A suggested new approach to combine estimates of illegally exported and locally sold west coast rock lobster

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Summary

A new approach which combines TRAFFIC and Compliance poaching indices to provide an overall trend for poaching in absolute terms is proposed. This incorporates penalties on options that imply negative values for local sales of poached lobster, and large changes in the amount poached from year to year. The approach is applied to these indices separated by North and South areas. A range of weighting combinations are reported.

Key words: West coast rock lobster, poaching trends

This document outlines a suggested new approach to combining the TRAFFIC and Compliance inputs to form an aggregated trend of overall poaching. For now, this approach is developed for the resource as a whole, but will have to be expanded later to split total poaching trends between the North and South (A8+) as the North and South areas have different compliance trends. The approach is presented now in this simpler form to give the TG some insight into "how it works"; the purpose is to somewhat narrow the options before taking this next step.

Information available

C_y Annual compliance-based **index** of poaching (weighted average between the North and South used here). This trend is assumed to apply to the combination of illegal local sales and exported lobsters [2009-2020]

T_y TRAFFIC-based estimates of illegally exported lobster [2001-2020]

L_y Annual locally sold poached lobster [2009-2020] [These values are to be **estimated**].

P_y Total annually poached lobster (exported and locally sold added together) [2008-2020]

Assumptions

1) P_y is roughly proportional to C_y, i.e. $P_y = k.\ C_y$+error.

   Thus $k = \frac{\sum_{2009}^{2020} P_y}{\sum_{2009}^{2020} C_y}$.

   Also $P_y = T_y + L_y$

2) A fixed value of locally sold poached lobsters L_{2020} is used for input. Here we set $L_{2020} = 850\ mt$ for most of the illustrative set of example applications shown.

Furthermore

3) L_y should not be negative.
4) P_y should not change too much from year to year.

Estimable parameters: $L_{2009}, L_{2020} \ldots L_{2019}$ (11 estimable parameters).

The values of the estimable parameters are obtained by minimising the following function:

$$SS = w1 * \sum_{2009}^{2020} \left(P_y - kC_y\right)^2 + w2 * \sum_{2009,}^{2020,} {L_y}^2 + w3 * \sum_{2009}^{2020} [P_y - P_{y-1}]^2$$

where $\sum_{2009,}^{2020,} {L_y}^2$ is only summed for those years for which L_y is negative.

The weights w1, w2 and w3 can be varied to see what form of P_y trajectories result.

Note:

By increasing w2, the Local Sales trajectory is pushed higher so that negative values are kept to a minimum.

By increasing w3, the overall poaching trend is "smoothed" over time.

Results

Preliminary results are shown primarily for the scenario of local sales = 850 mt in 2020.

Figure 1 illustrates the compliance trend for the resource as a whole (taking weighted averages of the North and South trends).

Figure 2 shows the different trajectories for different values of weight w2 (where w3=0) where w1=1. Figure 3 compares the Total poaching trajectories for these different w2 weights.

Figure 4 shows the different trajectories for different values of w3 (and w1=1, w2=0), and Figure 5 compares the total poaching trends for the two different w3 values (and w1=1, w2=0).

Figure 6 shows the different poaching trajectories for different values of w3 (and w1=1, w2=5), and Figure 7 compares the total poaching trends for the different w3 values (and w1=1, w2=5).

Changing the value of the estimate of 2020 Locally sold poached lobsters (L(2020)

Results presented so far assume that the 2020 estimate of locally sold poached lobsters is 850mt. Figure 8 shows the poaching trajectories for different estimates of L(2020) (w1=1, w2=5, w3=0.5), and Figure 9 compares the overall poaching trends for different estimates of L(2020) (w1=1, w2=5, w3=0.5).

Discussion

This approach is attractive is being able to produce smoother trends over time and reducing the extent of implied negative numbers of poaching lobsters sold locally in certain years. Naturally its difficulty is the basis on which to select values for the weights w2 and w3 on an "objective" basis.

