Supplementary Material

Supplementary Table 1. Distribution data of Pacific oysters.

Longitude	Latitude	Reference
Pacific oysterr reef		
117.963395	39.226077	Wang et al., 2014
117.921667	37.176667	Fang et al., 2007
117.993333	39.176667	
117.993333	39.125	
117.921667	39.125	
117.687449	38.539785	Li et al., 2020
121.532535	32.114455	
121.533333	32.136333	Gu et al., 2005
121.542556	32.139611	Quan et al., 2012
117.687449	38.539785	Quan et al., 2022
118.647558	39.124842	
118.600415	39.077804	
118.80451	39.127081	
117.911677	38.283601	Hong et al., 2023
Wild population sampling sites		
121.438985	37.543893	Song et al., 2020
122.510788	37.100187	Zhong et al., 2019
121.573693	38.882789	Ran et al., 2018
122.209279	40.412182	
120.957524	40.700758	
119.808519	39.976139	
117.84083	39.028304	
119.14024	37.855115	
119.069546	37.280443	
123.280614	39.700181	Zhang et al., 2021
117.78502	39.039452	
119.793176	37.251504	

Fang, E., Li, W., Yu, J. (2007). Sustainable Use of Live Oyster Reef in Bohai Gulf. *Modern Fishery Information* (11), 12-14. doi: 10.3969/j.issn.1004-8340.2007.11.003

Gu, Y., Qi, D., Ge, Y., Yu, R., Zhang, R. (2005). Ecological evaluation and conservation of oyster reefs in Xiaomiaohong tidal channel in Jiangsu Coast. *Marine Sciences* (03), 42-47. doi: 10.3969/j.issn.1000-3096.2005.03.010

Hong, X., Cheng, J., Li, Q., Wu, S., Yan, J., Shi, H. (2023). An experimental study on dissipating effect of double-layer oyster reefs in Binzhou coastal seawater. *Transactions of Oceanology and Limnology* 45(04), 106-111. doi: 10.13984/j.cnki.cn37-1141.2023.04.014.

Li, J., Shang, Z., Chen, Y., Tian, L., Jiang, X., Wang, F., et al. (2020). Research status and protection suggestions on oyster reef in Bohai Bay. *Geological survey and research* 43(04), 317-333. doi: 10.3969/j.issn.1672-4135.2020.04.003

Quan, W., An, C., Ma, C., Huang, H., Cheng, W., Wang, Y., et al. (2012). Biodiversity and community structure of benthic macroinvertebrates on the Xiaomiaohong oyster reef in Jiangsu province, China. *Oceanologia et Limnologia Sinica* 43(05), 992-1000. doi:10.11693/hyhz201205017017

Quan, W., Zhang, Y., Qi, Z., Xu, M., Fan, R., Wang, T., et al. (2022). Distribution and ecological status of natural oyster reefs on the coast of Caofeidian-Leting,Tangshan,Hebei Province. *Acta Ecologica Sinica* 42(03), 1142-1152. doi: 10.5846/stxb202005101172

Ran, W., Teng, J., Liu, Y., Wu, D., Hou, C., Wang, Q. et al. (2018). Microplastic ingestion characteristics in the Pacific oysters collected from the intertidal zone of the Bohai Rim. *Marine Science Bulletin* 37(05), 583-590. doi: 10.11840/j.issn.1001-6392.2018.05.012

Song, X., Jiang, Q., Li, L., Zhan, R., Wei, L., Wang, X. Differential analysis of physiological responses to seawater acidification in different Pacific oyster populations. *Marine Sciences* 44(01), 132-141. doi: 10.11759/hykx20190711002

Wang, T., Wang, Q., Shang, X., Wang, Y., Song, W. (2014). The water quality environment analysis of the National special Marine reserve in Tianjin Dashentang oyster reef. *Fishery Modernization* 41(06), 47-50. doi: 10.3969/j.issn.1007-9580.2014.06.010

