of the K-means algorithm with 500 clusters, without any trimming of the data. The colours shown here distinguish only sets from trawls and are not intended to show clusters.

4.2 Depiction of K-means Clusters

Figure 3. Plot of the location of fishing sets and trawls, 2015 to 2020, colour coded by K-means cluster, for the 200 cluster case. For this case 50 clusters encompass 95% of the gross catch and so only 50 clusters are represented in this figure.

4.3 GLM Results

Table 1. GLM based estimates of the slope of the covariate 'number of sets (n(SETS))' when the dependent variable is the number of drags (n(DRAGS)). For these analyses a record represents a single Cluster_Day or Bin_Day

combination which is a record because there was at least one drag or one set in that Cluster_Day or Bin_Day. For either of the Cluser_Day only, or Cluster then Bin_Day data preparation and spatial definitions, the data are first reduced to the highest ranked (by green weight catch) clusters which make up 95% of the total hake catch over the period 2015 to 2020 inclusive. This involves 121(or 74 or 50) clusters when the K-means algorithm used a predefined and fixed number of 500 (or 300 or 200) clusters. GLMs were run using either the 'identity' or 'log'-link functions, and the explanatory variable is either (a) n(SETS) and K-means clusters or (b) only n(SETS). Two bin width options were explored when implementing the Bin_Days step, either 0.2 degrees or 0.05 degrees (where a degree at the applicable latitude is approximately 100 km), but only for the 200 and 500 cluster options.

4.4 Number of fishing events per Cluster_Day and per Day

Figure 4. Histogram of the number of events on a Cluster_Day, where a Cluster_Day is only included in this histogram if there was at least one trawl or one longline set, for the 200 cluster case, but for the 50 clusters which in this case encompass 95% of the catch.

Figure 5 Histogram of the number of events on a Day, where a Day is only included in this histogram if there was at least 1 trawl or one set (for the 200 cluster case, but for the 50 clusters which in this case encompass 95% of the catch).

4.5 Visualisation of negative relationships between n(DRAGS) and n(SETS), at Cluster_Day resolution

Figure 6. For the 200, 300 and the 500 cluster cases, a plot of the number of drags (n(DRAGS)) vs the number of sets (n(SETS)) at the resolution of Cluster_Days. The top panels show the average number of drags on the y axis for given numbers of sets to clarify the average relationship. The bottom panels show all cases, except that larger dots represent more than one value (where a value is a Cluster_Day).

4.6 Whether the evidence of spatial competition is an artefact

There is perhaps a valid concern that the foregoing results which demonstrate spatial competition between trawl and long line effort could be an artefact. To test this, an analysis based purely on the trawl drag records, which comprise about 93% of the fishing events in the combined trawl + longlining dataset, was carried out. 7% of these trawl records were randomly designated as 'longline sets', and the calculations carried out to produce the results shown in Figure 6 were repeated with this new semi-artificial dataset (although the calculation of clusters and their definitions were not updated). The plots are shown in Figure 7. These show a positive relationship between the number of artificial sets (which are actually drags) and the number of drags, an opposite result to the result obtained using true sets. The indication from this is that the evidence demonstrating spatial competition (in e.g. Figure 6) is not an artefact, since the way that trawl locations relate to other trawl locations is very different to the way that trawl locations relate to real longline set locations.

5 Comments

Figure 1 provides a visual illustration that hake trawl and longline operations take place in the same locations when viewing these data over large spatial and temporal scales, in this case 2015 to 2020, and the entire fishing area.

However, when the spatio-temporal resolution is attenuated sufficiently, to the spatial scale of, say, 10 to 60 km, and to a temporal scale of a single day, then there is evidence of a negative relationship between the number of trawls and the number of longline sets – see e.g. Figure 6 which presents scatterplots that back this up, see also the GLM model results reported in Table 1. This shows that the presence of one type of fishing operation reduces the incidence of another kind of fishing operations in proximal locations. This is consistent with a scenario in which in any day there is competition for access to some clusters, resulting in the negative relationship between the number of trawls and sets evident in Figure 6 and Table 1. This process is central to concerns being expressed by the deep-sea trawl sector about a further 52.6% escalation in the amount of hake longline effort (see e.g. HAKE/BG1).

6 Acknowledgements

To DFFE for the provision of the hake longline and hake deep-sea trawl data.

7 References

MARAM/IWS/2022/HAKE/BG1: Bergh, M., 2022a. Economic and other impacts of proposed changes to hake sectoral allocations. FISHERIES/2022/APR/SWG-DEM/07. 64 pp.

MARAM/IWS/2022/HAKE/P3: Bergh, M., 2022b. Trends in the spatial distribution of hake long line fishing effort. FISHERIES/2022/AUG/SWG-DEM/10REV. 19 pp.

Government Gazette, 2021. Draft Policy on the Allocation and Management of Hake Longline Fishery: 2021 (September).

Table 1. GLM based estimates of the slope of the covariate 'number of sets (n(SETS))' when the dependent variable is the number of drags (n(DRAGS)). For these analyses a record represents a single Cluster_Day or Bin_Day combination which is a record because there was at least one drag or one set in that Cluster_Day or Bin_Day. For either of the Cluser_Day only, or Cluster then Bin_Day data preparation and spatial definitions, the data are first reduced to the highest ranked (by green weight catch) clusters which make up 95% of the total hake catch over the period 2015 to 2020 inclusive. This involves 121(or 74 or 50) clusters when the K-means algorithm used a predefined and fixed number of 500 (or 300 or 200) clusters. GLMs were run using either the 'identity' or 'log'-link functions, and the explanatory variable is either (a) n(SETS) and K-means clusters or (b) only n(SETS). Two bin width options were explored when implementing the Bin_Days step, either 0.2 degrees or 0.05 degrees (where a degree at the applicable latitude is approximately 100 km), but only for the 200 and 500 cluster options.