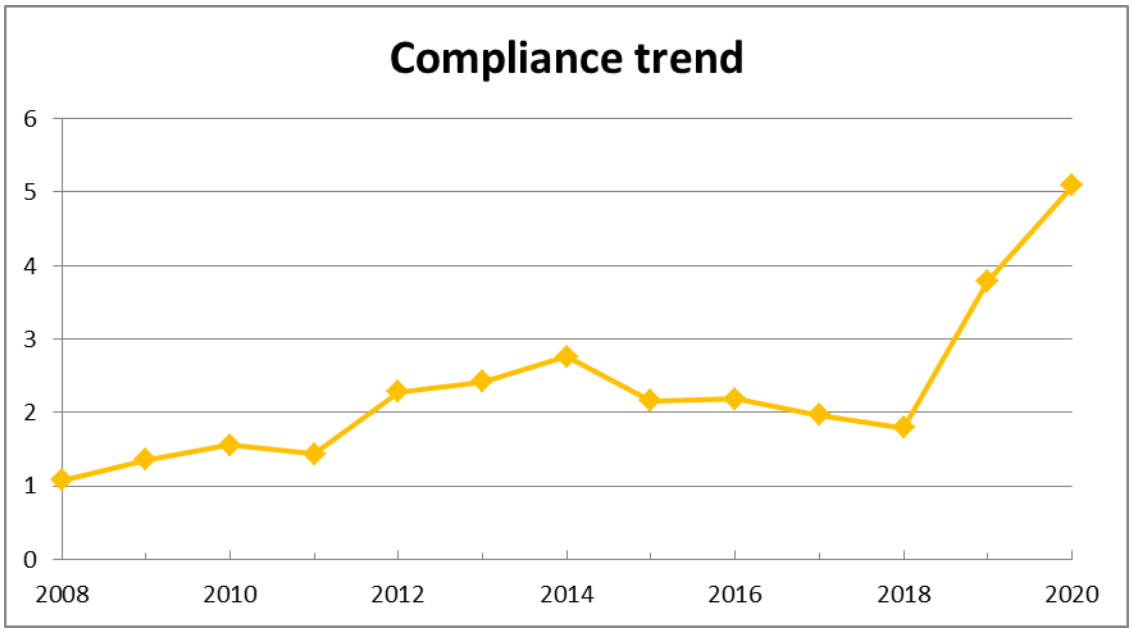

Figure 1: Compliance trend for the resource as a whole (taking weighted averages of the North and South trends).

