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Marine and Freshwater Research

Supplementary Material

Cross-jurisdictional larval supply essential for eastern Australian spanner crabs (*Ranina ranina*)

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Table S1. Details of the moorings used in the validation of BRAN2020.

Mooring	Latitude	Longitude	Velocity comparison (dd/mm/yyyy)	Temperature comparison (dd/mm/yyyy)
Coffs50	-30.3105	153.2291	NA	06/11/2016–30/01/2017; 20/09/2017–31/12/2019
Coffs70	-30.2741	153.2991	06/10/2009–22/10/2009; 16/12/2009–26/02/2011; 14/04/2011–28/06/2011; 01-09/2011–27/03/2013; 25/06/2013–11/07/2013; 24/10/2013–18/12/2016; 29/01/2017–31/12/2019	14/08/2009–19/10/2009; 16/12/2009–31/12/2019
Coffs100	-30.2656	153.3955	16/12/2009–19/04/2010; 20/05/2010–13/07/2011; 01/09/2011–21/05/2012; 10/07/2012–11/12/2012; 23/01/2013–05/05/2013; 25/06/2013–14/01/2014; 01/04/2014–06/03/2018; 29/05/2018–31/12/2019	15/12/2009–14/04/2011; 21/06/2011–31/12/2019
EAC0500	-27.3291	153.8989	24/05/2015–02/06/2017; 06/05/2018–24/09/2019	NA
EAC2000	-27.3175	154.0017	22/04/2012–28/08/2013; 23/05/2015–06/04/2019	15/11/2016–02/12/2016; 07/03/2017–23-09-2017; 19/11/2017–04/01/2018
EAC3200	-27.2839	154.1301	22/05/2015–18/11/2015; 18/02/2016–21/09/2019	NA
EAC4200	-27.2391	154.291	NA	NA
EAC4700	-27.2087	154.645	03/11/2016–20/11/2018	NA
GBRCCH	-22.403	151.9882	10/09/2007–18/04/2010; 16/03/2011–04/04/2011; 12/08/2011–29/04/2012; 19/09/2012–24/09/2013; 04/04/2014–31/12/2019	10/09/2007–18/10/2009; 19/09/2012–28/03/2013; 03/04/2014–31/12/2019
GBRHIN	-23.3817	151.9871	12/09/2007–07/10/2012	11/09/2007–11/01/2008; 08/05/2008–16/03/2013
GBRHIS	-23.5132	151.9554	12/09/2007–23/04/2009; 14/10/2009–31/12/2019	12/09/2007–23/04/2009; 14/10/2009–03/09/2019
GBROTE	-23.4827	152.1728	15/09/2007–08/05/2008; 28/10/2008–23/12/2010; 15/03/2011–29/08/2011; 23/03/2012–12/05/2012; 28/09/2012–25/06/2017; 07/10/2017–31/12/2019	14/09/2007–21/04/2009; 18/08/2011–08/11/2013; 11/04/2014–31/03/2017; 07/10/2017–03/09/2019
NRSNSI	-27.3424	153.5618	13/12/2010–29/03/2013; 07/11/2013–31/12/2019	13/12/2010–22/05/2012; 25/06/2012–21/03/2013; 06/06/2013–21/07/2015; 02/09/2015–16/03/2019 24/07/2019–31/12/2019
SEQ200	-27.34	153.7748	01/04/2012–08/06/2013	NA

Mooring	Latitude	Longitude	Velocity comparison (dd/mm/yyyy)	Temperature comparison (dd/mm/yyyy)
SEQ400	-27.3319	153.8765	01/04/2012–08/06/2013	NA

Validations were conducted with Taylor diagrams of velocity and temperature. Moorings can be seen in Figure S2 and the results can be seen in Figure S4. The comparison dates show the time series used in each correlation with breaks in the time series greater than 1 month shown as a gap.