Model	# Clusters	# Clusters, 95% of Catch	Lat/Long Bins; Bin width in degrees	# Cluster_Days in Analysis	# Bin_Days in Analysis	Transformation	Explanatory variable (Dependent variable - n(DRAGS))	n(SET) parameter estimate in transformed domain	95% Range
GLM	500	121	n/a	90110	n/a	None	n(SETS), K-means cluster	-0.748	(-0.777, -0.719)
GLM	500	121	n/a	90110	n/a	Natural Log	n(SETS), K-means cluster	-0.788	(-0.834, -0.742)
GLM	500	121	n/a	90110	n/a	None	n(SETS)	-0.823	(-0.850, -0.796)
GLM	500	121	n/a	90110	n/a	Natural Log	n(SETS)	-0.931	(-0.983, -0.880)
GLM	300	74	n/a	72077	n/a	None	n(SETS), K-means cluster	-0.669	(-0.706, -0.631)
GLM	300	74	n/a	72077	n/a	Natural Log	n(SETS), K-means cluster	-0.424	(-0.456, -0.392)
GLM	300	74	n/a	72077	n/a	None	n(SETS)	-0.720	(-0.756, -0.683)
GLM	300	74	n/a	72077	n/a	Natural Log	n(SETS)	-0.525	(-0.562, -0.487)
GLM	200	50	n/a	59637	n/a	None	n(SETS), K-means cluster	-0.649	(-0.693, -0.605)
GLM	200	50	n/a	59637	n/a	Natural Log	n(SETS), K-means cluster	-0.327	(-0.354, -0.299)
GLM	200	50	n/a	59637	n/a	None	n(SETS)	-0.775	(-0.818, -0.732)
GLM	200	50	n/a	59637	n/a	Natural Log	n(SETS)	-0.427	(-0.458, -0.395)
GLM	500	121	0.2	90110	58512	None	n(SETS)	-0.790	(-0.830, -0.750)
GLM	500	121	0.2	90110	58512	Natural Log	n(SETS)	-0.894	(-0.966, -0.821)
GLM	500	121	0.05	90110	131005	None	n(SETS)	-0.940	(-0.954, -0.925)
GLM	500	121	0.05	90110	131005	Natural Log	n(SETS)	-3.000	(-3.284, -2.715)
GLM	200	121	0.2	59637	86635	None	n(SETS)	-0.829	(-0.861, -0.797)
GLM	200	121	0.2	59637	86635	Natural Log	n(SETS)	-0.893	(-0.949, -0.838)
GLM	200	121	0.05	59637	168969	None	n(SETS)	-0.934	(-0.945, -0.923)
GLM	200	121	0.05	59637	168969	Natural Log	n(SETS)	-3.100	(-3.343, -2.865)