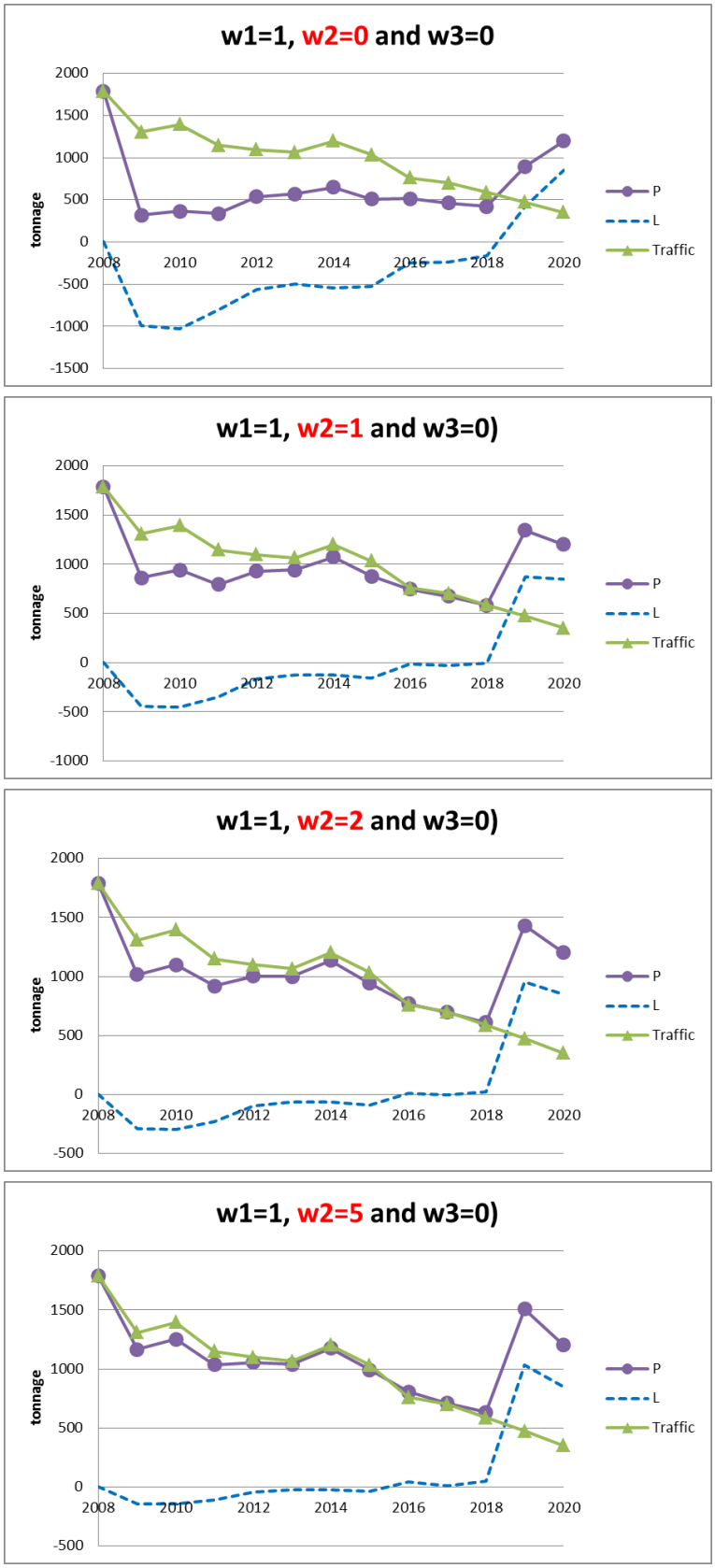

Figure 2: Poaching trajectories for different values of weight w2 (w3=0).

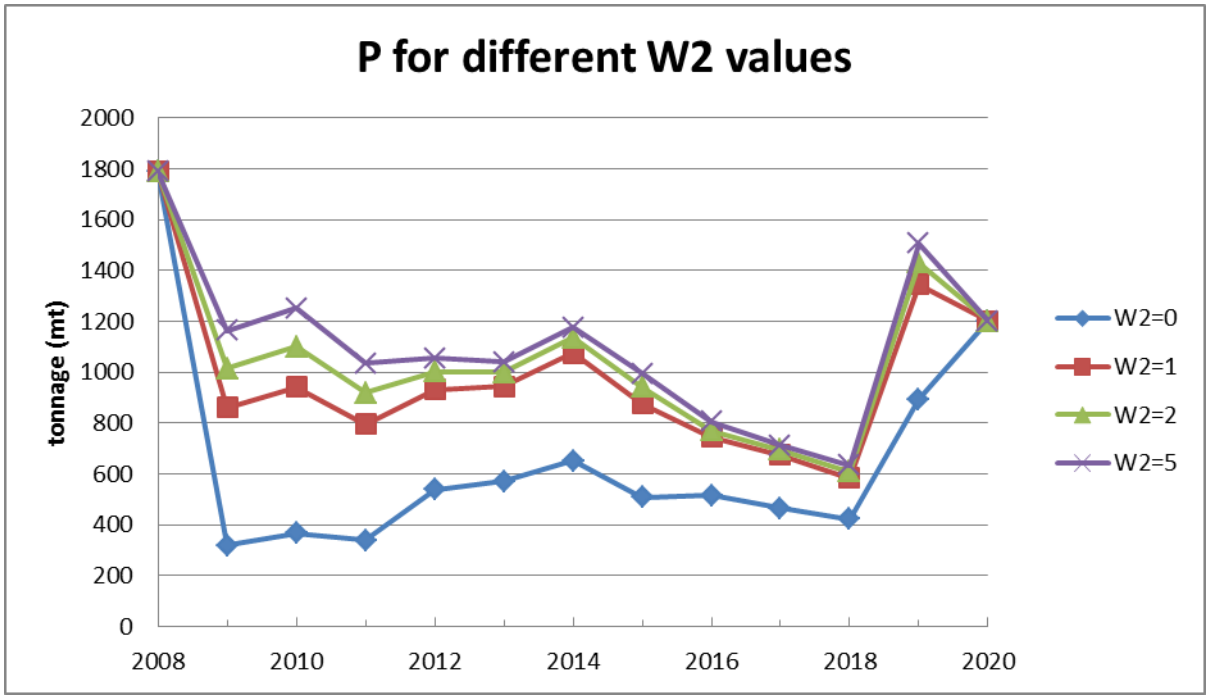

Figure 3: Total poaching trajectories for different w2 weights (for the case w1=1 and w3=0).