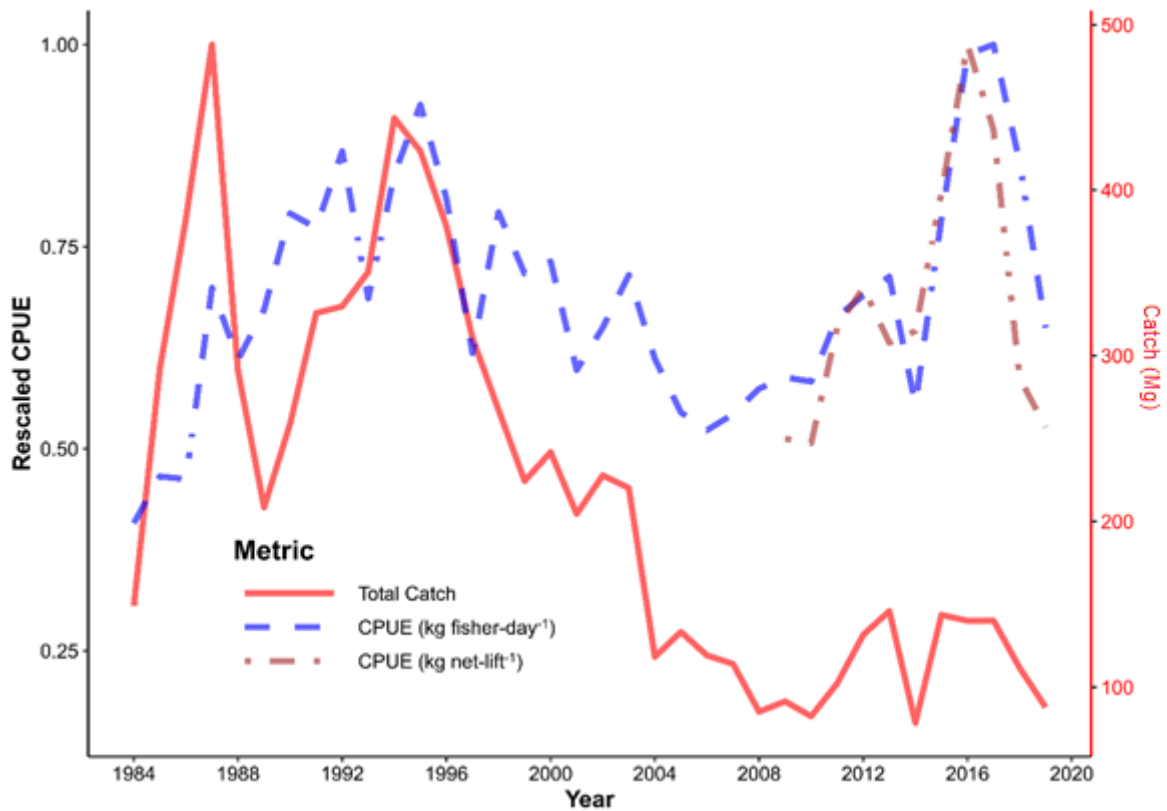


Figure S1. Summary of the NSW Spanner Crab Fishery 1984–2020 (zone 7 in Figure 1) reported as annual averages (July–June). The solid red line shows the total NSW catch (tonnes, Mg) in each year. The dashed blue line shows the catch per unit effort (CPUE) in kilograms of harvest per fisher-day. The brown dash-dot line shows the CPUE in kilograms per net-lift. Commercial fisheries statistics were extracted from NSW DPI FishOnline database