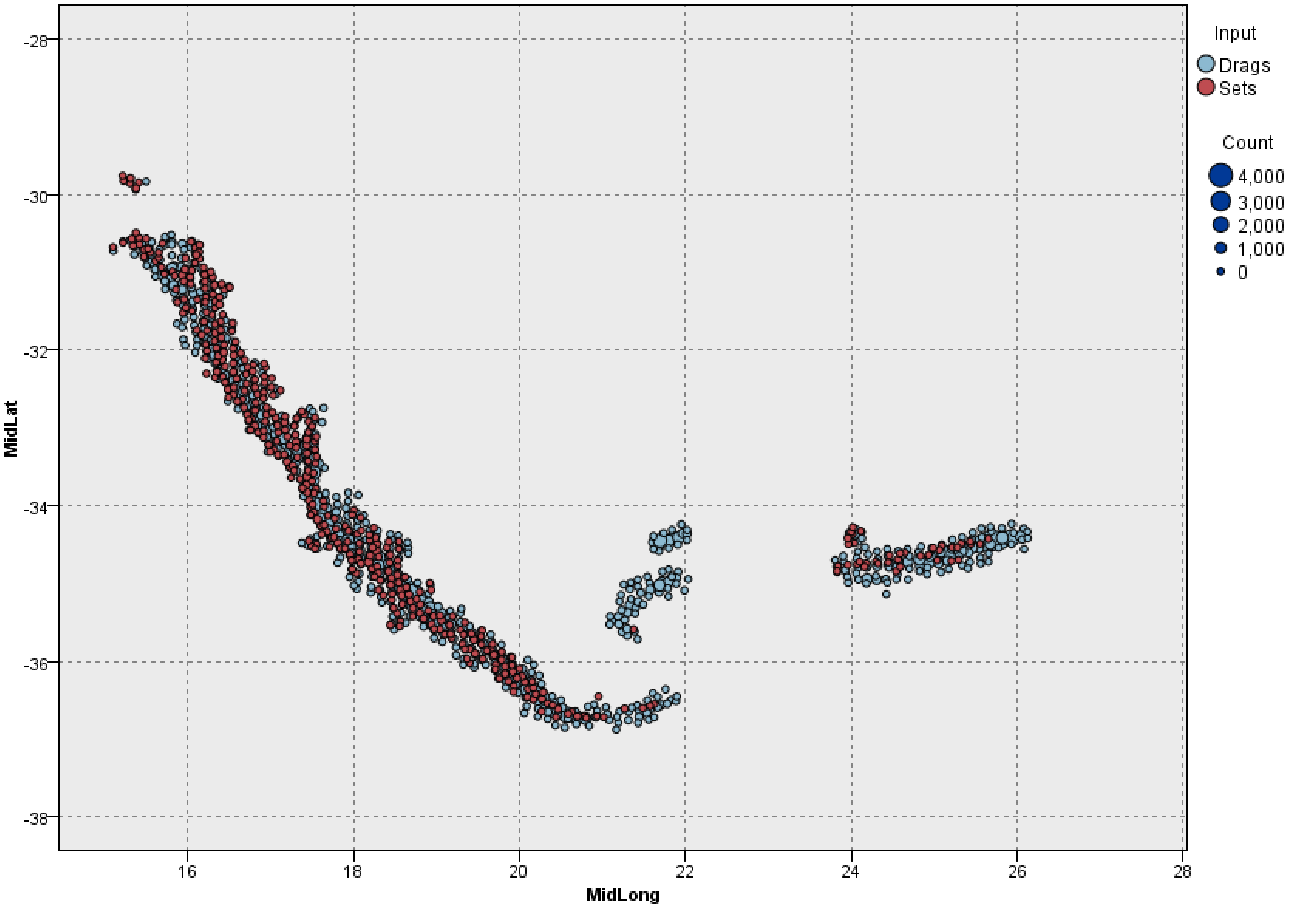


Figure 1. A scatter plot of the location of offshore trawls and hake longline sets according to the mid-point of fishing events (either sets in red or drags in light blue), for 2015 to 2020 only, following a run of the K-means algorithm with 500 clusters, **and trimming away clusters which all contribute less than any other clusters and collectively less than 5% of the total cumulative hake catch 2015 to 2020**. The colour shown here distinguishes only sets from trawls and are not intended to depict individual clusters.

