

Refined trends in poaching for West Coast rock lobster using information from the “new” database for the period 2012 to 2017

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Abstract

GLM methods are applied to the “new” compliance database in which policing effort is linked to confiscations taken as well as to the “old” compliance database on confiscations (and abandonments) and on policing effort (but restricting the analyses to policing effort types that are common with the “new” database) to estimate recent trends in the amount of rock lobster that is poached. GLM methods are also applied to this “old” database, but estimates of relative effort efficiencies for different effort types obtained from the “new” database (and adjusted to account for inspections with zero confiscations which are not recorded in the “new” database) are used to link effort to the number of confiscations to provide a refined “old”-linked time series for the level of poaching. Because the number of data in the “new” database is so much less (only some 0.5%) than in the “old” database, it is recommended that the “new” database analyses be used only to provide estimates of relative efficiency of different effort types, and that the “old”-linked series serve as the basis for the assumptions concerning poaching needed for future assessments. These series suggest generally higher levels of poaching subsequent to 2008/9 than did earlier analyses.

Introduction

This paper gives results for the tasks (ii) to (iv) as set out in Brandão and Butterworth (2018a) (and see below) to analyse poaching trends given the “old” (confiscations not linked to the type of policing) and the “new” (confiscations linked to policing effort type) databases. These tasks are:

- i) Update the poaching analyses as before using the updated “old” database.
- ii) Run an analysis on the “new database” to obtain results for the poaching trend – this will also provide the relative efficiencies of the different policing effort types.
- iii) Rerun analysis on the “old” database but now using the relative effort efficiencies estimated in ii).
- iv) Compare the overall “trends” between i), ii) and iii).

Not all policing effort types match between the “new” and the “old” databases. Further, because of the scarcity of data for all policing types in the “new” database, some policing effort types were combined if they were deemed to be of a similar type and some were omitted from any analyses. The policing effort types in the “new” database available for possible analyses are slipway inspections, coastal patrols, Tip Offs, Joint Ops and VCP's. Also to be able to apply the estimated relative policing effort efficiencies from the “new” database to the “old” data, common policing efforts are needed. These were chosen to be slipway inspections, coastal patrols and vehicle inspections (VCP's) on the advice of D van Zyl.

Brandão and Butterworth (2018a) presented results for task (i) but those include all policing effort types as for previous analyses. In this paper task (i) has been repeated, but only for the policing types common between the “new” and “old” databases, so as to be able to carry out the comparisons required under task (iv).

Data

Monthly data on confiscations and policing effort obtained from one of the Directorates within the CD (Directorate: Compliance) for the period of April 2008 to December 2017 form the “old” database. Data for the period 2012 to 2017 on rock lobster confiscations that are linked to a policing effort type form the “new” database. The first three months of the 2016 compliance data have been omitted from the analyses to remove the effect of the greatly enhanced policing levels during those months when Operation Phakisa was launched.

Methods

Generalized linear models (GLMs) were used to investigate trends in poaching. The methodology for task (i) but applied for the policing types common between the “new” and “old” databases is the same as in Brandão and Butterworth (2018a). For the “new” data for which confiscations are linked to the policing effort type, poaching trends are obtained from the number of confiscations adjusted by the policing effort as set out below (note that “year” refers to a calendar year throughout this document).

The expected number of confiscations is modelled as (task (ii)):

$$E(C_{new}) = \exp(\mu + \alpha_{month} + \beta_{type} + \delta_{year}) \quad (1)$$

where

C_{new} is the number of confiscations made in a single compliance event, assumed to have an overdispersed Poisson distribution (though this overlooks the complication that the new database does not include instances where no confiscations occurred),

μ is the intercept,

α_{month} is the month effect,

β_{type} is the type of policing effect which is linked to the confiscations, where the “type” factor is associated with the different types of policing such as coastal patrols, slipway inspections and vehicles inspections, and

δ_{year} is the year effect (2012 to 2017).

Note that effort “type” appears here only in the form of a single value. This is because unlike in Brandão and Butterworth (2018) where confiscations and effort are summed over each month in each year, here each event is treated as a separate datum entered into the analysis.