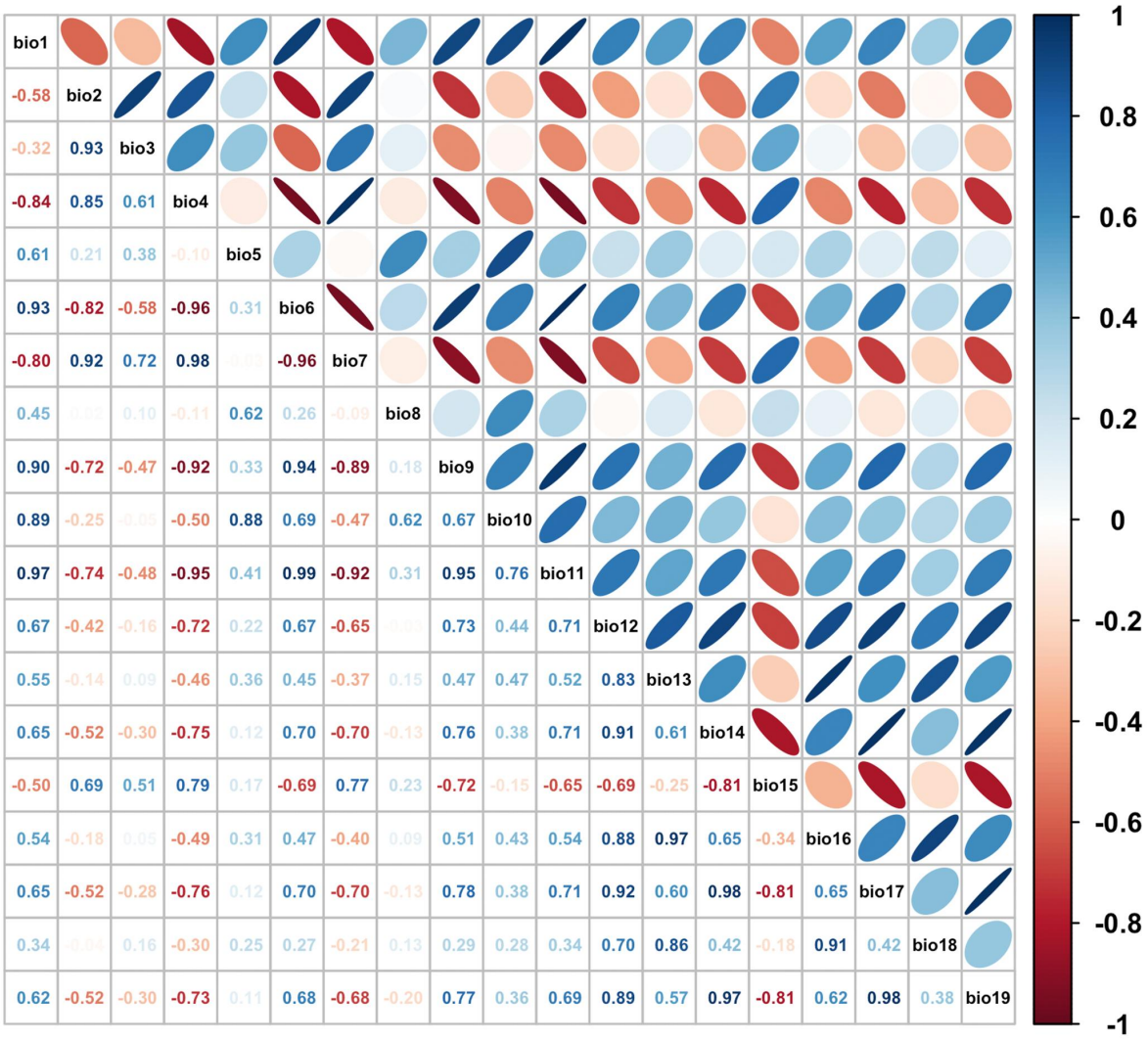
Zhang, X., Fan, C., Huo, Z., Ma, P., Li, Y., Li, J., et al. (2021). A comparative analysis of shell traits among different populations of Crassostrea gigas. *Periodical of Ocean Uinversity of China* 51(Sup.I), 1-9. doi: 10.16441/j.cnki.hdxb.20200305

Zhong, J., Li, Q., Wang, T. (2019). Comparison of feeding and metabolism between black-shell strain and wild population of the Pacific oyster (Crassostrea gigas). *Journal of Fisheries of China* 43(04), 1038-1047. doi: 10.11964/jfc.20180411248

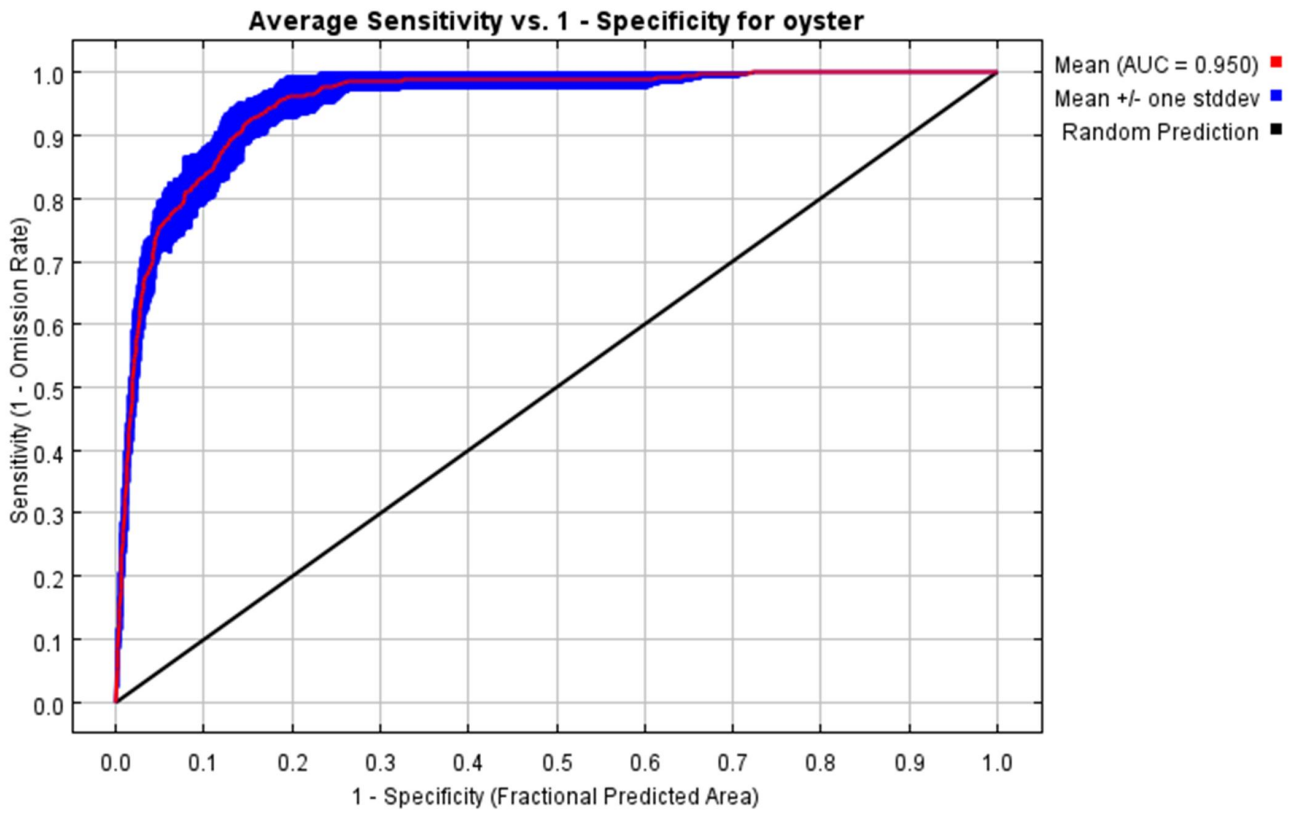
Supplementary Table 2. Relative contributions of the environmental variables to the Maxent model