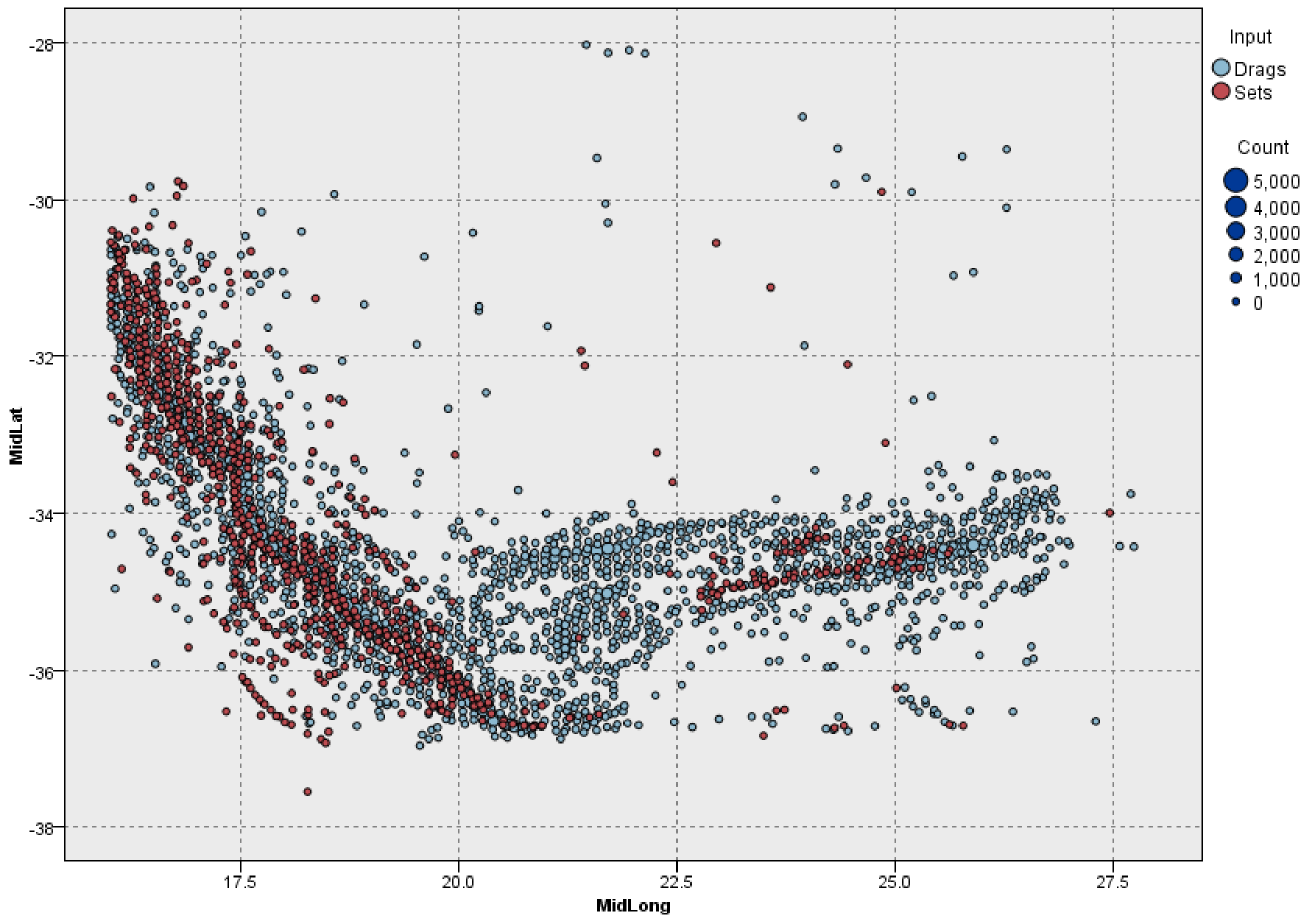


Figure 2. A scatter plot of the location of offshore trawls and hake longline sets by the mid-point of the fishing event, for 2015 to 2020 only, following a run of the K-means algorithm with 500 clusters, without any trimming of the data. The colours shown here distinguish only sets from trawls and are not intended to show clusters

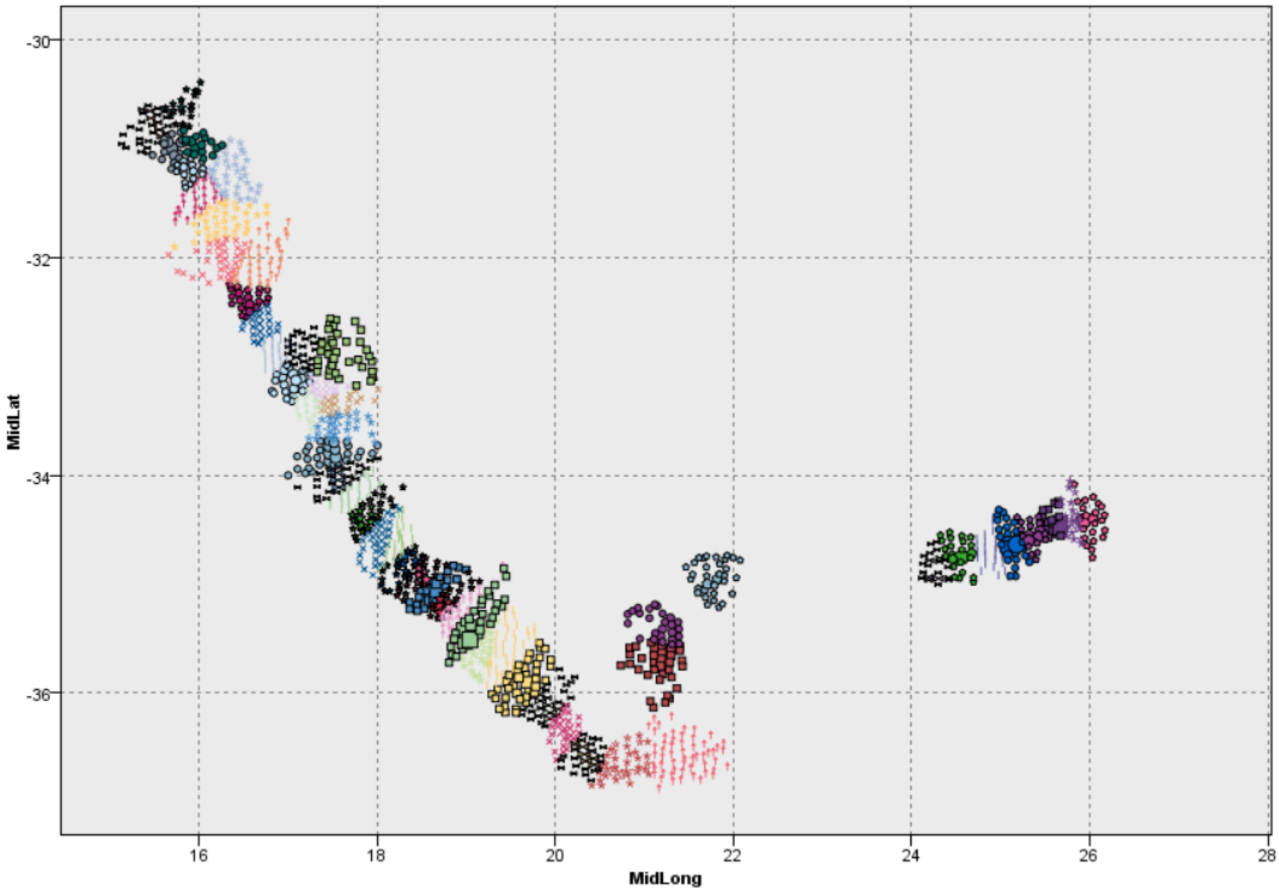


Figure 3. Plot of the location of fishing sets and trawls, 2015 to 2020, colour coded by K-means cluster, for the 200 cluster case. For this case 50 clusters encompass 95% of the gross catch and so only 50 clusters are represented in this figure.

