Supplementary Material

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**Figure S1.** (a) Attachment plates for monitoring sessile invertebrates, (b) Installation of attachment plates, (c) Retrieval of attachment plates for monitoring, (d) Capture of attachment plate surface photographs for data collection.

**Table S1.** Sea surface temperature (°C) and salinity (psu) across sampling sites and monitoring time points for each coastal region

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sampling site | Monitoring time point | Sea surface temperature | Salinity | Region |
| SC | 2017-07 | 23.10 | 31.16 | East Sea |
| DH | 2017-07 | 20.50 | 33.52 | East Sea |
| JB | 2017-07 | 21.90 | 33.59 | East Sea |
| YP | 2017-07 | 21.60 | 34.24 | East Sea |
| US | 2017-07 | 23.50 | 23.79 | East Sea |
| SC | 2017-10 | 14.70 | 32.42 | East Sea |
| DH | 2017-10 | 14.30 | 33.54 | East Sea |
| JB | 2017-10 | 15.00 | 34.24 | East Sea |
| YP | 2017-10 | 22.40 | 32.49 | East Sea |
| US | 2017-10 | 22.20 | 31.30 | East Sea |
| SC | 2018-01 | 10.70 | 34.86 | East Sea |
| DH | 2018-01 | 10.30 | 34.57 | East Sea |
| JB | 2018-01 | 11.50 | 35.29 | East Sea |
| YP | 2018-01 | 11.36 | 33.98 | East Sea |
| US | 2018-01 | 10.80 | 34.15 | East Sea |
| SC | 2018-04 | 8.50 | 33.88 | East Sea |
| DH | 2018-04 | 8.40 | 33.43 | East Sea |
| JB | 2018-04 | 10.80 | 34.26 | East Sea |
| YP | 2018-04 | 12.40 | 33.60 | East Sea |
| US | 2018-04 | 19.70 | 33.28 | East Sea |
| BS | 2017-07 | 20.40 | 20.22 | Korea Strait |
| TY | 2017-07 | 24.10 | 30.58 | Korea Strait |
| GY | 2017-07 | 29.30 | 33.66 | Korea Strait |
| YS | 2017-07 | 22.50 | 32.10 | Korea Strait |
| WD | 2017-07 | 18.70 | 33.52 | Korea Strait |
| BS | 2017-10 | 22.20 | 32.60 | Korea Strait |
| TY | 2017-10 | 23.00 | 31.91 | Korea Strait |
| GY | 2017-10 | 25.30 | 30.52 | Korea Strait |
| YS | 2017-10 | 22.90 | 30.94 | Korea Strait |
| WD | 2017-10 | 21.40 | 31.96 | Korea Strait |
| BS | 2018-01 | 13.20 | 35.06 | Korea Strait |
| TY | 2018-01 | 7.10 | 34.10 | Korea Strait |
| GY | 2018-01 | 8.60 | 33.50 | Korea Strait |
| YS | 2018-01 | 7.40 | 33.59 | Korea Strait |
| WD | 2018-01 | 9.10 | 33.82 | Korea Strait |
| BS | 2018-04 | 12.90 | 31.61 | Korea Strait |
| TY | 2018-04 | 13.30 | 33.49 | Korea Strait |
| GY | 2018-04 | 13.10 | 30.52 | Korea Strait |
| YS | 2018-04 | 12.20 | 33.25 | Korea Strait |
| WD | 2018-04 | 12.80 | 33.56 | Korea Strait |
| MP | 2017-07 | 23.90 | 28.89 | Yellow Sea |
| BE | 2017-07 | 23.80 | 31.32 | Yellow Sea |
| DJ | 2017-07 | 22.40 | 31.94 | Yellow Sea |
| IC | 2017-07 | 24.40 | 30.71 | Yellow Sea |
| MP | 2017-10 | 21.90 | 24.30 | Yellow Sea |
| BE | 2017-10 | 21.80 | 31.08 | Yellow Sea |
| DJ | 2017-10 | 22.50 | 29.67 | Yellow Sea |
| IC | 2017-10 | 22.30 | 28.54 | Yellow Sea |
| MP | 2018-01 | 6.60 | 32.02 | Yellow Sea |
| BE | 2018-01 | 4.70 | 32.33 | Yellow Sea |
| DJ | 2018-01 | 6.20 | 30.78 | Yellow Sea |
| IC | 2018-01 | 3.30 | 29.71 | Yellow Sea |
| MP | 2018-04 | 11.40 | 30.20 | Yellow Sea |
| BE | 2018-04 | 11.00 | 31.24 | Yellow Sea |
| DJ | 2018-04 | 9.40 | 30.31 | Yellow Sea |
| IC | 2018-04 | 8.60 | 30.48 | Yellow Sea |