From the GLM of the “new” database, the estimates of the β_{type} effect value provide relative policing effort efficiencies which can be used in re-analysing the “old” database (task (iii)). However, these relative efficiencies of the different compliance effort types need to be adjusted to account for the absences of inspections with zero rock lobster confiscations in the “new” database. The adjustments effected are the averages over years of proportions of successful (illegally caught rock lobster confiscated) inspections as given in Brandão and Butterworth (2018b).

The policing effort (E) for the “old” database that is linked to the number of confiscations is obtained by multiplying the policing effort value by its adjusted efficiency as determined in task (ii) and adding over all the effort type’s. Poaching trends for the “old” linked database are then obtained by the model:

$$E(C_{old}) = E \exp(\mu + \alpha_{month} + \delta_{year}). \quad (2)$$

Results

Results are restricted to the northern and southern areas division of the west coast rock lobster. Tables 1a and 2a show the parameter estimates for the GLMs fitted to the “new” database and to the “old” database confiscation data but linked to effort by using the estimates of relative effort efficiencies obtained from the GLM of the “new” data for Super-areas 3+4+5+6+7 and 8+ respectively. Tables 1b and 2b show the relative efficiencies of different types of policing effort after adjusting for the proportion of inspections which were successful in confiscating illegally caught lobster. Figure 1 shows the poaching trends obtained from the “new” database and compares these to those obtained from the “old” database and from the GLM for the “old” database in which the relative effort efficiency estimates from the “new” database GLM are applied to the policing effort data for these Super-area combinations.

The poaching trends obtained from the “old” database and from the “old” database that has used estimates of relative effort efficiencies obtained from the “new” database show broadly similar patterns for all Super-areas considered (Figure 1). The poaching trends obtained from the “new” database for the northern Super-areas (3-7) differ in the main in the last one or two years, but note the large associated confidence intervals (plots in Figure 1 in the middle – a consequence of the much lower number of entries in the new compared to the “old” database – see Table 3). For the

southern Super-area 8+ (Figure 1) the “new” estimated poaching trends are more variable than the “old” – again likely the result of smaller sample sizes.

Conclusions

While in due course the quantity of data recorded in the new database should increase to a level where it can be used as the primary basis to estimate poaching trends, at present this quantity seems too small (Table 3) for these data (at present only about 0.5% as numerous as the “old” data) to be deemed to provide sufficiently reliable inferences for these trends. We therefore advocate that the “old”-linked trends shown in Figure 1, which adjust earlier analyses for the relative efficiencies of different poaching types, should serve as the primary basis for inferring poaching trends. These do suggest some downturn in the last two years in the northern area, but seem to vary about a steady level from 2013 onwards for Super-area 8+.

Figure 2 and Tables 4a-b compare these trends to the results used two years ago, together with how they were smoothed for use in the base case assessment at that time. Importantly, because results here are shown relative to 2008 (for Super-area 8+) or 2009 (for the northern area), the relative levels of poaching since that time are notably **higher** for the “old”-linked trends than indicated two years ago. This “normalisation” relative to 2008/9 merits further discussion. Note that confidence intervals relative to 2014 for the “old”-linked annual estimates of poaching are shown in the right side panels of Figure 1.

References

- Brandão, A. and Butterworth, D.S. 2018a. Results for the updated trends in policing effort and the number of confiscations for West Coast rock lobster using the “old” database for the period 2008 to 2017. Fisheries/2018/AUG/SWG-WCRL/16.
- Brandão, A. and Butterworth, D.S. 2018b. Investigation of the comparability of the West Coast rock lobster compliance databases (“new” and “old”). Fisheries/2018/AUG/SWG-WCRL/17.

Table 1a. GLM parameter/coefficient (and standard error) estimates for Super-areas 3+4+5+6+7.