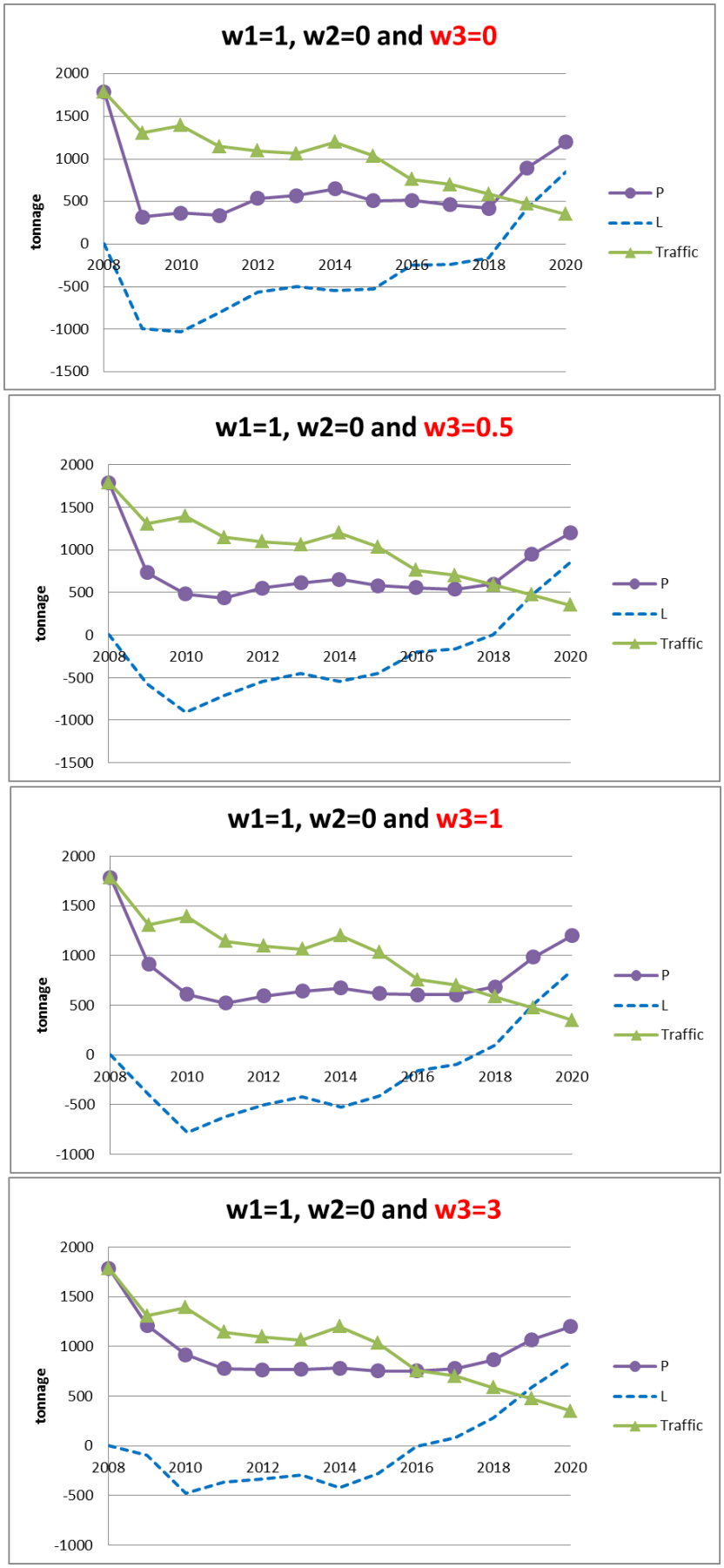

Figure 4: Poaching trajectories for different values of w3 (and w1=1, w2=0).

