Spillover and competitive exclusion in the crustacean community following the implementation of a marine reserve : Supplementary Material

Authors: Morgane Amelot1,\*\*, Julien Normand2,\*,\*\*, Ivan Schlaich1, Bruno Ernande3

1Ifremer, Laboratoire Ressources Halieutiques de Port-en-Bessin, Avenue du Général deGaulle, 14 520 Port-en-Bessin, France

2Ifremer, Laboratoire Environnement Ressources de Normandie, Avenue du Général de Gaulle, 14 520 Port-en-Bessin, France

3Ifremer, UMR MARBEC, Univ. Montpellier, IFREMER, CNRS, IRD, F-34 090, Montpellier, France

\*Corresponding author: julien.normand@ifremer.fr

\*\*These authors contributed equally to this work

ORCID : MA, 0000-0001-8603-6968, JN, 0000-0003-4020-7789, BE, 0000-0002-0727-5774

**Table 1: Results from the GLMM for CPUE for Lobster in June, estimates and results of the tests**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 0.188 | 0.434 | \*\*\* |
| Location | 0.190 | 0.454 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | 0.108 | 0.274 |  |
| Area (outside) | -0.930 | 0.282 | \*\* |
| Period (before) | -1.628 | 0.174 | \*\*\* |
| Area x Period | 0.783 | 0.090 | \*\*\* |
| Theta = 6.565 | | | |

**Table 2: Results from the GLMM for CPUE for Lobster in September, estimates and results of the tests**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 0.193 | 0.440 | \*\*\* |
| Location | 0.257 | 0.507 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | 0.163 | 0.311 |  |
| Area (outside) | -1.154 | 0.327 | \*\*\* |
| Period (before) | -2.134 | 0.183 | \*\*\* |
| Area x Period | 1.049 | 0.106 | \*\*\* |
| Theta = 6.052 | | | |

**Table 3: Results from the GLMM for CPUE for Edible crab in June, estimates and results of the tests**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 0.115 | 0.339 | \*\*\* |
| Location | 0.134 | 0.367 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | -1.354 | 0.2321 | \*\*\* |
| Area (outside) | 0.920 | 0.2421 | \*\*\* |
| Period (before) | 0.848 | 0.1504 | \*\*\* |
| Area x Period | -1.080 | 0.0989 | \*\*\* |
| Theta = 3.316 | | | |

**Table 4: Results from the GLMM for CPUE for Edible crab in September, estimates and results of the tests**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 0.130 | 0.361 | \*\*\* |
| Location | 0.119 | 0.345 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | -2.416 | 0.439 |  |
| Area (outside) | 0.980 | 0.475 | \* |
| Theta = 2.518 | | | |

**Table 5: Results from the GLMM for CPUE for Spider crab in June, estimates and results of the tests**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 0.084 | 0.289 | \*\*\* |
| Location | 0.104 | 0.323 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | -0.653 | 0.203 |  |
| Area (outside) | -0.549 | 0.212 | \*\* |
| Period (before) | -0.642 | 0.109 | \*\*\* |
| Theta = 3.066 | | | |

**Table 6: Results from the GLMM for CPUE for Spider crab in September, estimates and results of the tests**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 0.160 | 0.400 | \*\*\* |
| Location | 0.502 | 0.709 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | -0.653 | 0.203 |  |
| Area (outside) | -0.549 | 0.212 | \*\* |
| Period (before) | -0.642 | 0.109 | \*\*\* |
| Theta = 2.420 | | | |

**Table 7: Results from the LMM for Cephalothorax length for Lobster in June, estimates and results of the tests.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 7.227 | 2.689 | \*\*\* |
| Location | 12.047 | 3.471 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | 92.401 | 2.109 |  |
| Area (outside) | -7.315 | 2.232 | \*\* |
| Period (before) | -9.281 | 1.158 | NS |
| Area x Period | 10.688 | 0.697 | \*\*\* |

**Table 8: Results from the LMM for Cephalothorax length for Lobster in September, estimates and results of the tests.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 4.467 | 2.113 | \*\*\* |
| Location | 12.607 | 3.551 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | 94.736 | 2.116 |  |
| Area (outside) | -9.298 | 2.283 | \*\*\* |
| Period (before) | -11.082 | 1.121 | NS |
| Area x Period | 11.653 | 0.872 | \*\*\* |

**Table 9: Results from the LMM for Cephalothorax length for Edible crab in June, estimates and results of the tests.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 4.467 | 2.113 | \*\*\* |
| Location | 12.607 | 3.551 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | 94.736 | 2.116 |  |
| Area (outside) | -9.298 | 2.283 | \*\*\* |
| Period (before) | -11.082 | 1.121 | NS |
| Area x Period | 11.653 | 0.872 | \*\*\* |

**Table 10: Results from the LMM for Cephalothorax length for Edible crab in September, estimates and results of the tests.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 19.690 | 4.437 | \*\*\* |
| Location | 122.230 | 11.060 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | 113.311 | 6.529 |  |
| Area (outside) | 20.670 | 7.140 | \*\* |
| Period (before) | 2.715 | 1.982 | NS |
| Area x Period | -3.086 | 1.264 | \* |

**Table 11: Results from the LMM for Cephalothorax length for Spider crab in June, estimates and results of the tests.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 38.000 | 6.165 | \*\*\* |
| Location | 55.590 | 7.456 | \*\*\* |

**Table 12: Results from the LMM for Cephalothorax length for Spider crab in September, estimates and results of the tests.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Random effects** | **Variance** | **Standard deviation** | **LR-test P-Value** |
| Year | 85.970 | 9.272 | \*\*\* |
| Location | 23.810 | 4.880 | \*\*\* |
| **Fixed effects** | **Estimate** | **Standard error** | **Chi² P-Value** |
| Intercept | 78.745 | 4.320 |  |
| Area (outside) | 15.868 | 3.990 | \*\*\* |
| Period (before) | 9.614 | 4.766 | NS |
| Area x Period | -8.029 | 3.536 | \* |