**Table S2.** Two-way analysis of variance (ANOVA) table for sea surface temperature (°C) and salinity (psu) with respect to sampling date and coastal region for two key independent variables

|  |
| --- |
| **Sea Surface Temperature (°C)** |
|  | DF | F-Value | p-value |
| Sampling date | 3 | 105.9 | <0.0001 |
| Coastal region | 2 | 2.35 | 0.1065 |
| Sampling date \* Coastal region | 6 | 3.84 | 0.0036 |
| **Salinity (psu)** |
| Sampling date | 3 | 3.74 | 0.0176 |
| Coastal region | 2 | 6.3 | 0.0039 |
| Sampling date \* Coastal region | 6 | 0.72 | 0.6329 |

**Table S3**. Two-way ANOVA of total percent cover of non-indigenous species with respect to sampling date and region, the two key independent variables

|  |
| --- |
| Total Abundance |
|  | DF | F-Value | p-value |
| sampling date | 3 | 1.45 | 0.2423 |
| Region | 2 | 4.05 | 0.0244 |
| sampling date\*Region | 6 | 1.92 | 0.0988 |

**Table S4**. Two-way analysis of variance (ANOVA) table for total abundance, species richness, and corrected Shannon index with respect to sampling date and region, the two key independent variables

|  |
| --- |
| Total Abundance |
|  | DF | F-Value | p-value |
| sampling date | 3 | 0.914 | 0.442 |
| Region | 2 | 0.769 | 0.470 |
| sampling date\*Region | 6 | 0.531 | 0.782 |
| **Species richness** |
|  | DF | F-Value | p-value |
| sampling date | 3 | 3.784 | 0.017 |
| Region | 2 | 0.507 | 0.606 |
| sampling date\*Region | 6 | 0.544 | 0.772 |
| **Corrected Shannon index**  |
|  | DF | F-Value | p-value |
| sampling date | 3 | 0.862 | 0.468 |
| Region | 2 | 0.839 | 0.439 |
| sampling date\*Region | 6 | 0.738 | 0.622 |