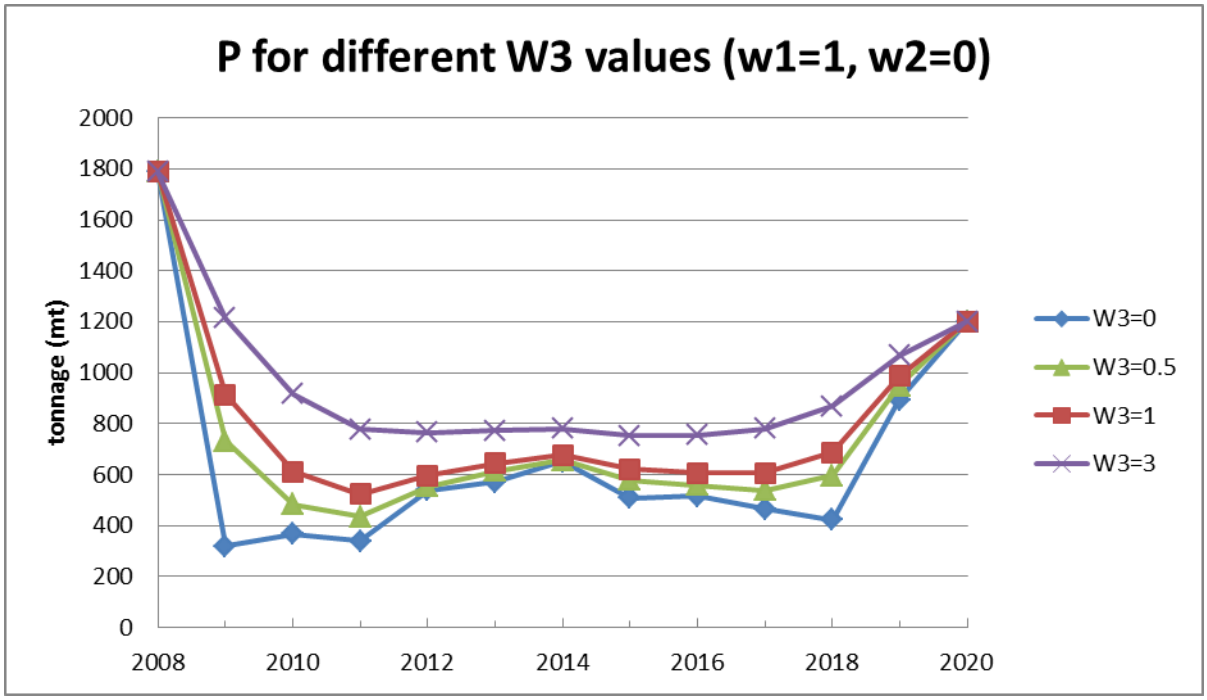

Figure 5: Total poaching trends for different w3 values (and w1=1, w2=0).