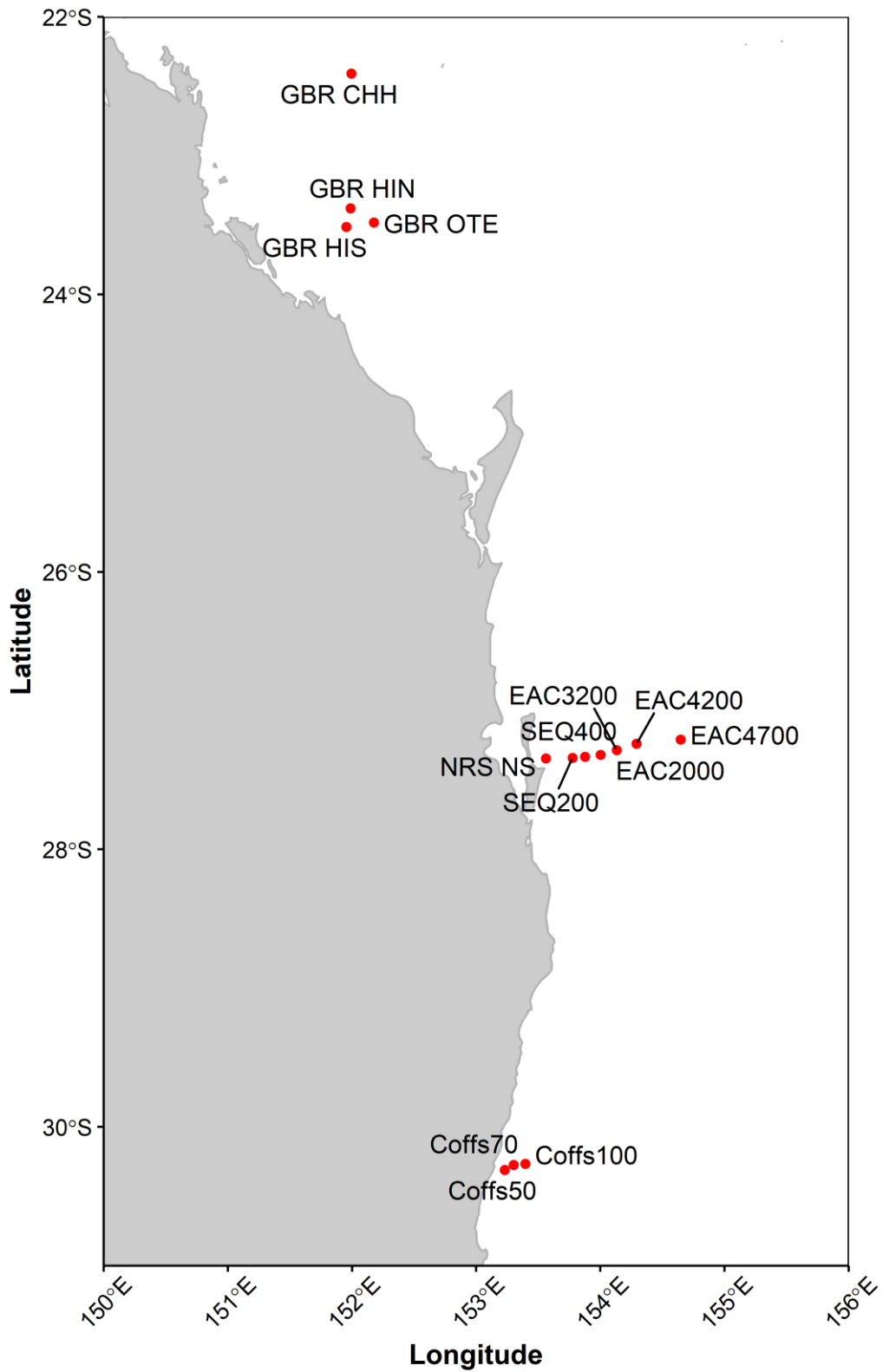


Figure S2. Locations of the moorings used in the comparison of BRAN2020 with observations. Details of the moorings are given in Table S1 with results in Figure S2.