**Table S5.** Total abundance (%), species richness, and corrected Shannon index across sampling dates and points

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sampling date | Sampling Point | Abundance | Richness | Shannon Index | Invasive Species Abundance |
| 2017-07 | BE | 39.37 | 13 | 1.80 | 19.18 |
| 2017-07 | BS | 24.46 | 9 | 1.32 | 21.41 |
| 2017-07 | DH | 6.16 | 7 | 1.08 | 5.42 |
| 2017-07 | DJ | 9.35 | 9 | 1.55 | 3.68 |
| 2017-07 | GY | 0 | 0 | 0.00 | 0 |
| 2017-07 | IC | 31.2 | 8 | 1.47 | 12.76 |
| 2017-07 | JB | 1.38 | 7 | 1.62 | 0.84 |
| 2017-07 | MP | 27.63 | 9 | 1.84 | 9.34 |
| 2017-07 | SC | 11.64 | 9 | 1.30 | 9.51 |
| 2017-07 | TY | 28.41 | 10 | 1.91 | 17.32 |
| 2017-07 | US | 0 | 0 | 0.00 | 0 |
| 2017-07 | WD | 3.34 | 5 | 1.36 | 1.7 |
| 2017-07 | YP | 27.39 | 15 | 2.10 | 9.51 |
| 2017-07 | YS | 16.79 | 8 | 1.11 | 14.7 |
| 2017-10 | BE | 15.65 | 15 | 1.81 | 4.56 |
| 2017-10 | BS | 88.32 | 8 | 0.97 | 46.14 |
| 2017-10 | DH | 22.06 | 17 | 2.22 | 8.94 |
| 2017-10 | DJ | 12.18 | 8 | 1.62 | 7.41 |
| 2017-10 | GY | 6.26 | 12 | 1.87 | 3.67 |
| 2017-10 | IC | 17.15 | 9 | 1.10 | 11.38 |
| 2017-10 | JB | 18.27 | 15 | 1.67 | 15.06 |
| 2017-10 | MP | 11.28 | 11 | 1.82 | 3.29 |
| 2017-10 | SC | 20.76 | 9 | 1.71 | 8.82 |
| 2017-10 | TY | 33.89 | 13 | 1.38 | 3.67 |
| 2017-10 | US | 13.62 | 10 | 1.69 | 3.36 |
| 2017-10 | WD | 22.78 | 11 | 1.11 | 0.89 |
| 2017-10 | YP | 29.75 | 15 | 1.95 | 17.57 |
| 2017-10 | YS | 18.3 | 8 | 1.16 | 6.79 |
| 2018-01 | BE | 44.79 | 13 | 1.55 | 33.09 |
| 2018-01 | BS | 12.13 | 16 | 1.82 | 2.2 |
| 2018-01 | DH | 21.1 | 12 | 1.86 | 17.02 |
| 2018-01 | DJ | 30.8 | 9 | 1.17 | 28.09 |
| 2018-01 | GY | 0 | 0 | 0.00 | 0 |
| 2018-01 | IC | 11.66 | 6 | 1.18 | 10.26 |
| 2018-01 | JB | 34.09 | 11 | 1.69 | 24.59 |
| 2018-01 | MP | 80.02 | 11 | 1.01 | 74.14 |
| 2018-01 | SC | 17.88 | 10 | 1.69 | 12.12 |
| 2018-01 | TY | 43.4 | 15 | 1.67 | 9.05 |
| 2018-01 | US | 19.86 | 14 | 2.21 | 12.25 |
| 2018-01 | WD | 15.14 | 7 | 1.12 | 1.89 |
| 2018-01 | YP | 43.14 | 14 | 1.95 | 27.39 |
| 2018-01 | YS | 14.6 | 11 | 0.88 | 14.26 |
| 2018-04 | BE | 21.66 | 8 | 1.50 | 17.15 |
| 2018-04 | BS | 7.88 | 10 | 1.71 | 1.55 |
| 2018-04 | DH | 8.19 | 10 | 1.83 | 0.75 |
| 2018-04 | DJ | 30.15 | 9 | 0.93 | 24.85 |
| 2018-04 | GY | 14.77 | 10 | 1.30 | 6.07 |
| 2018-04 | IC | 12.96 | 7 | 1.11 | 10.93 |
| 2018-04 | JB | 8.39 | 6 | 1.29 | 1.97 |
| 2018-04 | MP | 86.18 | 12 | 1.13 | 78.03 |
| 2018-04 | SC | 8.12 | 6 | 1.50 | 1.7 |
| 2018-04 | TY | 58.07 | 9 | 1.90 | 27.57 |
| 2018-04 | US | 39.1 | 9 | 1.89 | 22.29 |
| 2018-04 | WD | 0 | 0 | 0.00 | 0 |
| 2018-04 | YP | 42.96 | 8 | 1.41 | 22.61 |
| 2018-04 | YS | 36.58 | 2 | 0.18 | 1.64 |

**Table S6.** Average attachment ratio (%) of observed species according to coastal region, overall mean, and standard deviation for all coastal regions and Z-score (species with a Z-score greater than 1.96 (p<0.05) are considered to appear at a higher rate in a specific region compared to others, they are highlighted in bold in the table. All species' overall attachment ratio and standard deviation are provided below the table for each season)