Variable	Percent contribution
Bio2	73.7
Bio10	7.7
Bio8	4.7
Bio16	2.9
Bio14	2
Bio15	1.8
Bio7	1.7

Bio6	1.1
Bio5	1
Bio11	0.8
Bio3	0.6
Bio12	0.5
Bio9	0.3
Bio13	0.3
Bio19	0.3
Bio18	0.3
Bio1	0.2
Bio4	0.2
Bio17	0

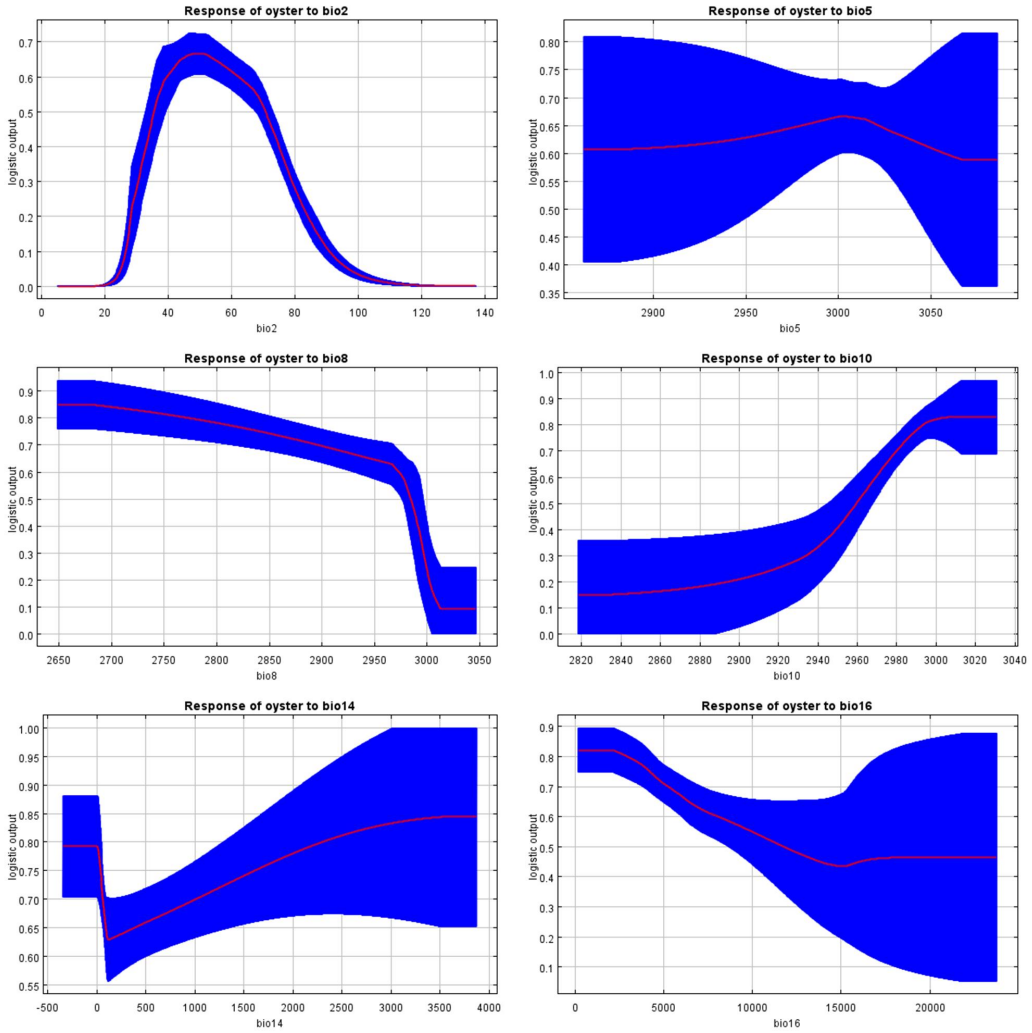


Supplementary Figure 1. Results of Pearson correlation analysis of raster data for each factor.