	Poaching ("new")	Poaching ("old"-linked)
January	0	0
February	1.300 (0.684)	0.848 (0.365)
March	0.819 (0.772)	1.077 (0.329)
April	0.442 (0.760)	0.214 (0.359)
May	0.780 (1.060)	-0.038 (0.379)
June	0.043 (1.312)	-2.928 (1.278)
July	-0.725 (2.247)	-3.141 (1.239)
August	-0.365 (3.248)	-2.477 (0.773)
September	0.998 (1.169)	-1.231 (0.628)
October	1.519 (0.726)	-2.163 (0.720)
November	-1.490 (1.417)	-1.351 (0.478)
December	1.326 (0.665)	0.194 (0.361)
2008	—	—
2009	—	0.409 (0.383)
2010	—	1.225 (0.320)
2011	—	0.142 (0.363)
2012	-1.620 (1.044)	-0.835 (0.420)
2013	-1.044 (0.593)	-0.594 (0.407)
2014	0	0
2015	-0.094 (0.408)	0.084 (0.373)
2016	-1.203 (1.531)	-1.350 (0.950)
2017	0.401 (0.490)	-1.063 (0.558)
coastal	0	—
slipway	0.611 (0.568)	—
vehicles	1.013 (0.571)	—

Table 1b. Relative efficiencies of different types of policing effort after adjusting for the proportion of inspections which were successful in confiscating illegally caught lobster for Super-areas 3+4+5+6+7.

Policing effort type	Adjusted relative efficiency
coastal	1.000
slipway	2.155
vehicles	2.390

Table 2a. GLM parameter/coefficient (and standard error) estimates for Super-area 8+.

	Poaching ("new")	Poaching ("old"-linked)
January	0	0
February	1.547 (0.423)	1.152 (0.433)
March	0.272 (0.682)	-1.099 (0.791)
April	-1.102 (0.715)	0.571 (0.463)
May	-0.250 (0.667)	0.140 (0.514)
June	0.339 (0.629)	-0.119 (0.535)
July	-0.619 (1.493)	-1.278 (0.739)
August	-1.333 (1.936)	-2.983 (1.391)
September	2.400 (0.520)	-0.086 (0.531)
October	-1.380 (2.410)	-0.729 (0.613)
November	-0.993 (0.858)	-1.223 (0.746)
December	-2.310 (0.971)	-0.582 (0.589)
2008	—	-1.223 (0.812)
2009	—	-1.137 (0.696)
2010	—	-0.595 (0.549)
2011	—	-0.113 (0.487)
2012	-1.012 (1.417)	-1.033 (0.626)
2013	1.206 (0.474)	0.750 (0.424)
2014	0	0
2015	0.988 (0.431)	0.090 (0.456)
2016	-0.073 (0.686)	0.673 (0.478)
2017	-0.953 (0.782)	0.070 (0.452)
coastal	0	—
slipway	-0.357 (0.314)	—
vehicles	3.032 (0.596)	—

Table 2b. Relative efficiencies of different types of policing effort after adjusting for the proportion of inspections which were successful in confiscating illegally caught lobster for Super-area 8+.

Policing effort type	Adjusted relative efficiency
coastal	1.000
slipway	0.805
vehicles	1.037

Table 3. Number of observations in the “old” and the “new” databases available for analyses.

	“Old” database	“New” database
2008	9687	—
2009	20059	—
2010	22278	—
2011	26575	—
2012	27494	50
2013	24196	129
2014	19560	152
2015	22323	163
2016	21067	89
2017	22539	107

Table 4a. Poaching series obtained from the “old” database and the “old” database using relative effort efficiencies from the “new” database model (“old”-linked) and the “previous” series assumed for the 2016 assessment and projections for the northern Super-areas 3+4+5+6+7.

	Previous	“Old”	“Old”-linked
2008	—	—	—
2009	1.000	1.000	1.000
2010	0.767	0.918	2.262
2011	0.533	0.355	0.766
2012	0.300	0.216	0.288
2013	0.367	0.288	0.367
2014	0.433	0.403	0.664
2015	0.500	0.356	0.722
2016	0.500	0.074	0.172
2017	0.500	0.113	0.229

Table 4b. Poaching series obtained from the “old” database and the “old” database using relative effort efficiencies from the “new” database model (“old”-linked) and the “previous” series assumed for the 2016 assessment and projections for the southern Super-area 8+.