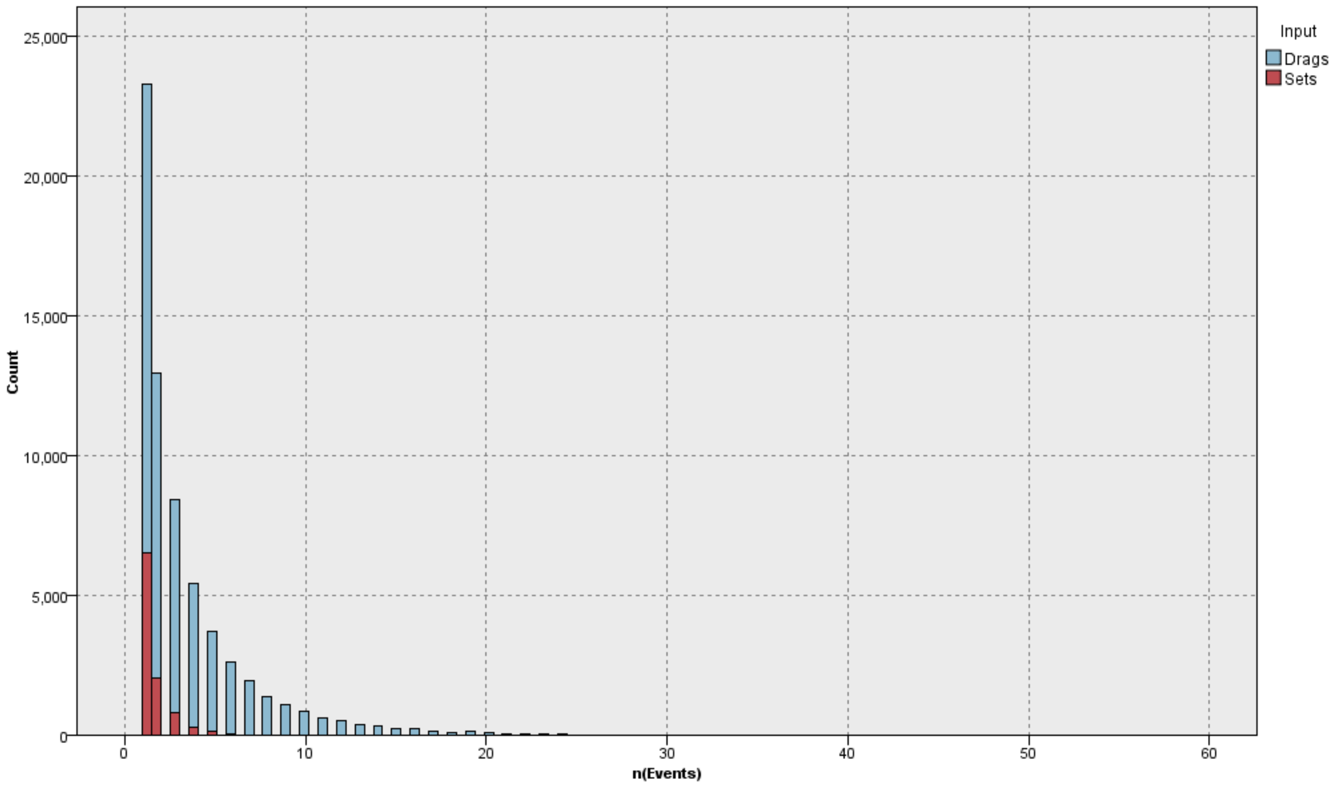
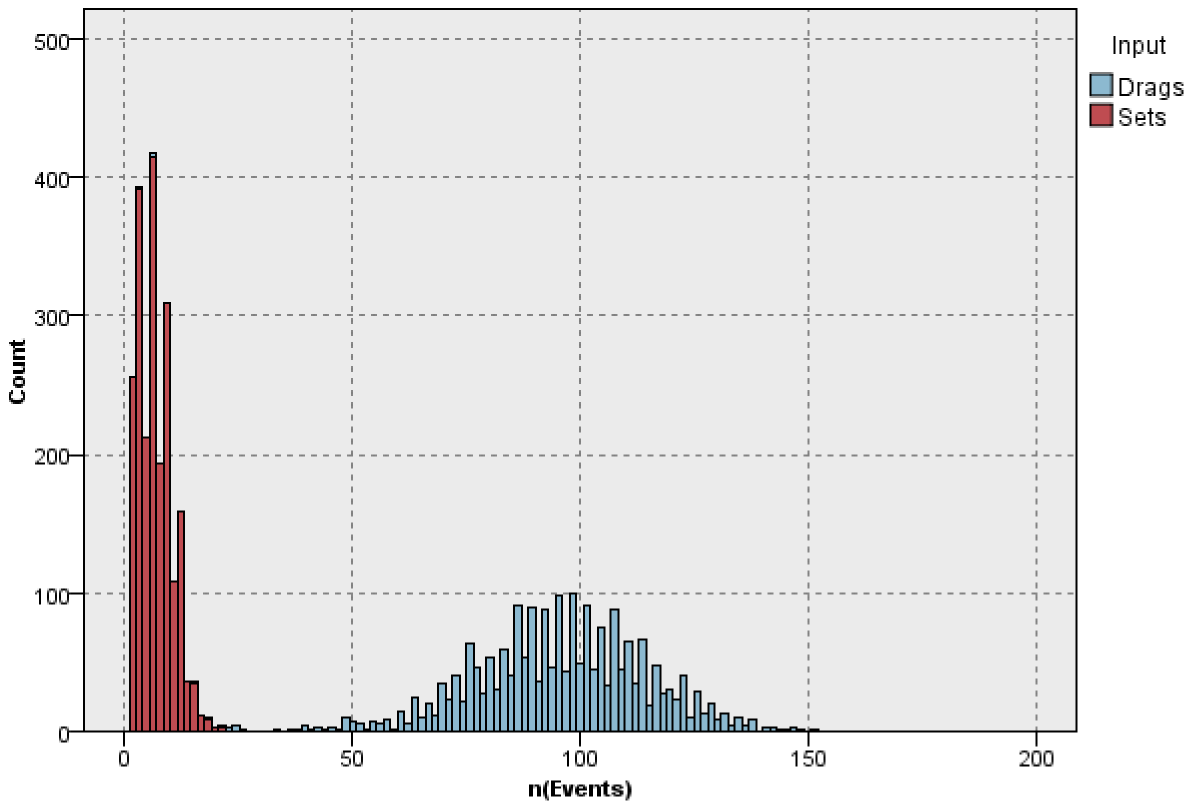