Supplementary Figure 2. Receiver operating characteristic (ROC) curve (history).

Supplementary Figure 2 showed the receiver operating characteristic (ROC) curve for the same data, again averaged over the replicate runs. The Area Under the Curve (AUC) of the ROC curve is the primary tool for evaluating the accuracy of the MaxEnt. A higher AUC value indicates better model performance, with values close to 1 reflecting superior performance. When the AUC exceeds 0.9, it indicates a high level of accuracy in the results. The average training AUC for the replicate runs is 0.950.

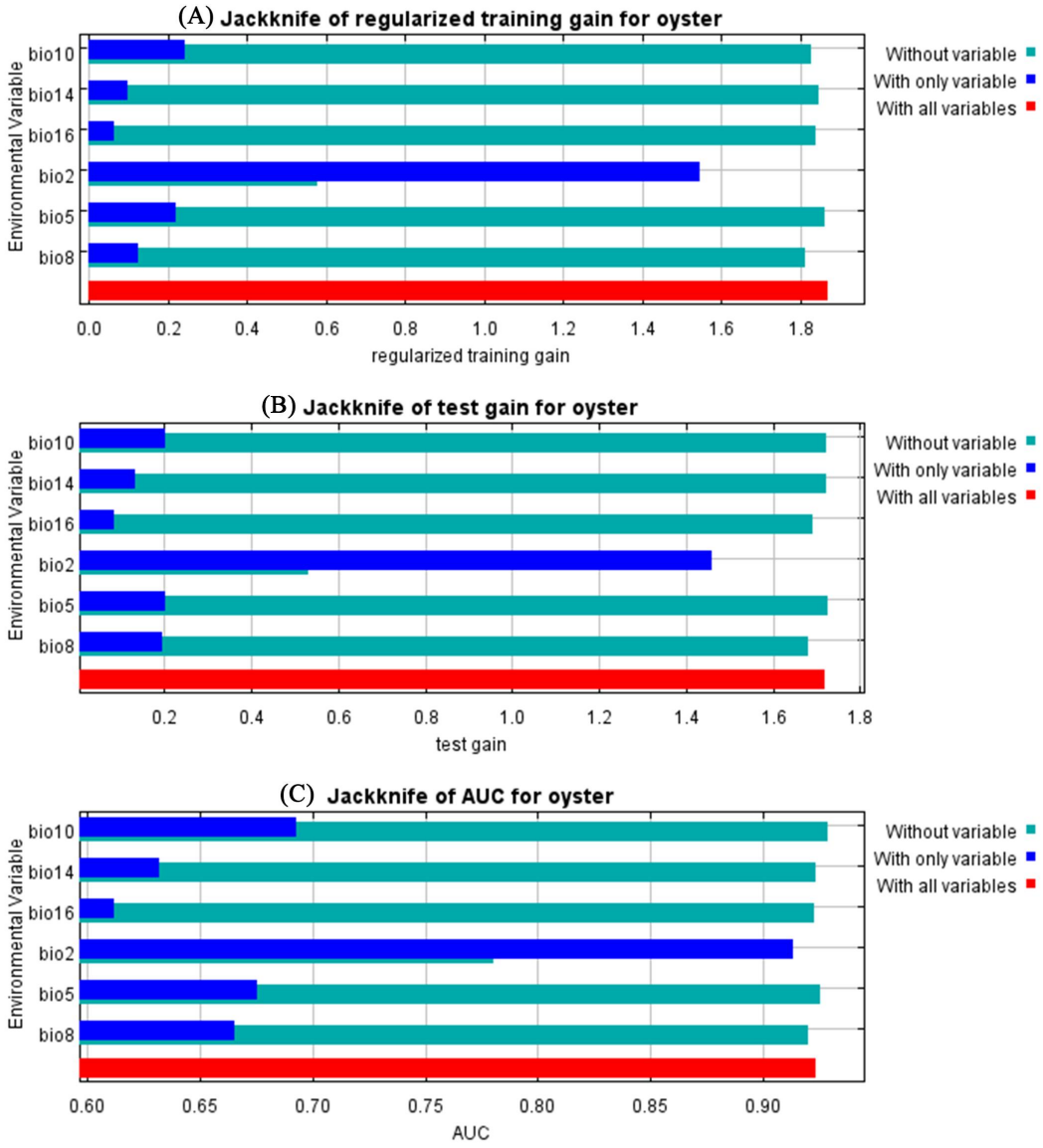


Supplementary Figure 3. Response curves (history).

These curves show how each environmental variable affects the Maxent prediction. The curves show how the predicted probability of presence changes as each environmental variable is varied, keeping all other environmental variables at their average sample value. The curves show the mean response of the 10 replicate Maxent runs (red) and and the mean +/- one standard deviation (blue, two shades for categorical variables).

