Text S1. Supplementary Material and Methods (and references).

2.1 *Study sites, occurrence of* F.serratus *and other fucoid macroalgae, and environmental variables.*

The Ría de Muros, the northernmost of the Rías Baixas, covers an area of 90 km^2 with an average volume of 2060 hm^3 and a length of 13 km along its main axis. The primary source of freshwater inflow to this ria is the river Tambre, with a smaller contribution from the river Tines (Carballo et al. 2009). The Ría de Arousa is the largest of the four rias, spanning an area of 230 km^2, with an average volume of 4800 hm^3 and a length of 33.1 km along its main axis. Two main rivers flow into this inlet: the Umia and the Ulla (Fig. 1). The largest inflow of freshwater in this ria, and to the Rías Baixas, is from the river Ulla. The island of Sálvora divides the mouth of the ria, with water exchange to the shelf predominantly occurring through the southern mouth, since the northern mouth is quite shallow (10 m, Rosón et al. 1995).

The intertidal rocky platform was carefully inspected at each site in the field surveys carried out in 2004-06 and 2011. Sites were geo-referenced on the ground with a Garmin GPS 60 (Garmin, Olathe, KS). To ensure the reliability of the absence data, we tracked the intertidal fringe corresponding to a minimum linear distance of 600 m at each location. Given the conspicuous nature of the target species, it is unlikely that erroneous absences were recorded.

Mechanical failure or loss of data loggers due to human interference generated some gaps in the data set of temperature. Therefore, part of the seawater temperature time series had to be interpolated for some loggers. Missing records were interpolated by linear regression of seawater temperature data from the location in question plotted against temperature data from another site. The following criteria were used to select locations for interpolating missing data: (1) there were no gaps in the period to be completed, (2) data from the locations fulfilling the first criterion were most closely correlated with those from the site including the missing data (Pearson product-moment correlation r values ranged 0.97-0.99), and (3) data from the locations were linearly correlated (as observed by examination of scatterplots).

2.2. *Transplant experiments*

Algal cover was estimated by the point-intercept method by using a 50 x 50 cm PVC frame, with a grid of double thread and 81 regularly spaced intersections. Both primary and secondary cover (holdfast of adult plants and juveniles < 5 cm in length, and overstory canopies, respectively) were estimated, and the values were transformed into percentages. The total cover could thus sum > 100%. A 1% was assigned to fucoids present in the plots but not recorded. Density of grazing molluscs was estimated using 30 x 30 cm PVC frames subdivided into 25 squares.

We used artificial discs with a rough surface (4 cm in diameter and 0.5 cm thick) for settlement of *Fucus serratus* in the field. These discs were made of epoxy resin (Fetadit 55/63; Fetasa, Madrid, Spain) following the procedure of Johnson (1994). The discs were rinsed with tap water and then immersed in seawater (previously filtered with Whatman GF/C filters) for 48 hours before use. They were drilled to create a central hole and then attached with screws to polycarbonate plates (14 x 14 cm and 0.3 cm thick).

2.4 *Species distribution models*.

To test for spatial autocorrelation, we generated multi-directional correlograms (Legendre and Legendre 1998) for the residuals from the selected distribution model by plotting Geary's c coefficient values against Euclidean distances between sites. We used Sturges' rule (Sturges 1926) to determine the number of spatial lags and pooled the lags with smaller sample sizes. Geary's c calculation and significance testing were performed using 4999 Monte Carlo permutations in Excel add-in Rookcase (Sawada 1999).

Model performance was tested using jackknife partitioning techniques. In the jackknife approach, one observation was excluded; the model was recalibrated, and the predicted probability was calculated for the excluded observation (jackknife score). This process was repeated for all remaining data. Model accuracy was then tested by checking the correct and incorrect classification of the predicted jackknife scores.

Supplementary references

Carballo R, Iglesias G, Castro A (2009) Residual circulation in the Ría de Muros (NW Spain): a 3D numerical model study. J Mar Syst 75: 116-130

Johnson LE (1994) Enhanced settlement on micro topographical high points by the intertidal red alga *Hulosaccion glandiforme*. Limnol Oceanogr 39: 1893-1902

Legendre P, Legendre L (1998) Numerical Ecology. Second English Edition. Elsevier Science B.V., Amsterdam, The Netherlands.