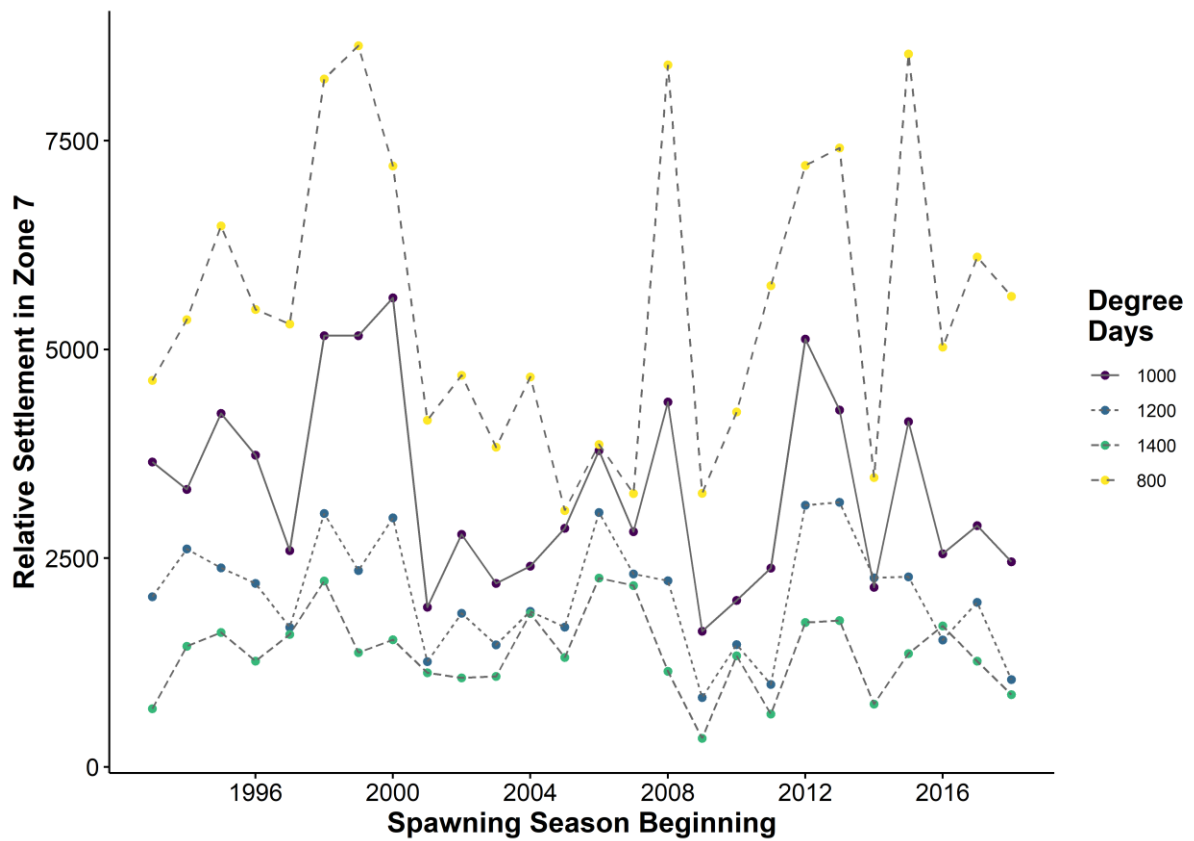


Figure S3. Sensitivity analysis of the degree-days (DD) threshold used in our analysis. This figure replicates Figure 3b which shows the predicted settlement in our main area of interest (zone 7). Colours and line types show various thresholds (800, 1000, 1200 and 1400). The formal analysis for this study used a threshold of 1032.5 DD (Minagawa 1990).