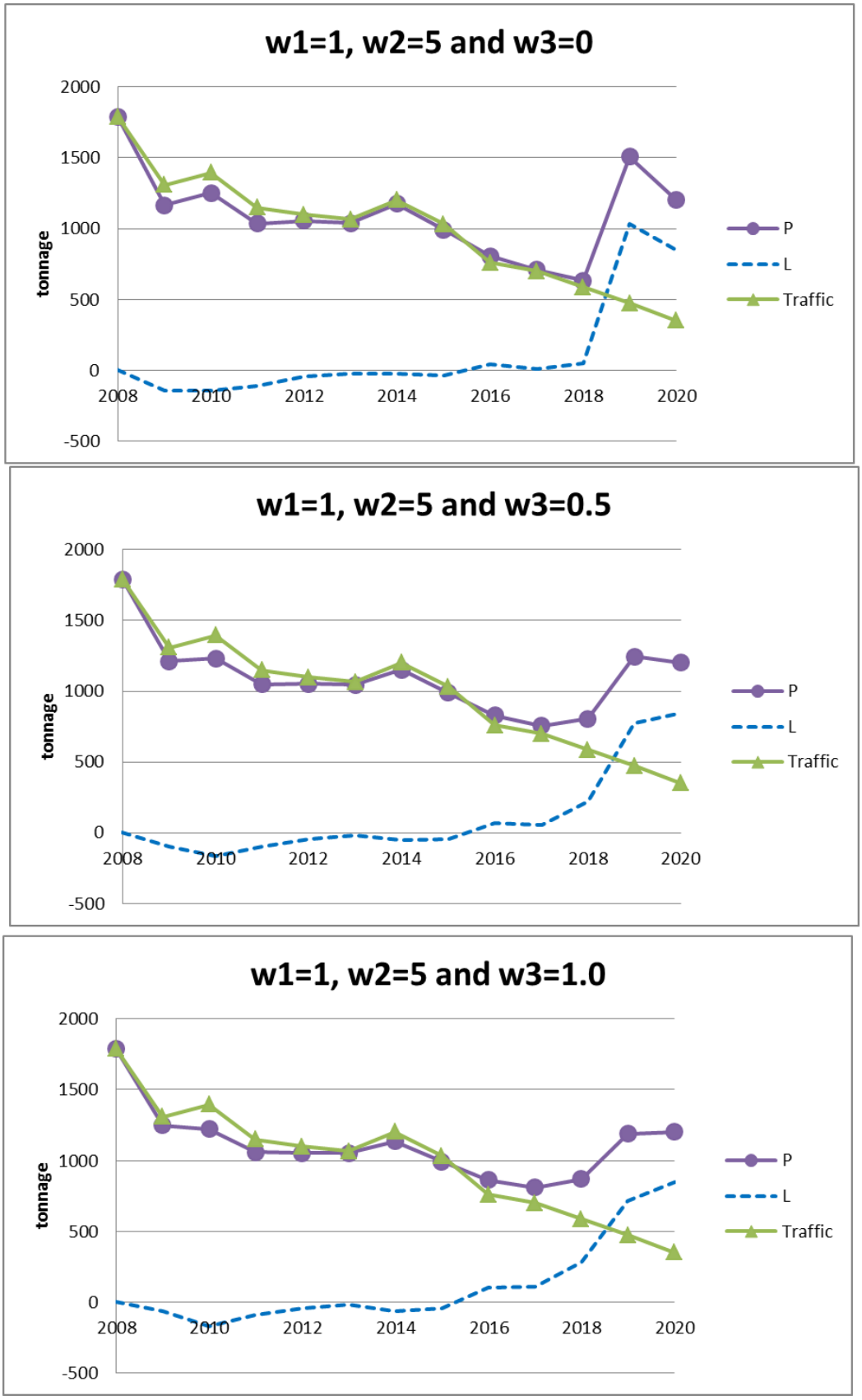

Figure 6: Poaching trajectories for different values of w3 (and w1=1, **w2=5**).