	Previous	“Old”	“Old”-linked
2008	1.000	1.000	1.000
2009	1.250	0.837	1.090
2010	1.500	1.673	1.874
2011	1.750	2.070	3.033
2012	2.000	0.978	1.209
2013	2.667	5.084	7.189
2014	3.333	2.883	3.396
2015	4.000	3.149	3.715
2016	4.000	5.566	6.657
2017	4.000	3.035	3.642

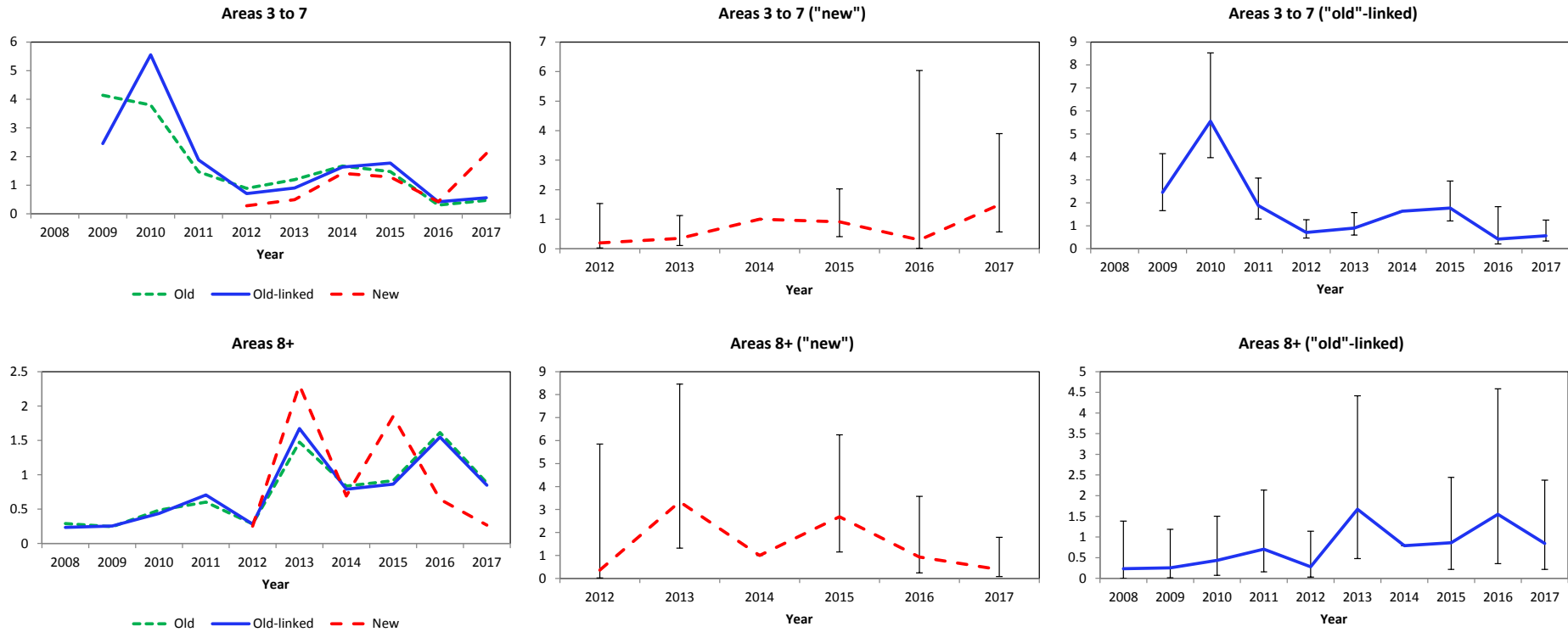


Figure 1. Year effect (together with 95% confidence limits, middle plots) for confiscations for the “new” database (right) and the comparison of poaching trends (left) obtained from the “old” database and the “old” database using relative effort efficiencies from the “new” database model (“old”-linked) (together with 95% confidence limits, plots on the right hand side) for the northern Super-areas 3+4+5+6+7 and the southern Super-area 8+. The series plotted on the left hand side have been normalised to the period 2012 to 2017 for which they overlap.

