DOCUMENT P4:

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

MARAM/IWS/2022/HAKE/P4

28 NOVEMBER 2022

Document P4, Objective

Is there a negative relationship between the number of trawls and the number of sets at operationally meaningful spatial and temporal scales?

P4: Dataset and data preparation

Combined the deep sea trawl and longline data sets

Focussed on the period 2015 to 2022

P4: Operationally meaningful time scale

Day

P4: Operationally meaningful spatial scale

Cannot be too small or too large

Too small: There must be a negative relationship since you can't trawl on top of a longline set

Too large: Will miss important interactions

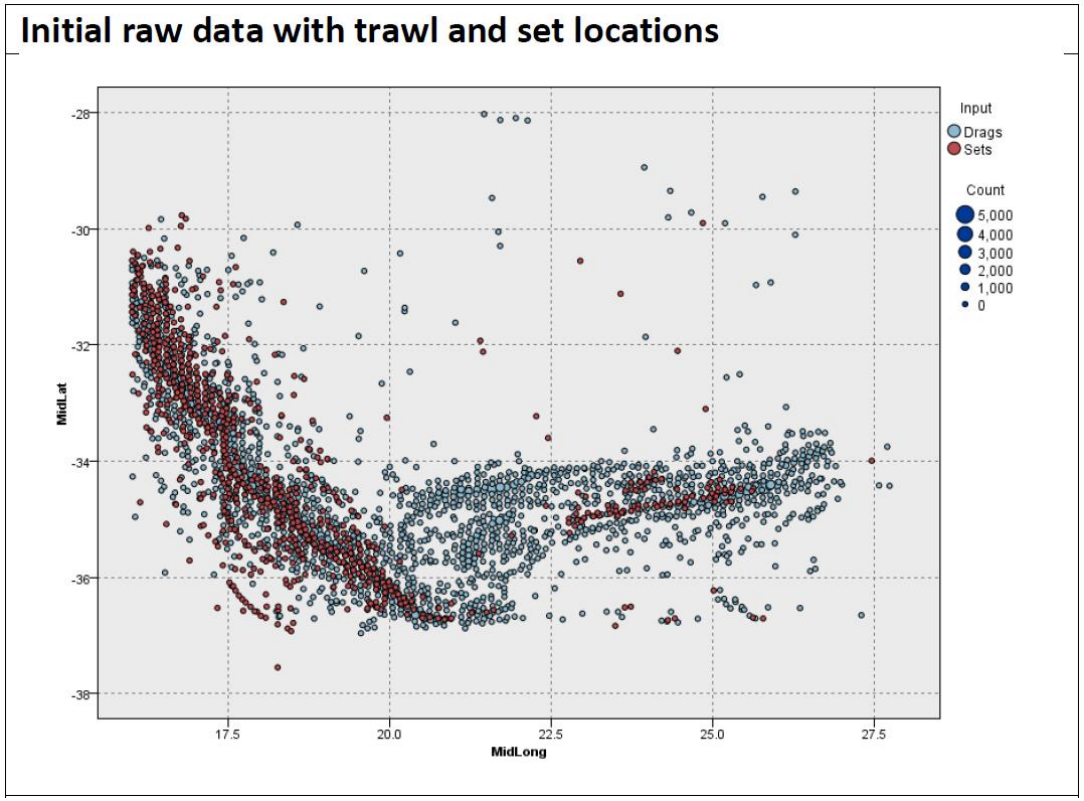
Operationally meaningful: 10s of kilometres (set length ~ 25 km, trawl path length could be 10 – 20 km)