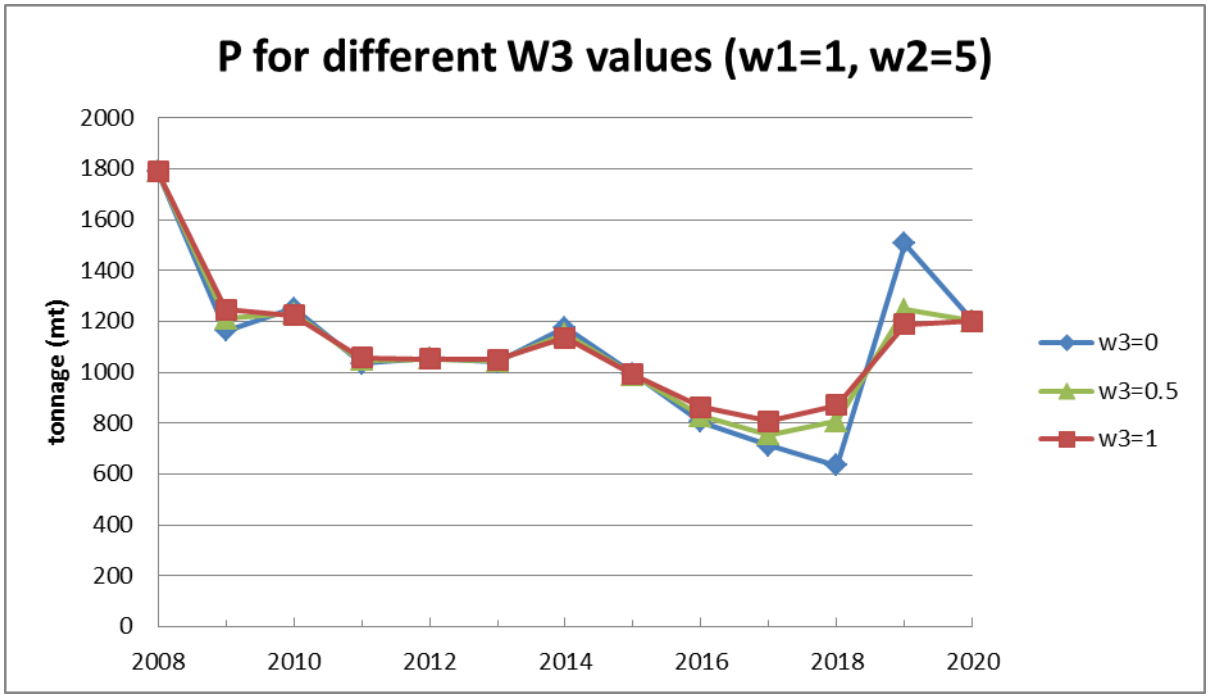

Figure 7: Total poaching trends for different w3 values (and w1=1, w2=5).