Figure 4. Histogram of the number of events on a Cluster_Day, where a Cluster_Day is only included in this histogram if there was at least one trawl or one longline set, for the 200 cluster case, but for the 50 clusters which in this case encompass 95% of the catch.



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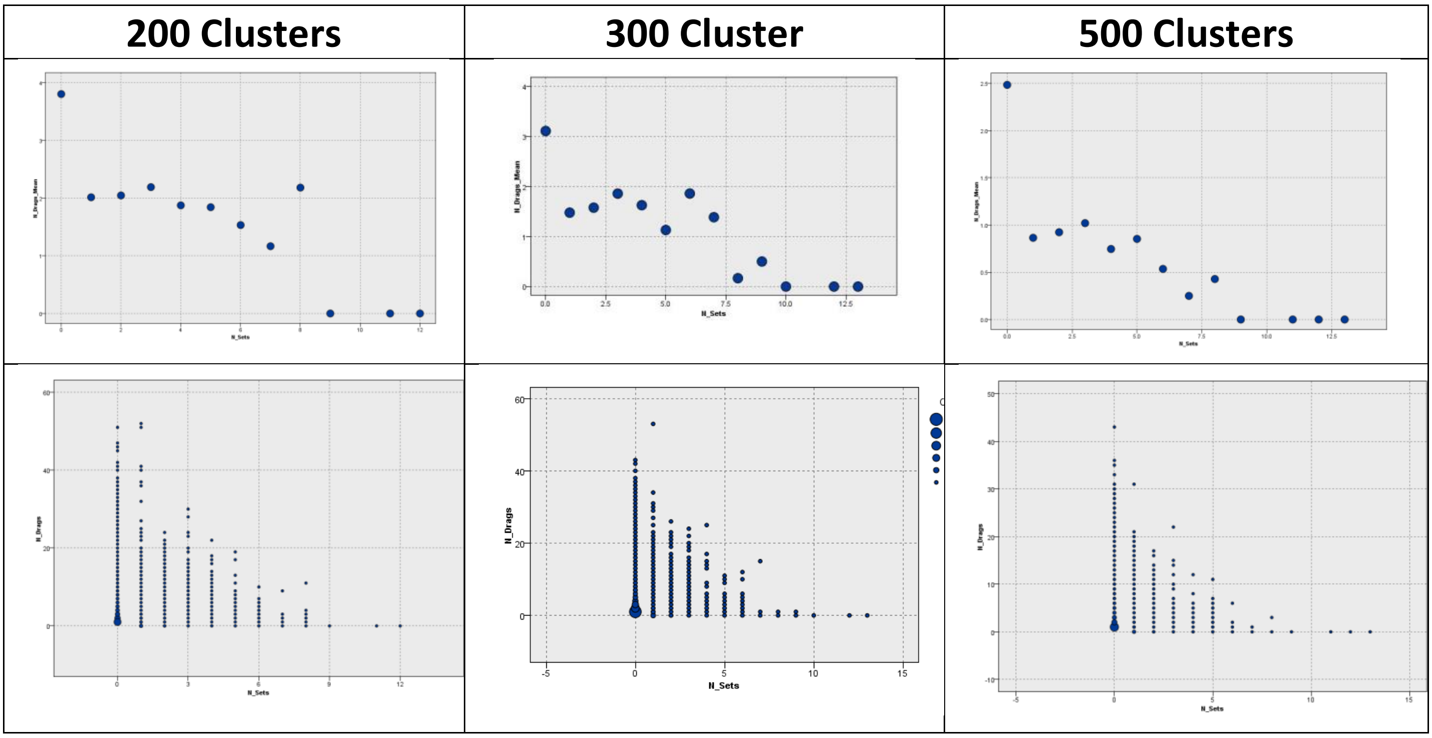