Rosón G, Pérez FF, Álvarez-Salgado XA, Figueiras FG (1995) Variation of both thermohaline and chemical properties in an estuarine upwelling ecosystem: Ria de Arousa; I. Time evolution. Estuar Coast Shelf Sci 41:195-213

Sawada M. (1999). ROOKCASE: An Excel 97/2000 Visual Basic (VB) Add-in for Exploring Global and Local Spatial Autocorrelation. Bull Ecol Soc Am 80:231-234

Sturges HA (1926). The choice of a class interval. J Am Stat Assoc 21:65–66

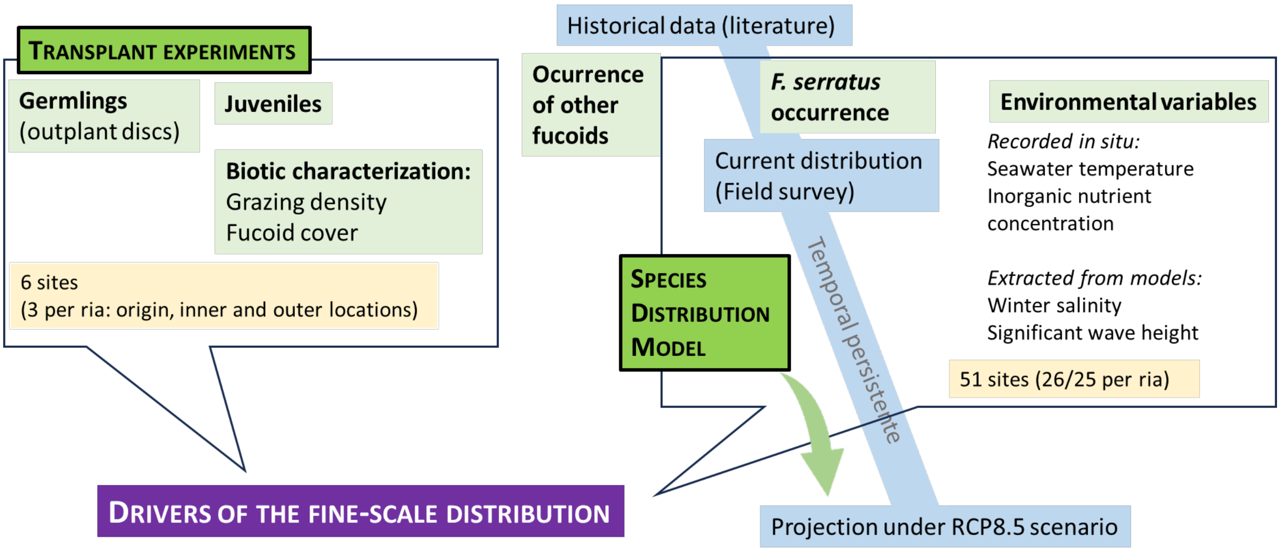

Figure S1. Summary diagram of methodology.