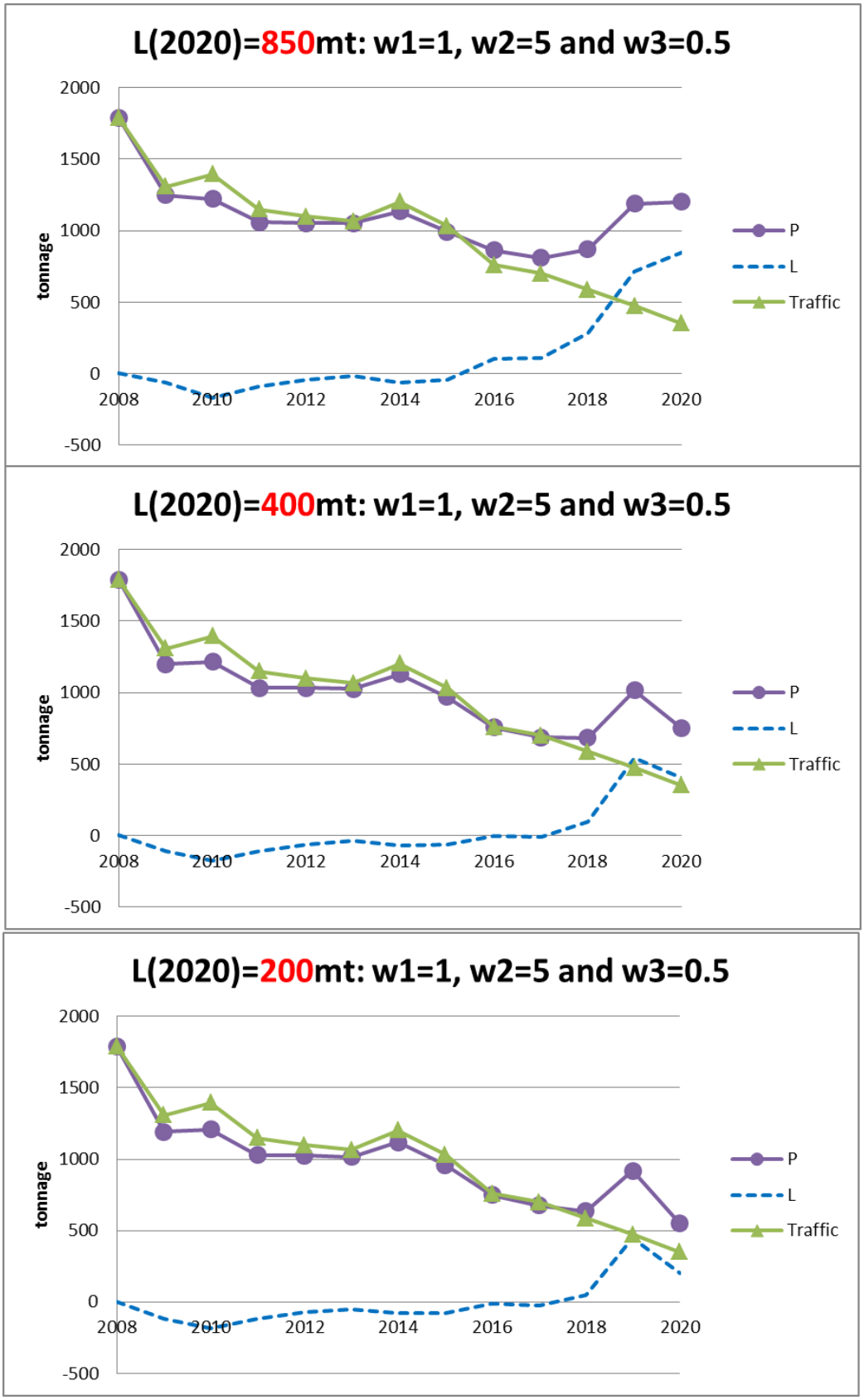

Figure 8: Poaching trajectories for different estimates of L(2020) (for the case w1=1, w2=5, w3=0.5).

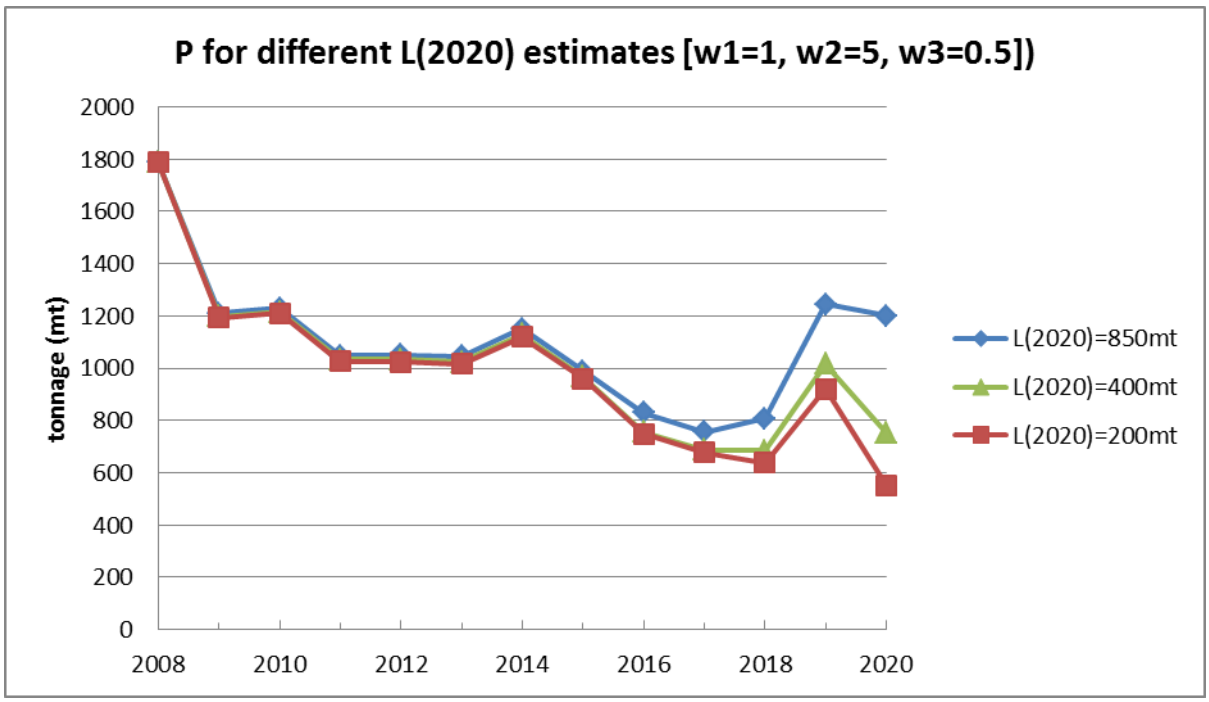

Figure 9: Different poaching trends for different estimates of L(2020) (for the case w1=1, w2=5, w3=0.5).