|  |  |
| --- | --- |
| July 2017 | Observed Species |
|  | HBO | ECR | MGA | AAM | AEB | BTR | MRO | PPE | BNE | BCA | TOC | JTU | SUN | WSU | DVE | AAS | CRO | CSA | MMA | BDI | **BSC\*** | BVI | SCL | SPL |
| East Sea | 0.44 | 0.00 | 0.01 | 0.00 | 0.00 | 0.25 | 0.00 | 0.35 | 1.35 | 0.01 | 0.25 | 0.00 | 0.75 | 2.11 | 0.32 | 0.06 | 0.20 | 0.00 | 0.00 | 0.92 | **2.15** | 0.00 | 0.08 | 0.06 |
| Korea Strait | 0.00 | 0.23 | 0.71 | 0.00 | 0.12 | 0.31 | 0.16 | 3.05 | 0.45 | 0.00 | 0.14 | 0.00 | 0.56 | 1.11 | 0.00 | 2.08 | 0.18 | 0.07 | 0.00 | 1.35 | **3.37** | 0.60 | 0.00 | 0.09 |
| Yellow Sea | 0.00 | 0.01 | 0.50 | 0.11 | 0.00 | 0.00 | 0.02 | 0.00 | 0.15 | 0.18 | 4.21 | 0.03 | 0.41 | 1.03 | 3.39 | 1.31 | 1.63 | 4.98 | 0.31 | 3.43 | **4.09** | 0.82 | 0.31 | 0.00 |
| Average | 0.15 | 0.08 | 0.41 | 0.04 | 0.04 | 0.19 | 0.06 | 1.13 | 0.65 | 0.06 | 1.54 | 0.01 | 0.58 | 1.42 | 1.24 | 1.15 | 0.67 | 1.68 | 0.10 | 1.90 | **3.20** | 0.47 | 0.13 | 0.05 |
| Z-score | -0.48 | -0.54 | -0.26 | -0.58 | -0.57 | -0.45 | -0.56 | 0.37 | -0.05 | -0.55 | 0.71 | -0.60 | -0.11 | 0.61 | 0.46 | 0.38 | -0.03 | 0.84 | -0.52 | 1.03 | **2.15** | -0.20 | -0.50 | -0.56 |
| Average for total observation | 0.71 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Stdev for total observation | 1.16 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| October 2017 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | HBO | ECR | MGA\* | MGI | AAM | AEB | AIM | BTR | MRO | PPE | BNE | BCA | TOC | JTU | SUN | WSU | DVE | AAS | CRO | CSA | MMA | HMO | SCL | SPL | SRE |
| East Sea | 1.69 | 0.32 | 3.28 | 0.22 | 0.00 | 0.53 | 1.30 | 2.37 | 0.02 | 2.96 | 1.46 | 0.02 | 1.48 | 0.06 | 0.31 | 3.97 | 0.04 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.30 | 0.48 | 0.07 |
| Korea Strait | 0.00 | 0.00 | 8.95 | 3.43 | 0.17 | 0.12 | 2.23 | 11.10 | 2.84 | 0.19 | 0.12 | 0.03 | 0.94 | 0.01 | 0.00 | 0.23 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.02 | 1.90 | 0.67 |
| Yellow Sea | 0.03 | 0.00 | 1.05 | 0.47 | 2.82 | 0.54 | 1.08 | 1.07 | 0.12 | 0.03 | 0.34 | 0.05 | 0.01 | 0.07 | 0.00 | 1.49 | 1.14 | 0.13 | 0.23 | 1.16 | 0.29 | 0.07 | 1.87 | 0.00 | 0.02 |
| Average | 0.57 | 0.11 | 4.43 | 1.37 | 1.00 | 0.40 | 1.53 | 4.85 | 0.99 | 1.06 | 0.64 | 0.03 | 0.81 | 0.04 | 0.10 | 1.90 | 0.66 | 0.05 | 0.08 | 0.39 | 0.10 | 0.08 | 0.73 | 0.79 | 0.25 |
| Z-score | -0.19 | -0.45 | 1.94 | 0.25 | 0.04 | -0.29 | 0.34 | 2.17 | 0.04 | 0.08 | -0.15 | -0.49 | -0.06 | -0.48 | -0.45 | 0.54 | -0.14 | -0.48 | -0.46 | -0.29 | -0.45 | -0.46 | -0.10 | -0.07 | -0.37 |
| Average for total observation | 0.92 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Stdev for total observation | 1.81 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| January 2018 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | HBO | MGA\* | MGI | AAM | AEB | BTR | MRO | PPE | BNE | BCA | TOC | JTU | WSU | DVE | AAS | CRO | CSA | HMO | BDI | BSC | BVI | SCL | SPL | SRE |
| East Sea | 0.97 | 5.39 | 0.68 | 0.16 | 0.43 | 2.42 | 0.04 | 3.65 | 1.50 | 0.08 | 1.16 | 0.00 | 6.02 | 1.13 | 0.21 | 0.34 | 0.00 | 0.00 | 0.29 | 0.53 | 0.00 | 0.25 | 1.58 | 0.36 |