Divide spatial extent of fishing into 10s or 100s of subareas

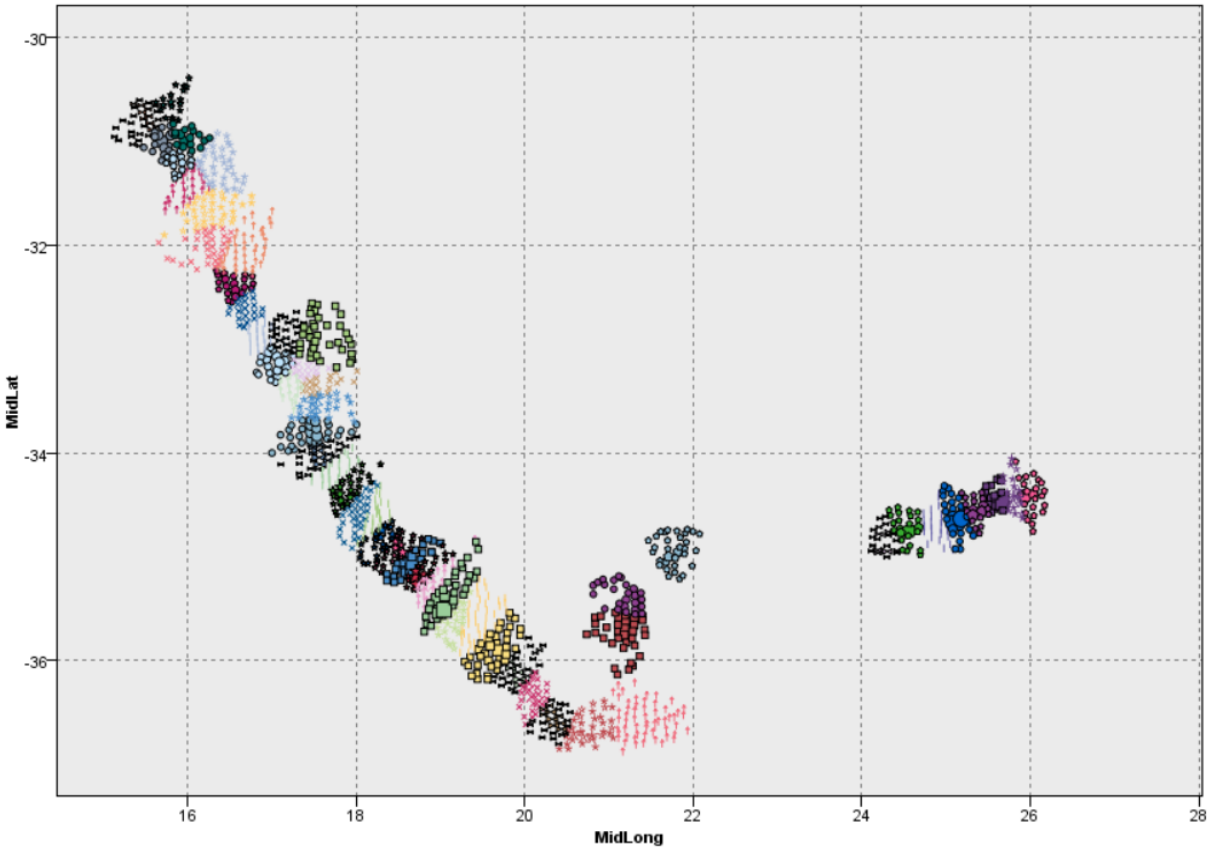
K-means cluster, simple binning procedures, various dimensions