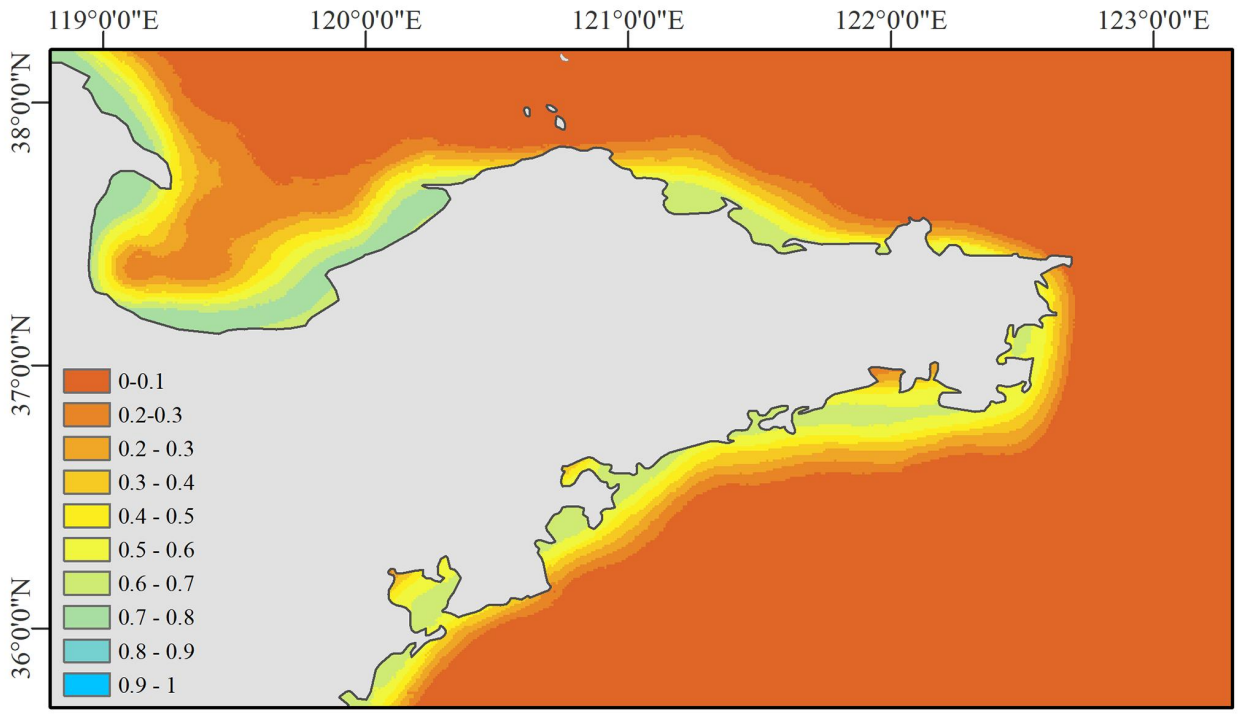
Supplementary Table 3. Variable contributions

Variable	Percent contribution
Bio2	80
Bio10	7.8
Bio8	5
Bio5	3.3
Bio16	2
Bio14	1.9



Supplementary Figure 4. (A) Jackknife of regularized training gain for oyster ; (B) Jackknife of test gain for oyster; (C) Jackknife of AUC for oyster (history).

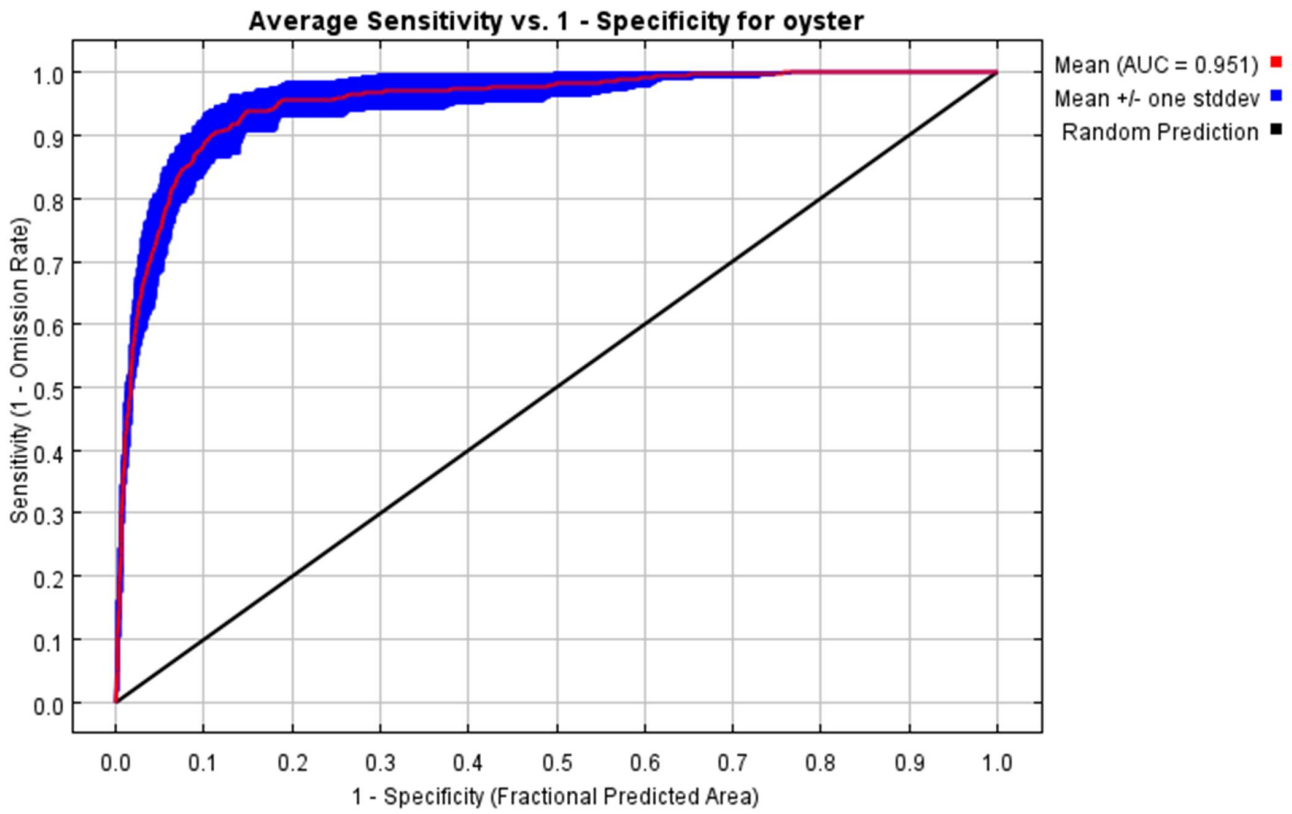
Supplementary Figure 4 (A) shows the results of the jackknife test of variable importance. The environmental variable with highest gain when used in isolation is bio2, which therefore appears to have the most useful information by itself. The environmental variable that decreases the gain the most when it is omitted is bio2, which therefore appears to have the most information that isn't present in the other variables. Values shown are averages over replicate runs. Figure 3(B) shows the same jackknife test, using test gain instead of training gain. Note that conclusions about which variables are most important can change. Figure 3(C) using AUC on test data.