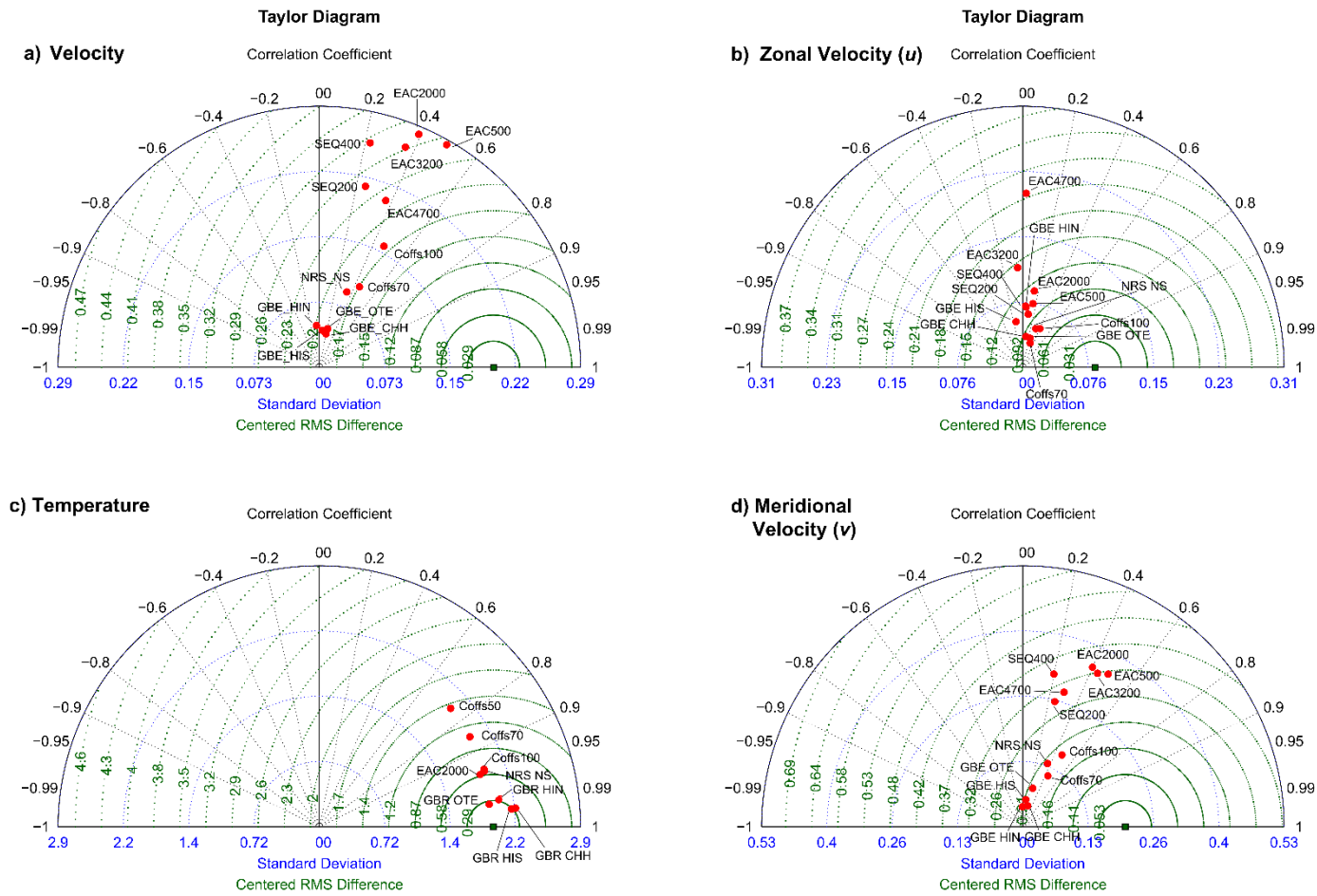


Figure S4. Taylor diagrams comparing the output from BRAN2020 with observations from moorings in eastern Australia. Mooring details are given in Table S1. All comparisons used data from between 10- and 30-m depth.