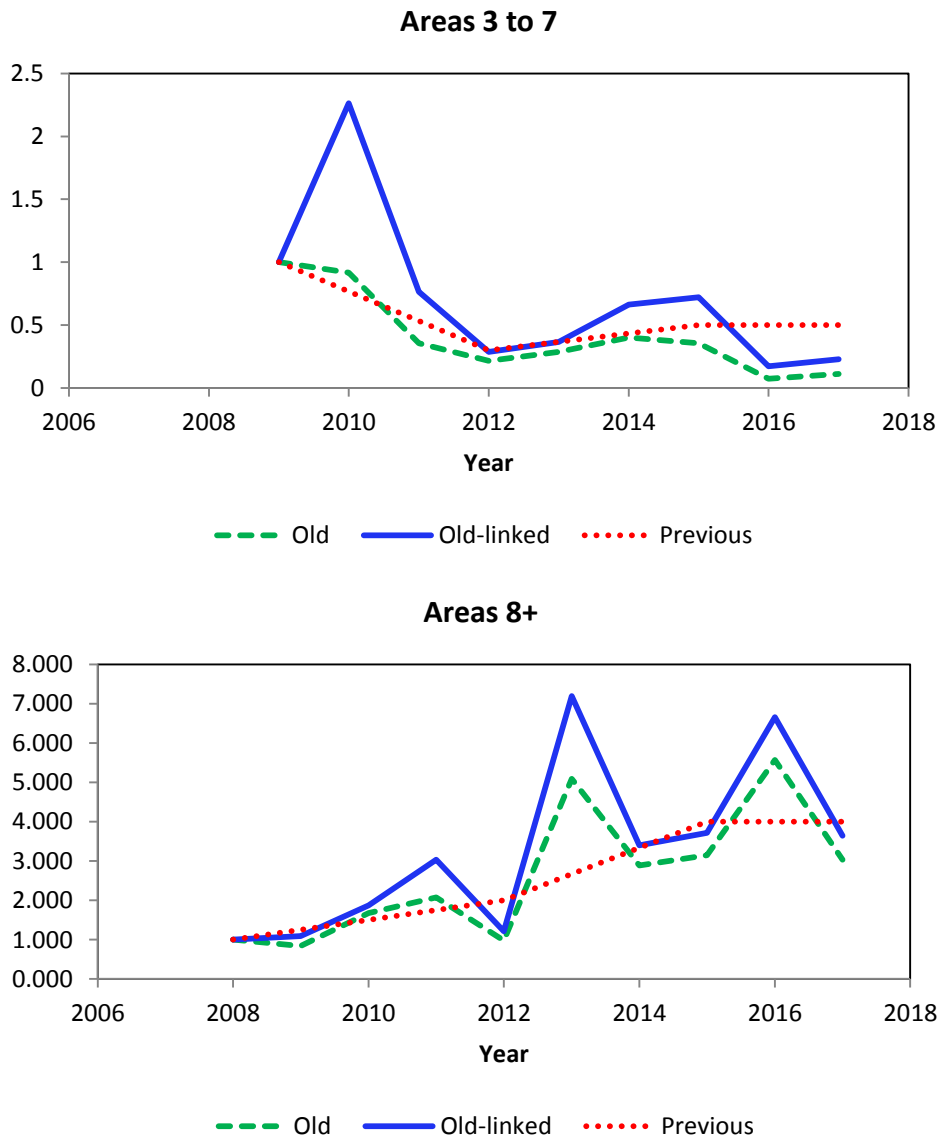


Figure 2. Poaching trends (left) obtained from the “old” database and the “old” database using relative effort efficiencies from the “new” database model (“old”-linked) for Super-areas 3+4+5+6+7 (top) and Super-area 8+ (bottom) with WCRL SWG agreements on the poaching trends as assumed for the 2016 assessment (“Previous”). Results shown are normalised to 2008=1 for Super-area 8+ or to 2009=1 for Super-areas 3+4+5+6+7 as assumed for that previous assessment and projections.