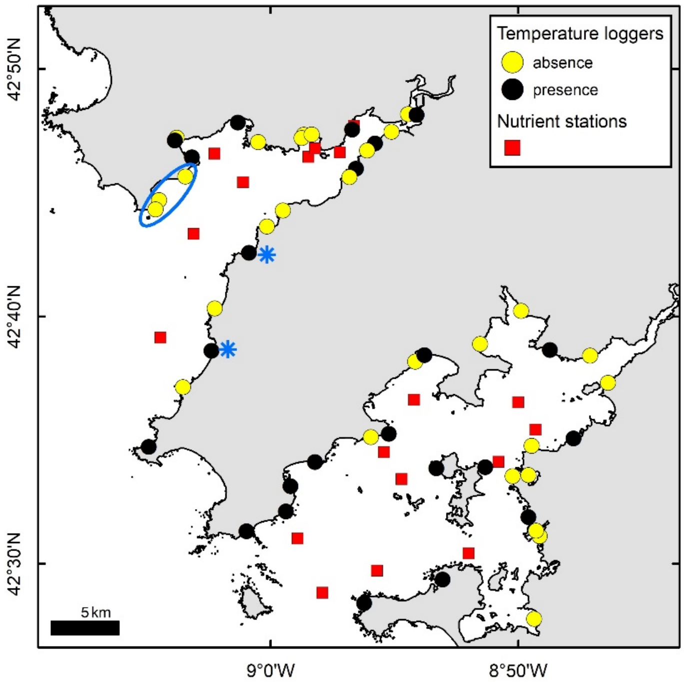

Figure S2. The 23 coastal locations (black circles) where sea temperature was measured *in situ* with data loggers and the 18 oceanographic stations (red squares) where inorganic nutrient data (nitrite and nitrate) were measured by the *Instituto Tecnolóxico para o Control do Medio Mariño de Galicia (INCTEMAR, Xunta de Galicia*). The asterisks indicate the two sites used for extrapolating the temperature in the three facing sites of the northern coast (encircled) in the Ría de Muros (see material and methods).

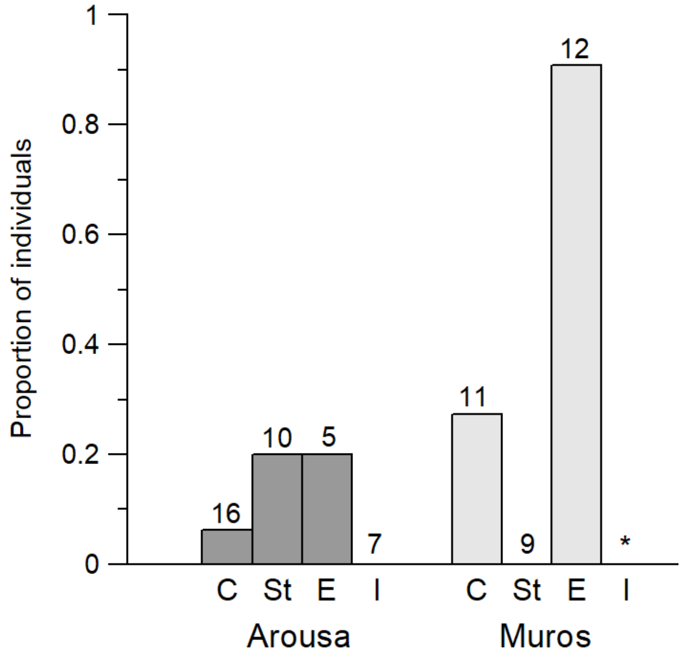

Figure S3. Proportion of juveniles with grazing marks in the second trial of the transplant experiments in Ría de Arousa and Ría de Muros (in the first trial, only two individuals out of 80 presented evident grazing damage). Abbreviations: C= controls, St= self-transplant, E=exterior transplants, I= interior transplants, n as indicated. Asterisk indicates the treatment where all data are missing.

Table S1. Surveyed locations inside the rias of Muros and Arousa with presence of populations of *Fucus serratus* in 2005 and 2011. Origin locations for the transplant experiments are indicated with asterisks.

Ría de Muros		**Ría de Arousa**	
Location	*Coordinates (ETRS89)*	*Location*	*Coordinates (ETRS89)*
Agrocobo	42°47'20" N, 8°58'19"W	Castañeiras Beach	42°32'7" N, 8°59'22" W
O Freixo*	42°47'32" N, 8°56'42"W	Riveira	42°33'8"N, 8°59'11"W
Boa Beach	42°46'59" N, 8°55'46"W	Río Azor[1]	42°34'6"N, 8°58'12"W
Punta Boa	42°46'41" N, 8°56'6" W	Vilaxoan	42°35'3"N, 8°47'46"W
Ormanda Beach	42°45'57" N, 8°56'32"W	Sinas Beach	42°34'46"N, 8°49'26"W
		Isla de Arousa (interior site)*	42°33'54"N, 8°51'19"W
		Isla de Arousa (exterior site)	42°33'51"N, 8°53'18"W

[1] Only a few individuals were detected in 2005 and 2011 and none were detected in 2020