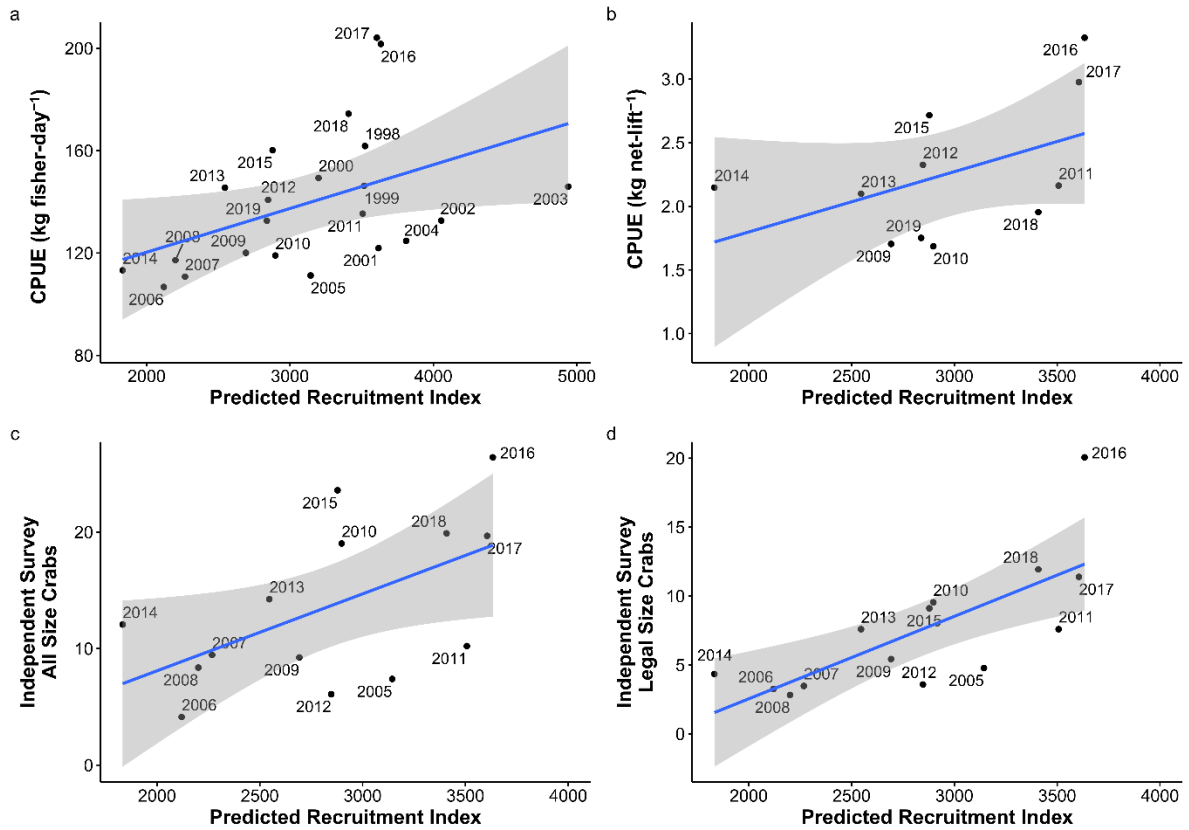


Figure S5. x - y correlation plots between the predicted recruitment index and the various NSW CPUE metrics. A) the long-term kilograms per fisher-day method ($r = 0.45$, $t_{20} = 2.262$, $P = 0.035$), B) the shorter-term kilograms per net-lift method ($r = 0.48$, $t_9 = 1.623$, $P = 0.139$), C) the fishery independent survey method for all crabs ($r = 0.55$, $t_{12} = 2.307$, $P = 0.040$) and, D) the fishery independent survey method for legal size crabs ($r = 0.74$, $t_{12} = 3.793$, $P = 0.003$). Note the predicted recruitment index is a relative measure only. The blue line shows the linear relationship, and the grey ribbon shows the 95% confidence interval.