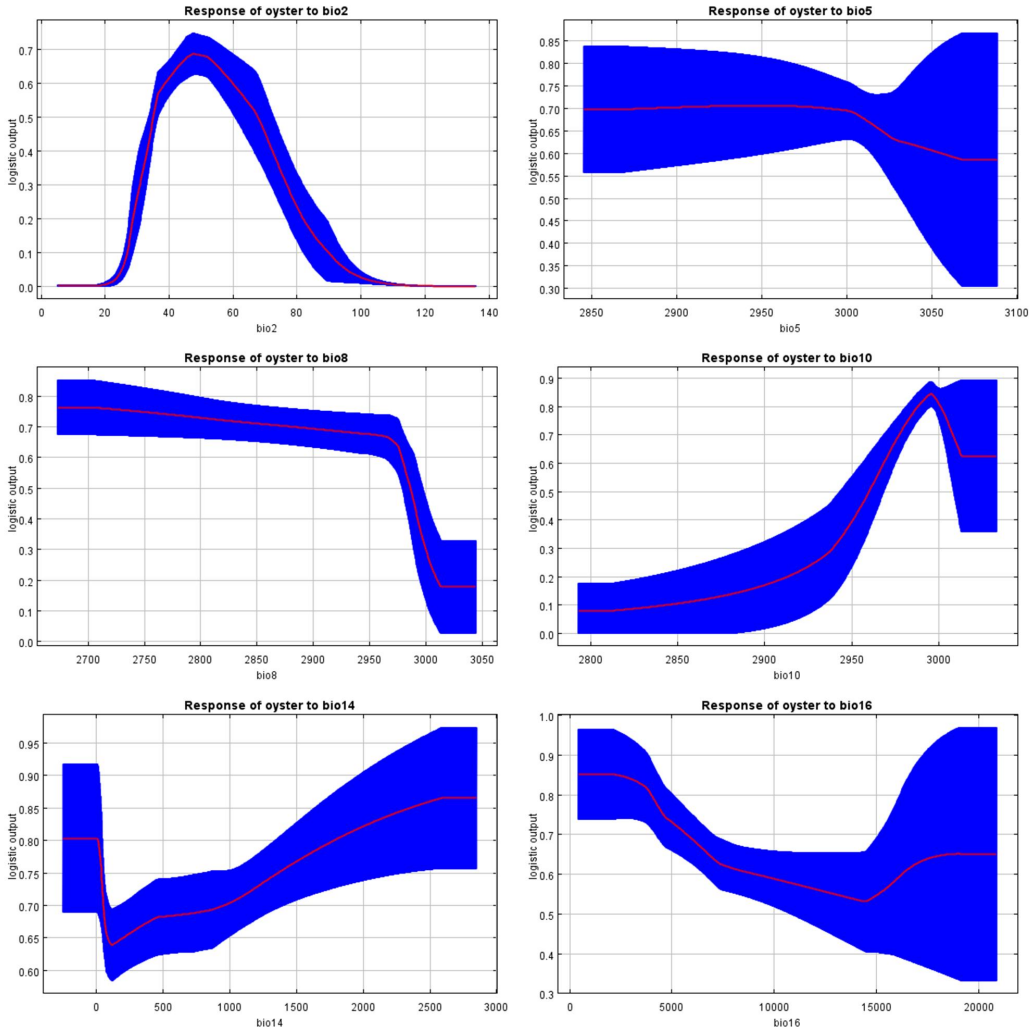
Supplementary Figure 5. Spatial distribution of the Pacific oyster of suitable area (history).

Supplementary Figure 5 showed the point-wise mean of the 10 output grids.