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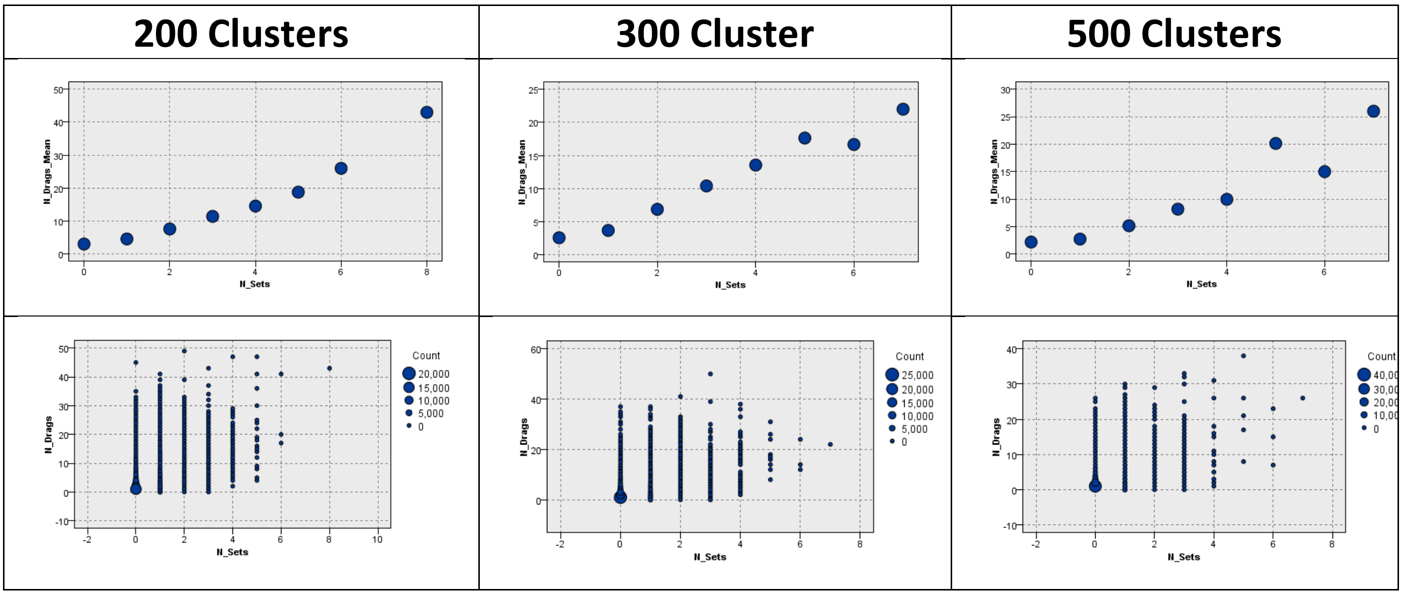

Figure 7. For the 200, 300 and the 500 cluster cases, a plot of the number of drags (n(DRAGS)) vs the number of sets (n(SETS)) at the resolution of Cluster_Days, **where for this case the sets are a random selection of 7% of the trawls and the true set level information has been excluded from the calculations**. The top panels show the average number of drags on the y axis for given 'numbers of sets' to clarify the average relationship. The bottom panels show all cases, except that larger dots represent more than one value (where a value is a Cluster_Day) as indicated by the legend.

8 Appendix A. An assessment of the quality of the trawl and longline data made available

Table 2 . The amount of catch i.t.o green weight that is available in the trawl dataset 'Raw data', followed by the amount of catch for which different combinations of the drag date, fishing depth and position (GPS) information is available.

	Trawl Hake Green Weight				
	Raw data	Drag Date Available	Drag Date Available, and GPS Available	Drag Date Available, and GPS Available, and Depth Available	% of Raw Data
2000	112,162,798	112,162,798	163,532	163,532	0.1%
2001	111,880,912	111,880,912	605,882	605,882	0.5%
2002	102,865,033	102,865,033	635,672	635,672	0.6%
2003	127,264,392	127,264,392	32,522,228	32,522,228	25.6%
2004	126,476,207	126,476,207	83,849,260	83,849,260	66.3%
2005	124,627,868	124,627,868	103,199,860	103,199,860	82.8%
2006	120,737,568	120,737,568	120,198,024	120,198,024	99.6%
2007	125,320,551	125,320,551	124,982,383	124,982,383	99.7%
2008	108,727,468	108,727,468	108,251,683	108,251,683	99.6%
2009	97,296,222	97,296,222	97,132,581	97,123,919	99.8%
2010	102,699,995	102,699,995	102,699,995	102,699,995	100.0%
2011	120,475,286	120,475,286	120,475,286	120,475,286	100.0%
2012	117,669,217	117,669,217	117,669,217	117,669,217	100.0%
2013	117,361,788	117,361,788	117,361,788	117,361,788	100.0%
2014	132,697,840	132,697,840	132,697,840	132,697,840	100.0%
2015	128,629,978	128,629,978	128,629,978	128,629,978	100.0%
2016	132,204,874	132,204,874	132,204,874	132,204,874	100.0%
2017	124,267,557	124,267,557	124,247,613	124,247,613	100.0%
2018	115,193,856	115,168,357	115,152,169	115,152,169	100.0%
2019	122,224,966	122,224,966	122,191,138	122,191,138	100.0%
2020	124,791,976	124,791,976	124,791,976	124,791,976	100.0%
Total	2,495,576,349			2,009,654,318	80.5%
				Discarded	19.5%

Table 3 . The number of records that are available in the trawl dataset 'Raw data', followed by the number of records for which different combinations of the drag date, fishing depth and position (GPS) information is available.