P4 – Additional data trim, 95% of catch 2015 - 2022

Initial raw data with trawl and set locations



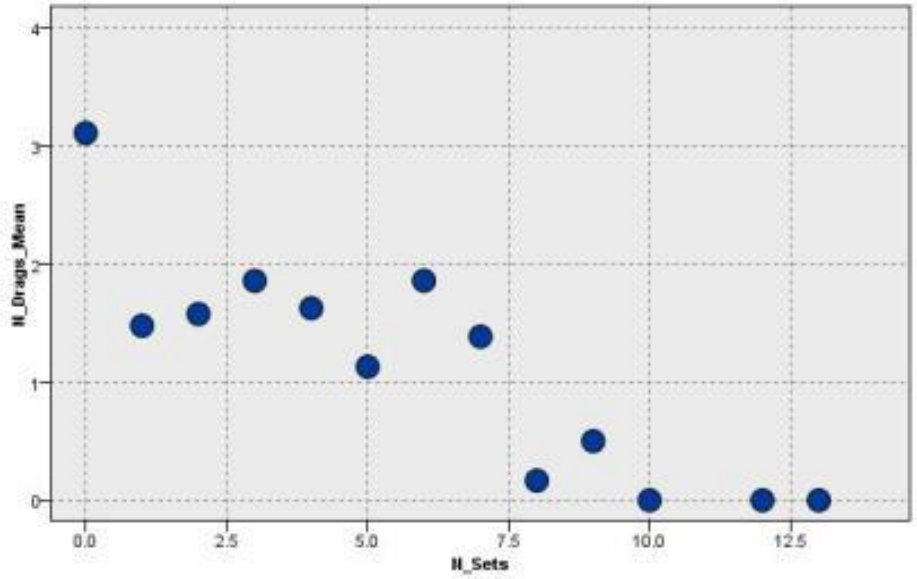
200 cluster example, 50 clusters remain



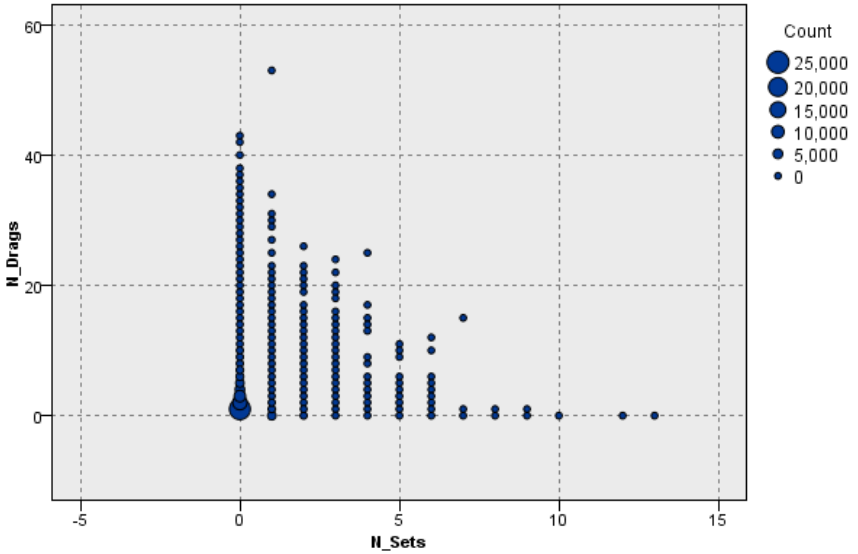
P4 – Relationship between number of trawls and number of sets

300 Cluster example

Mean number of trawls per Cluster_Day vs #sets per Cluster_Day

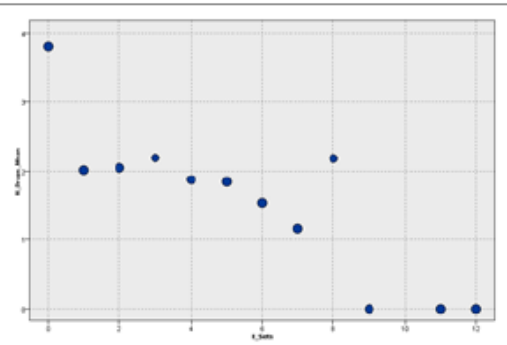
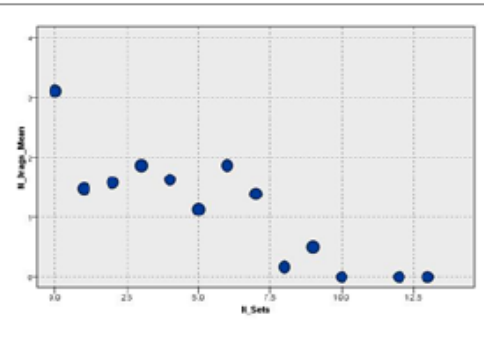
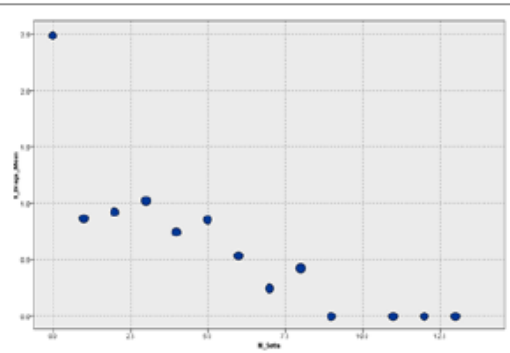
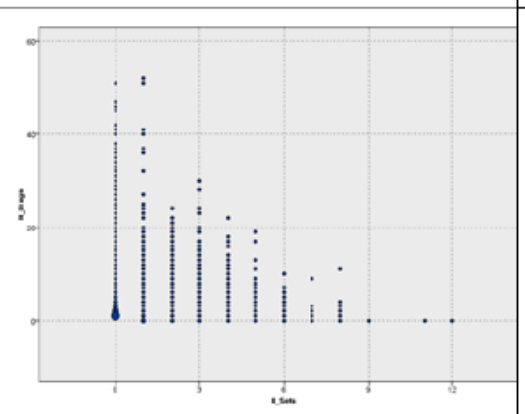
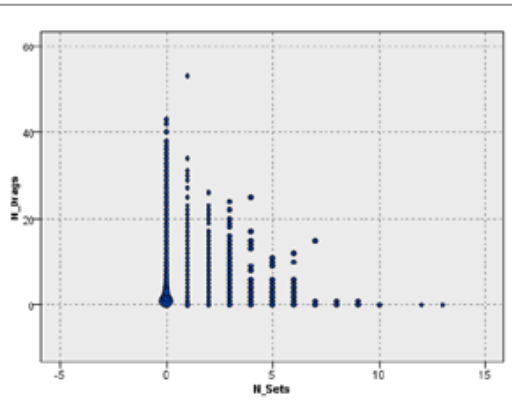
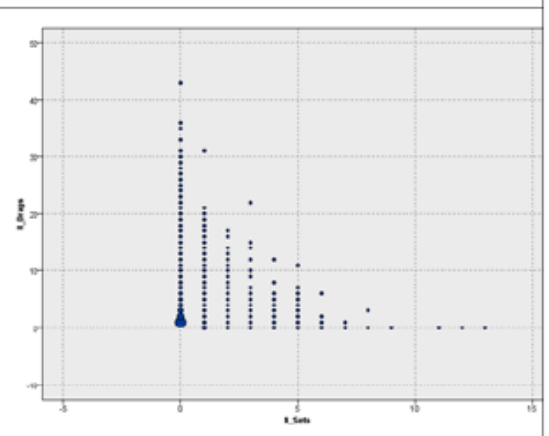


