**Equation**

Logistic regression formula for proportion of Mytilus trossulus (Ptros) as a function of proportion of T-morphotype (PT): Ptros equals e raised to the power of (-2.4 + 5.4 PT), divided by 1 plus the same exponential term.

**Figure 1**

Sampling maps with parameter-specific point styles. Top left: Point size indicates fetch (coastal openness to surf; inset: Europe map). Top right: Point color intensity shows salinity (lighter = lower salinity). Bottom left: Color intensity reflects Mytilus trossulus frequency on bottom substrates (darker = higher frequency; inset: local-scale map). Bottom right: Same for algal substrates.

**Figure 2**

Left graphs: Regression model 1. Top four lines show Mytilus trossulus frequency vs. predictors: 1) U-shaped salinity curve (min at 24 PSU), 2) horizontal line (distance to the nearest river), 3) and 4) declining lines (dependence on the distance to the nearest port and on surf level). Bottom bars: M. trossulus frequency (light algae, dark = bottom substrates) near small/large rivers—light bars higher.

Right graphs: Regression model 2. Top four plots compare T-morphotype (solid) and E-morphotype (dashed) abundance vs. predictors: 1) salinity (T horiontal, E rising), 2) distance to river (both rise), 3) distance to port (T declines, E horizontal), 4) surf (T declines, E flat). Bottom bars: T (dark) and E (light) abundance near small/large rivers.

**Figure 3**

Regression model 3 visualization. Left: Bell-shaped curve showing the dependence of the proportion difference (algae vs. bottom substrates) of Mytilus trossulus on its frequency in a site. Middle: Decreasing line for PC one (proxy for T-morphotype abundance). Right: Increasing line for PC two (proxy for E-morphotype abundance).

**Figure 4**

Evaluation of Model one's predictive power for M. trossulus frequency. All plots compare observed (X-axis) vs. predicted (Y-axis) values, with a dashed diagonal line indicating perfect prediction. Top left: training White Sea data. Top right: White Sea littoral test data. Bottom left: Barents Sea littoral test data. Bottom right: Barents Sea sublittoral test data (shows weaker fit). Most points (except bottom right) cluster in quadrants one and three, indicating generally accurate predictions.

**Figure S1**

Map of the Kandalaksha Bay of the White Sea. The inset shows the position of samples used as testing data set.

**Figure S2**

Associations between the environmental parameters. Top left: Positive correlation between salinity (Y-axis) and distance to river – salinity increases farther from rivers. Top right: Violin plots show higher salinity near large rivers (right) vs. small rivers (left). Bottom left: Surf increases with distance from ports. Bottom right: No clear relationship between salinity and port distance.