The outputs of the other climate scenarios are listed below：



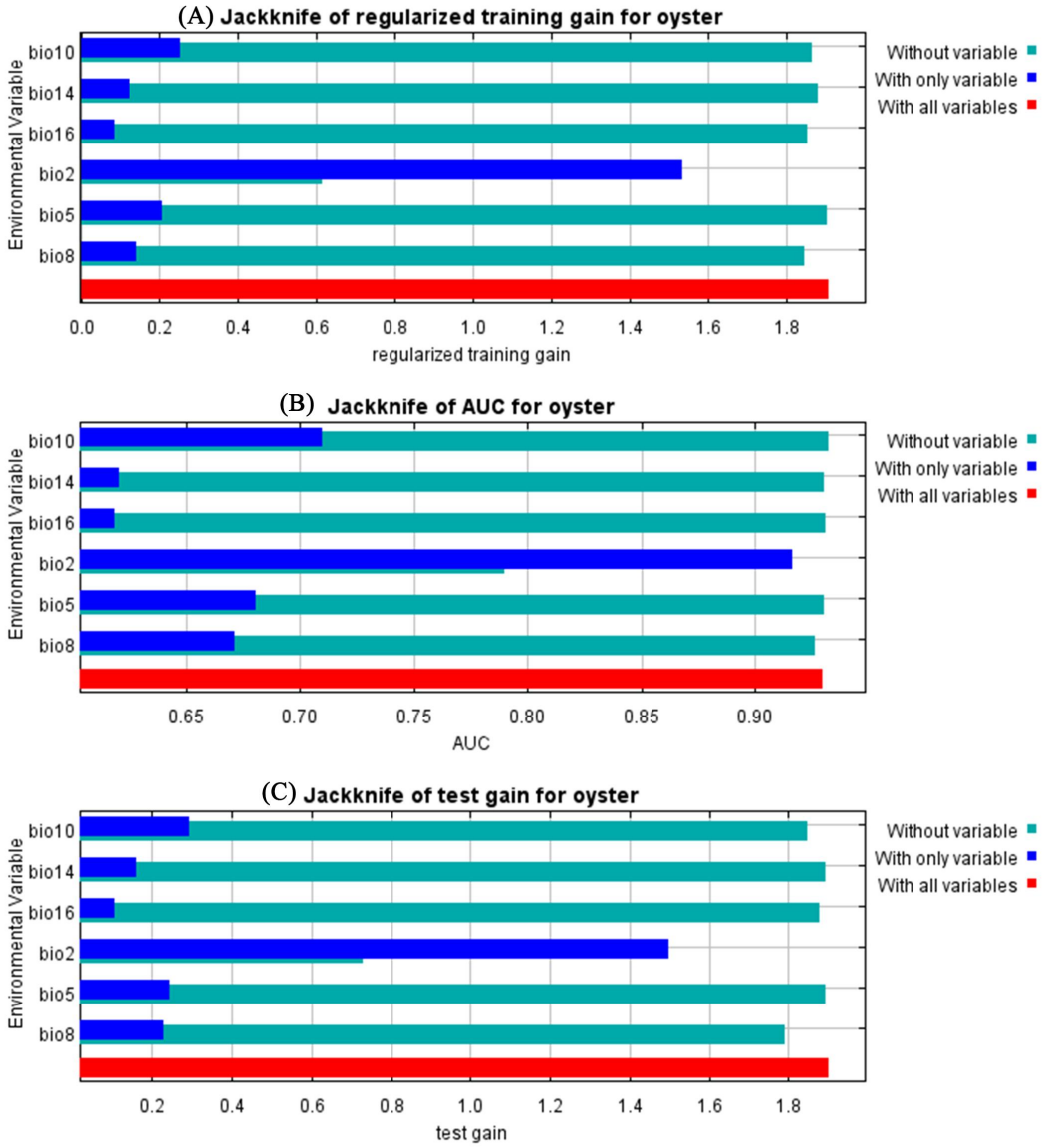
Supplementary Figure 6. Receiver operating characteristic (ROC) curve (SSP1-2.6, 2010-2040).