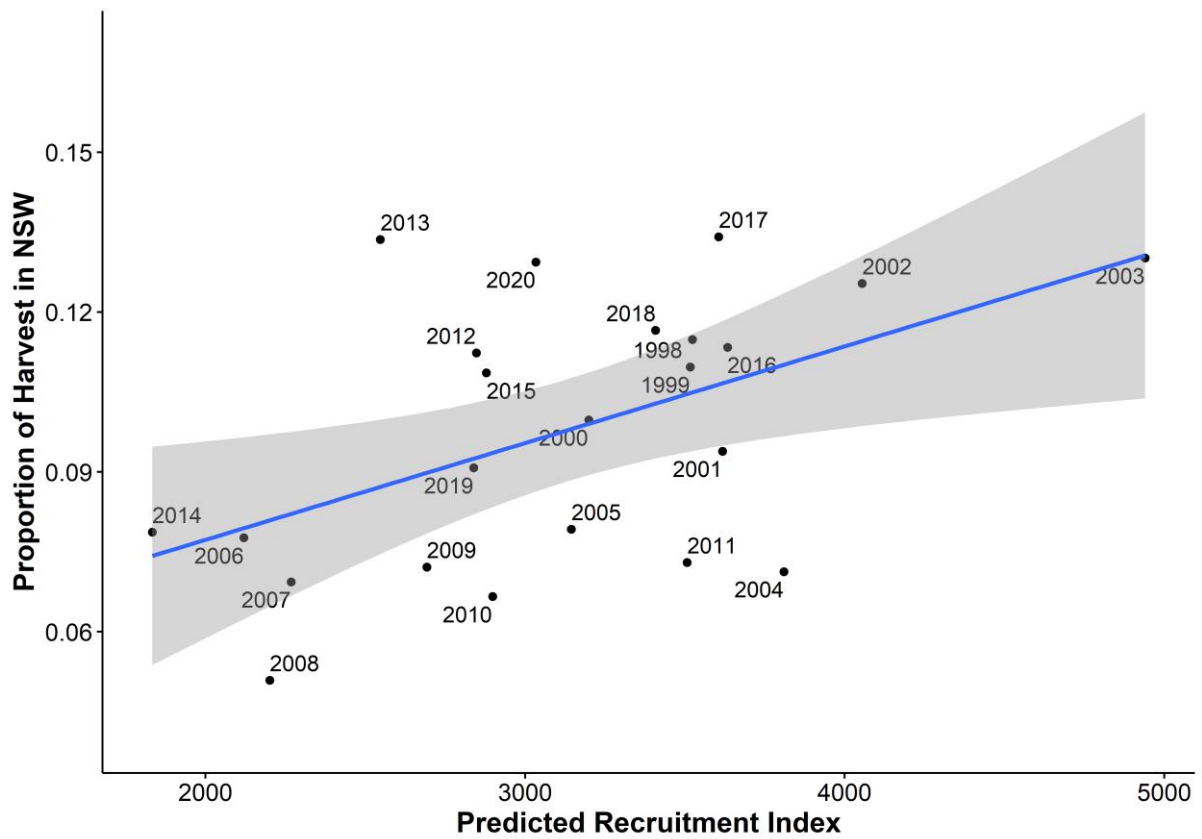


Figure S6. x - y correlation plots between the predicted recruitment index and the proportion of the harvest taken in NSW (out of the total NSW and Qld harvest; $r = 0.51$, $t_{21}=2.262$, $P = 0.013$). Note the predicted recruitment index is a relative measure only. The blue line shows the linear relationship and the grey ribbon shows the 95% confidence interval.