Table S2. ANOVAs for initial differences in the juvenile size (length and volume) between Treatments (T: self-transplants, controls, outer and inner transplants) and between rias (Ri: Muros, Arousa) in both trials in the transplant experiment. Variances were homogeneous

First trial							
		length			volume		
Source	df	MS	F	p	MS	F	p
Treatment,	3	4.627	0.977	0.406	674.8	0.395	0.757
Ria, Ri	1	21.778	4.600	0.034	8934.6	5.234	0.024
T x Ri	3	2.197	0.464	0.708	2487.9	1.458	0.229
Residual	136	4.734			1707.0		
Second trial							
		length			volume		
Source	df	MS	F	p	MS	F	p
Treatment,	3	6.714	1.856	0.140	2631.8	1.024	0.384
Ria, Ri	1	0.047	0.013	0.909	5471.7	2.128	0.147
T x Ri	3	0.735	0.203	0.894	6193.6	2.409	0.070
Residual	136	3.617			2571.4		

Table S3. Parameters, AIC and Δi of the subset of candidate models with Δi ≤6. The best model (see methods) and the corresponding parameters are marked in bold. Icpt: Intercept; Hs99: 99th percentile significant wave height; Nitr: summer average nitrate+nitrite concentration (0-15 m); Sal: mean salinity of January-February; TAut: maximum sea temperature in autumn. Quadratic components of these predictors are also included.

Model number	Icpt	Hs99	$Hs99^2$	Nitr	$Nitr^2$	Rock	Sal	Sal^2	TAut	$TAut^2$	df	AIC	Δi
1	**-8920**						**553.5**	**-8.152**	**-28.48**		**4**	**29.3**	**0**
2	-10070					+	625.8	-9.219	-32.75		5	30.8	1.47
3	-8594	-0.421					534.5	-7.871	-28.75		5	31.2	1.88
4	-9257			-0.172			575.4	-8.481	-30.12		5	31.2	1.94
5	-7659						576.3	-8.488	-228.3	6.057	5	31.2	1.95
6	-10070	-0.984				+	629.6	-9.274	-36.57		6	32.2	2.93
7	-10690			-0.212		+	665.0	-9.803	-35.40		6	32.7	3.38
8	-8255	1.602	-0.889				513.5	-7.564	-27.70		6	32.7	3.41
9	-10770					+	620.2	-9.137	62.95	-2.911	6	32.8	3.46
10	-10690			-1.606	0.304		656.8	-9.653	-28.79		6	32.8	3.55
11	-6908	-0.478					564.0	-8.306	-293.80	8.026	6	33.1	3.80
12	-8828	-0.363		-0.103			549.4	-8.096	-29.66		6	33.2	3.86
13	-9856	2.811	-2.004			+	617.4	-9.097	-37.17		7	33.2	3.91
14	-8315			-0.129			585.8	-8.632	-166.40	4.142	6	33.2	3.92
15	-13040			-2.164	0.402	+	801.3	-11.78	-35.28		7	34.0	4.72
16	-10250	-0.948		-0.065		+	640.7	-9.441	-37.22		7	34.2	4.92
17	-10630	-0.979				+	624.7	-9.203	41.06	-2.360	7	34.2	4.92
18	-5595	1.86	-1.038				566.6	-8.346	-458.90	13.050	7	34.5	5.21
19	-9012	2.258	-1.069	-0.324			561.9	-8.288	-30.65		7	34.6	5.25
20	-14310			-0.367		+	671.8	-9.910	394.50	-13.140	7	34.6	5.28
21	-8488			-1.968	0.415		725.5	-10.65	-440.50	12.510	7	34.7	5.37
22	-10540	-0.085		-1.536	0.293		647.7	-9.519	-28.73		7	34.8	5.54
23	-11190	4.185	-2.607	-0.424		+	702.0	-10.36	-42.40		8	35.0	5.66
24	-6925	-0.476		-0.003			564.3	-8.310	-292.20	7.977	7	35.1	5.80
25	-8837	2.916	-2.066			+	630.0	-9.283	-187.00	4.549	8	35.2	5.90