| Korea Strait | 0.50 | 0.11 | 0.30 | 0.00 | 4.13 | 1.15 | 1.96 | 0.30 | 0.46 | 0.00 | 2.23 | 0.00 | 0.11 | 2.70 | 0.13 | 0.07 | 0.01 | 0.22 | 0.01 | 0.61 | 0.13 | 0.10 | 1.40 | 0.44 |
| Yellow Sea | 0.00 | 12.56 | 0.00 | 2.84 | 0.12 | 0.15 | 0.04 | 0.00 | 0.02 | 0.13 | 0.00 | 0.17 | 6.59 | 13.47 | 0.08 | 0.12 | 0.89 | 0.00 | 0.86 | 0.78 | 0.09 | 2.52 | 0.00 | 0.40 |
| Average | 0.49 | 6.02 | 0.33 | 1.00 | 1.56 | 1.24 | 0.68 | 1.32 | 0.66 | 0.07 | 1.13 | 0.06 | 4.24 | 5.77 | 0.14 | 0.18 | 0.30 | 0.07 | 0.39 | 0.64 | 0.07 | 0.96 | 1.00 | 0.40 |
| Z-score | -0.29 | 1.96 | -0.35 | -0.08 | 0.15 | 0.02 | -0.21 | 0.05 | -0.22 | -0.46 | -0.03 | -0.46 | 1.24 | 1.86 | -0.43 | -0.41 | -0.36 | -0.46 | -0.33 | -0.23 | -0.46 | -0.10 | -0.08 | -0.32 |
| Average for total observation | 1.20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Stdev for total observation | 2.46 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| April 2018 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Species | HBO | ECR | MGA | AAM | AEB | AIM | BTR | MRO | PPE | BCA | TOC | WSU | DVE | AAS | CRO | CSA | HMO | BDI | BVI | SCL | SPL |
| East Sea | 3.77 | 0.00 | 0.00 | 0.00 | 0.87 | 0.00 | 0.47 | 0.01 | 1.22 | 0.05 | 0.00 | 0.00 | 6.34 | 0.51 | 0.03 | 0.20 | 0.00 | 4.52 | 0.00 | 1.58 | 1.80 |
| Korea Strait | 1.40 | 0.00 | 0.01 | 0.00 | 0.00 | 9.33 | 0.38 | 0.00 | 0.04 | 0.00 | 0.03 | 0.08 | 2.23 | 3.66 | 0.25 | 0.07 | 0.02 | 3.46 | 0.33 | 1.14 | 1.02 |
| Yellow Sea | 0.23 | 0.08 | 13.28 | 2.33 | 0.00 | 1.08 | 0.34 | 0.03 | 0.05 | 0.16 | 0.17 | 6.95 | 9.77 | 0.11 | 0.00 | 0.37 | 0.00 | 0.87 | 0.26 | 1.68 | 0.00 |
| Average | 1.80 | 0.03 | 4.43 | 0.78 | 0.29 | 3.47 | 0.40 | 0.01 | 0.44 | 0.07 | 0.07 | 2.34 | 6.11 | 1.43 | 0.09 | 0.21 | 0.01 | 2.95 | 0.19 | 1.47 | 0.94 |
| Z-score | 0.19 | -0.49 | 1.19 | -0.20 | -0.39 | 0.82 | -0.35 | -0.49 | -0.33 | -0.47 | -0.47 | 0.39 | 1.83 | 0.04 | -0.46 | -0.42 | -0.50 | 0.62 | -0.42 | 0.06 | -0.14 |
| Average for total observation | 1.31 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Stdev for total observation | 2.63 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Table S7.** Summary of linear regression analyses for *Amphibalanus amphitrite* (AAM), *Didemnum vexillum* (DVE), and *Perforatus perforatus* (PPE) (the table includes regression equation, slope with 95% confidence interval, intercept with 95% confidence interval, and R² value for each species)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Regression Equation | Slope (95% CI) | Intercept (95% CI) | R² |
| *Botryllus schlosseri*(BSC) | y = -0.029x + 0.55 | -0.029 (-0.0791, 0.0208) | 0.55 (0.2926, 0.8028) | 0.1447 |
| *Mytilus galloprovincialis* (MGA) | y = 0.01x + 0.42 | 0.01 (-0.0043, 0.0254) | 0.42 (0.2226, 0.6191) | 0.1830 |
| *Amphibalanus Amphitrite* (AAM) | y = -0.053x + 0.63 | -0.053 (-0.1152, 0.0091) | 0.63 (0.3786, 0.8841) | 0.2073 |
| *Didemnum vexillum* (DVE) | y = 0.012x + 0.43 | 0.012 (-0.0097, 0.0336) | 0.43 (0.1493, 0.7074) | 0.0987 |
| *Perforatus perforatus* (PPE) | y = 0.015x + 0.59 | 0.015 (-0.0879, 0.1185) | 0.59 (0.3180, 0.8651) | 0.0053 |