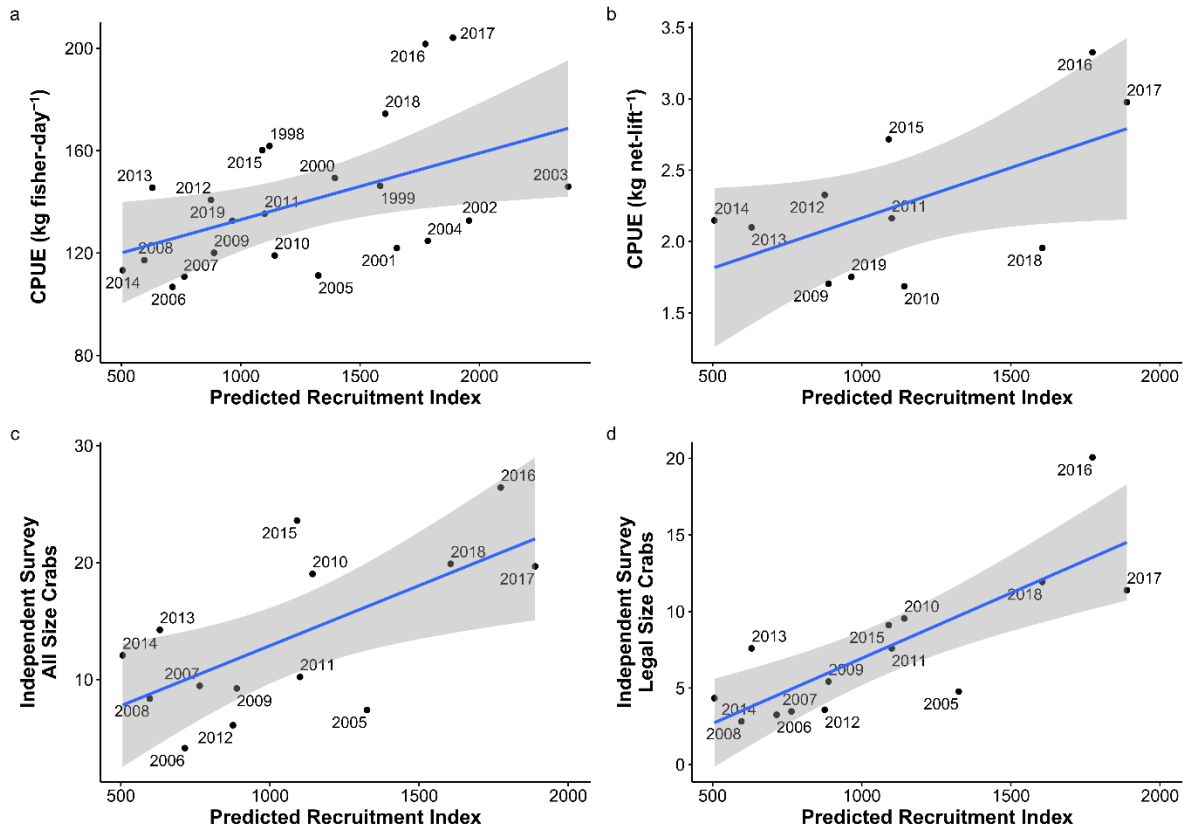


Figure S7. x - y correlation plots between the predicted recruitment index (December spawning only) and the various NSW CPUE metrics. A) the long-term kilograms per fisher-day method ($r = 0.49$, $t_{20}=2.481$, $P = 0.022$), B) the shorter-term kilograms per net-lift method ($r = 0.59$, $t_9=2.168$, $P = 0.059$), C) the fishery independent survey method for all crabs ($r = 0.78$, $t_{12}=4.3378$, $P < 0.001$) and, D) the fishery independent survey method for legal size crabs ($r = 0.84$, $t_{12}=5.447$, $P < 0.001$). Note the predicted recruitment index is a relative measure only. The blue line shows the linear relationship, and the grey ribbon shows the 95% confidence interval.

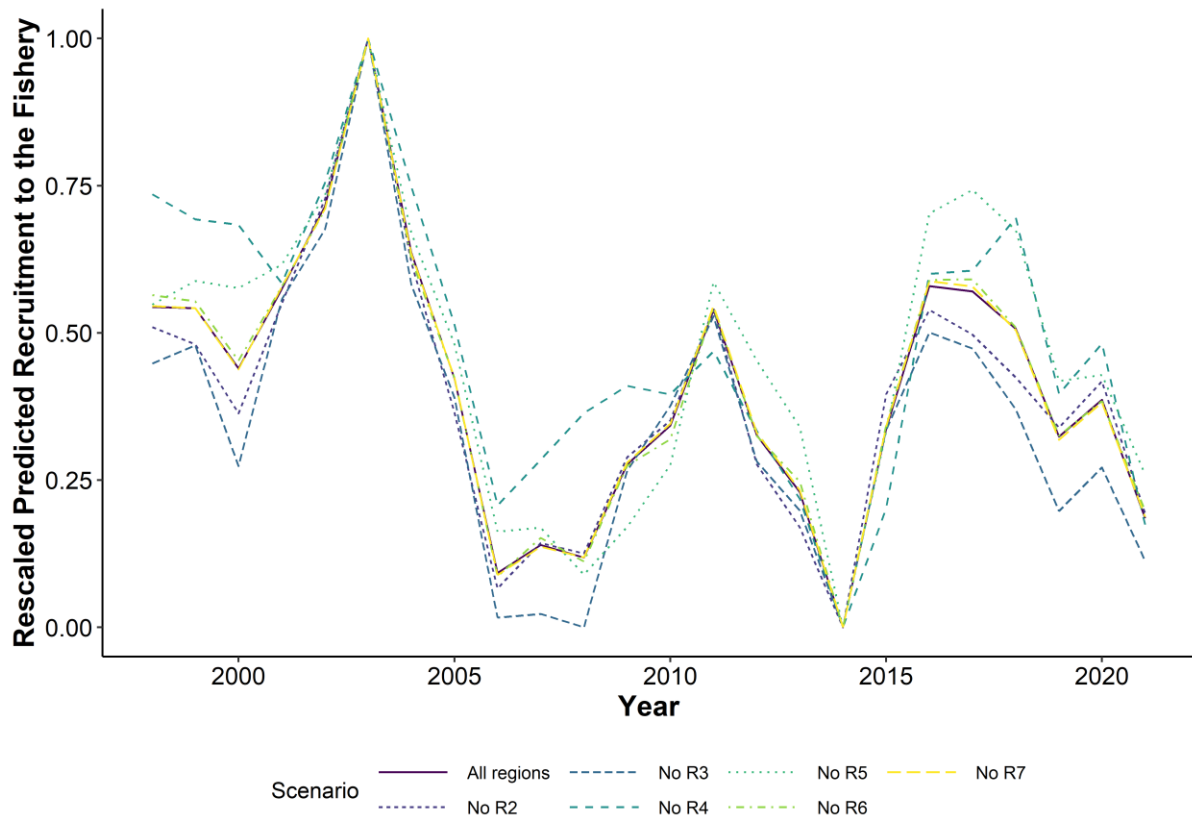


Figure S8. Results from the sensitivity analysis showing the effects of removing spawning from each of the regions. Colours and line types show the tested scenario where “No RX” refers to a simulation run removing spawning from Region X. Regions are shown in Figure 1. The “All regions” line is the same line shown in Figure 4 as the predicted recruitment.