Number of trawls per Cluster_Day vs #sets per Cluster_Day



P4 – Other clustering options

Use of actual longline set data

200 Clusters	300 Cluster	500 Clusters
		
		

P4 – There may just be areas that are naturally suited for trawling and others naturally suited for longlining

Include 'Cluster' as a factor in a GLM relating #trawls to #sets

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)

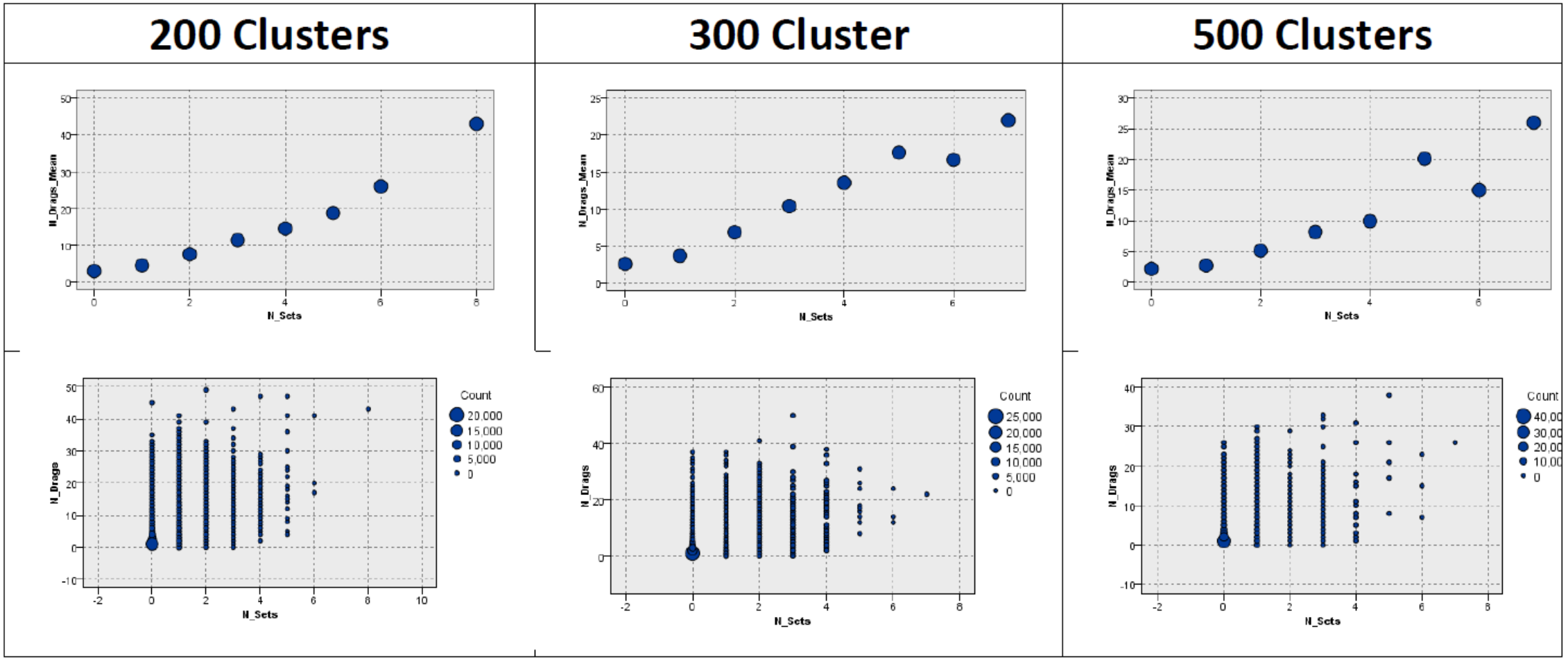
P4 – Result could be a numerical artefact

Exclude longline sets from the analysis (~7% by number)

Randomly convert trawls to sets, 7% of the trawls.

Repeat the analyses – graphical results only.

P4: 7% of trawl are randomly converted to sets



P4: Conclusions

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.

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 a negative relationship between the number of trawls and the number of sets.