	Trawl Records				
	Raw data	Drag Date Available	Drag Date Available, and GPS Available	Drag Date Available, and GPS Available, and Depth Available	% of Raw Data
2000	57,179	57,179	266	266	0.5%
2001	63,743	63,743	398	398	0.6%
2002	64,102	64,102	441	441	0.7%
2003	68,646	68,646	16,151	16,151	23.5%
2004	75,543	75,543	52,828	52,828	69.9%
2005	75,822	75,822	69,828	69,828	92.1%
2006	67,786	67,786	65,099	65,099	96.0%
2007	62,044	62,044	60,013	60,013	96.7%
2008	53,488	53,488	51,440	51,440	96.2%
2009	41,531	41,531	41,116	41,114	99.0%
2010	40,616	40,616	40,616	40,616	100.0%
2011	43,056	43,056	43,056	43,056	100.0%
2012	44,518	44,518	44,518	44,518	100.0%
2013	44,494	44,494	44,493	44,492	100.0%
2014	46,525	46,525	46,525	46,525	100.0%
2015	47,500	47,500	47,500	47,500	100.0%
2016	47,062	47,062	47,062	47,062	100.0%
2017	40,955	40,955	40,950	40,950	100.0%
2018	36,821	36,793	36,785	36,785	99.9%
2019	41,153	41,153	41,141	41,141	100.0%
2020	37,720	37,697	37,697	37,697	99.9%
Total	1,100,304			827,920	75.2%
				Discarded	24.8%

Table 4 . The amount of catch i.t.o green weight that is available in the longline dataset 'Raw data', followed by the amount of catch for which different combinations of the set date, fishing depth and position (GPS) information is available.

	Raw data	Set Date Available	Set Date Available, and GPS Available	Set Date Available, and GPS Available, and Depth Available	% of Raw Data
1994	1,080,672	1,080,672	1,080,672	1,074,587	99.4%
1995	565,681	565,681	565,681	555,636	98.2%
1996	3,998,609	3,998,609	3,998,609	3,994,892	99.9%
1997	3,938,143	3,938,143	3,938,143	3,868,611	98.2%
1998	2,009,376	2,009,376	2,009,376	2,001,765	99.6%
1999	6,249,111	6,249,111	6,249,111	6,242,996	99.9%
2000	6,258,842	6,258,842	6,258,842	6,231,113	99.6%
2001	5,129,049	5,129,049	5,129,049	5,128,529	100.0%
2002	9,730,455	9,730,455	9,730,455	9,730,455	100.0%
2003	9,262,602	9,262,602	9,262,602	9,260,628	100.0%
2004	8,397,024	8,397,024	8,397,024	8,389,853	99.9%
2005	9,358,052	9,358,052	9,358,052	9,355,243	100.0%
2006	8,745,935	8,745,935	8,745,935	8,731,142	99.8%
2007	7,291,620	7,291,620	7,291,620	7,243,674	99.3%
2008	8,174,254	8,174,254	8,174,254	8,143,009	99.6%
2009	8,285,037	8,285,037	8,285,037	8,265,005	99.8%
2010	8,156,404	8,156,404	8,156,404	8,078,647	99.0%
2011	8,498,183	8,498,183	8,498,183	8,436,037	99.3%
2012	9,665,031	9,665,031	9,665,031	9,641,251	99.8%
2013	9,317,527	9,317,527	9,317,527	9,255,459	99.3%
2014	9,213,094	9,213,094	9,213,094	9,192,733	99.8%
2015	8,019,230	8,019,230	8,019,230	8,005,113	99.8%
2016	8,476,743	8,476,743	8,476,743	8,472,915	100.0%
2017	7,612,064	7,612,064	7,612,064	7,539,661	99.0%
2018	7,851,697	7,851,697	7,851,697	7,846,149	99.9%
2019	8,588,092	8,588,092	8,588,092	8,539,002	99.4%
2020	7,726,867	7,726,867	7,726,867	7,695,132	99.6%
2021	8,694,375	8,694,375	8,694,375	8,694,375	100.0%
2022	809,178	809,178	809,178	809,178	100.0%
Total	201,102,948			200,422,787	99.7%
				Discarded	0.3%

Table 5 . The number of records that are available in the longline dataset 'Raw data', followed by the number of records for which different combinations of the set date, fishing depth and position (GPS) information is available.

	Longline Records				
	Raw data	Set Date Available	Set Date Available, and GPS Available	Set Date Available, and GPS Available, and Depth Available	% of Raw Data
1994	765	756	756	746	97.5%
1995	460	452	452	439	95.4%
1996	1,648	1,644	1,644	1,640	99.5%
1997	2,113	2,111	2,111	2,082	98.5%
1998	709	705	705	702	99.0%
1999	2,137	2,133	2,133	2,131	99.7%
2000	1,956	1,935	1,935	1,924	98.4%
2001	1,713	1,692	1,692	1,691	98.7%
2002	3,267	3,233	3,233	3,233	99.0%
2003	3,611	3,580	3,580	3,579	99.1%
2004	3,524	3,483	3,483	3,479	98.7%
2005	4,233	4,171	4,170	4,168	98.5%
2006	4,197	4,152	4,152	4,139	98.6%
2007	3,906	3,860	3,860	3,836	98.2%
2008	3,580	3,516	3,516	3,491	97.5%
2009	2,592	2,583	2,583	2,575	99.3%
2010	2,394	2,393	2,393	2,369	99.0%
2011	2,279	2,274	2,274	2,257	99.0%
2012	2,663	2,653	2,653	2,643	99.2%
2013	2,785	2,778	2,778	2,766	99.3%
2014	3,076	3,060	3,060	3,056	99.3%
2015	3,199	3,187	3,187	3,181	99.4%
2016	3,131	3,117	3,117	3,111	99.4%
2017	2,890	2,887	2,887	2,848	98.5%
2018	2,785	2,778	2,778	2,775	99.6%
2019	2,887	2,876	2,876	2,861	99.1%
2020	2,560	2,549	2,549	2,535	99.0%
2021	2,486	2,478	2,478	2,478	99.7%
2022	286	223	223	223	78.0%
Total	73,832			72,958	98.8%
				Discarded	1.2%