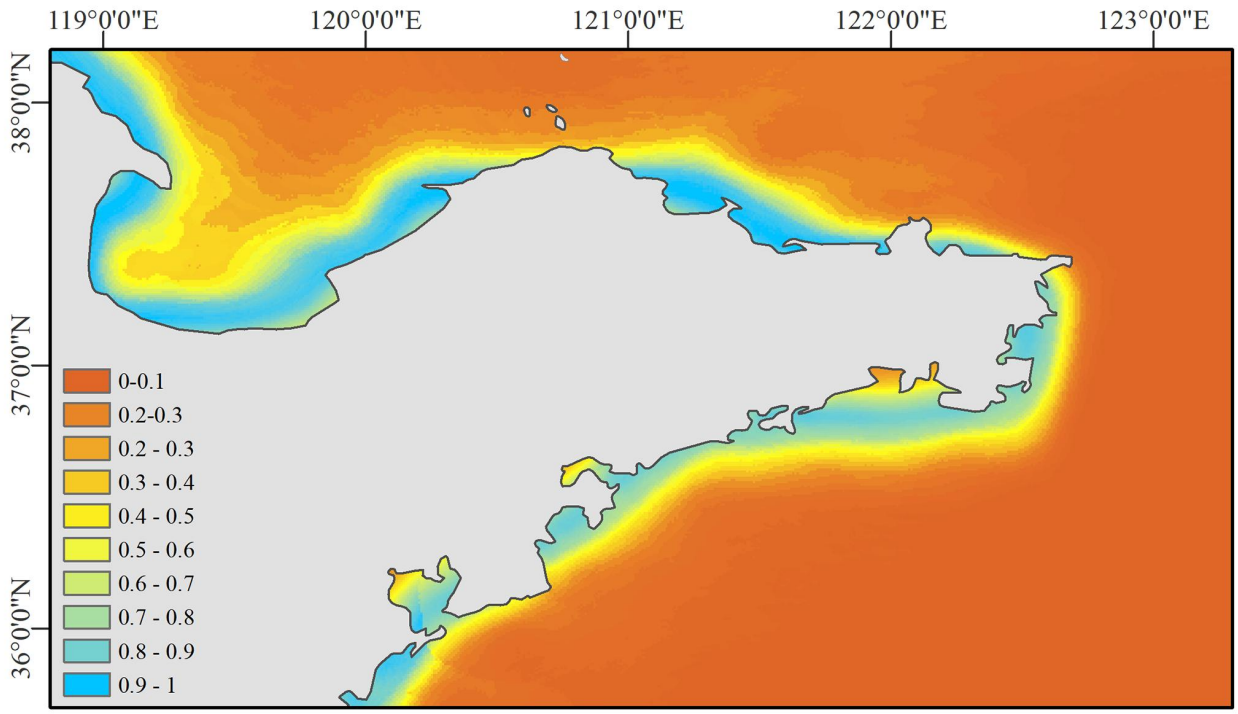
Supplementary Figure 7. Response curves (SSP1-2.6, 2010-2040).

Supplementary Table 4. Variable contributions (SSP1-2.6, 2010-2040).

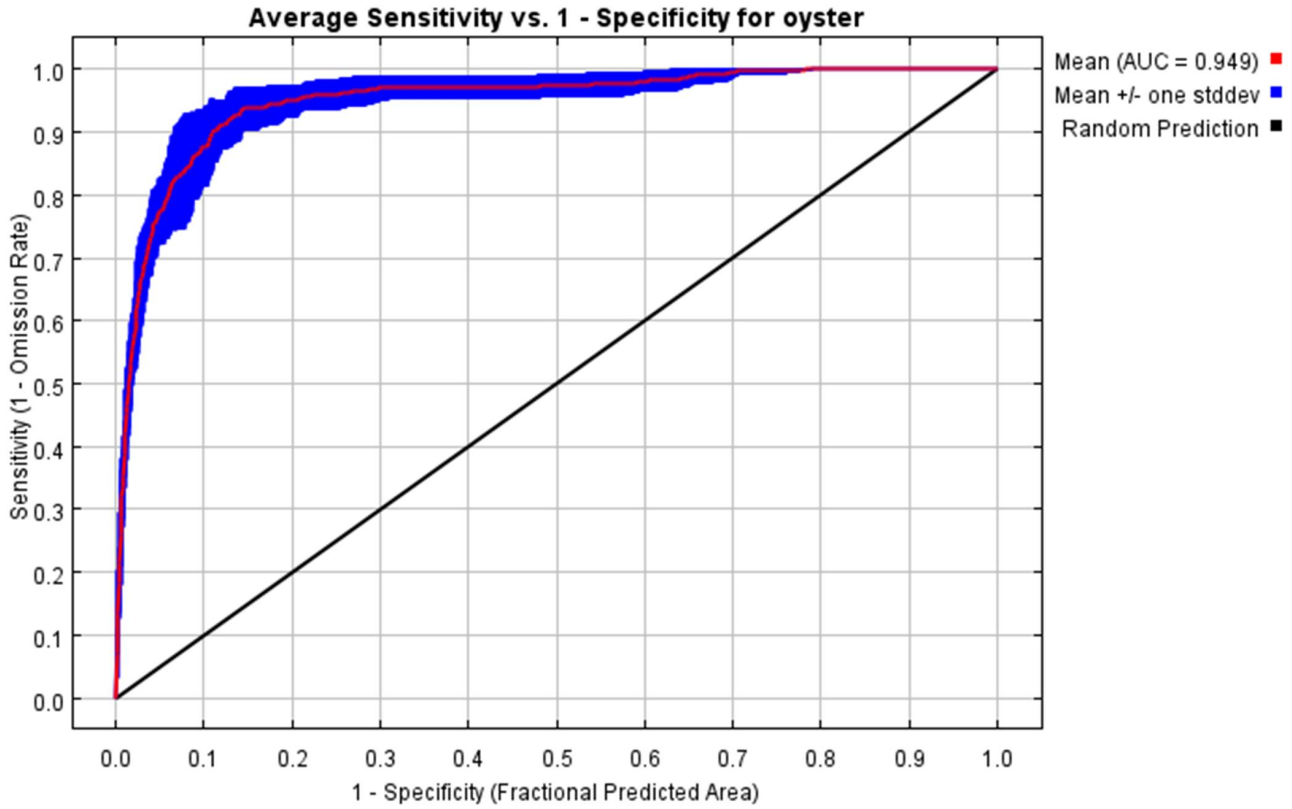
Variable	Percent contribution
Bio2	81.5
Bio10	7.7
Bio8	3.2
Bio14	3
Bio5	2.6
Bio16	1.9



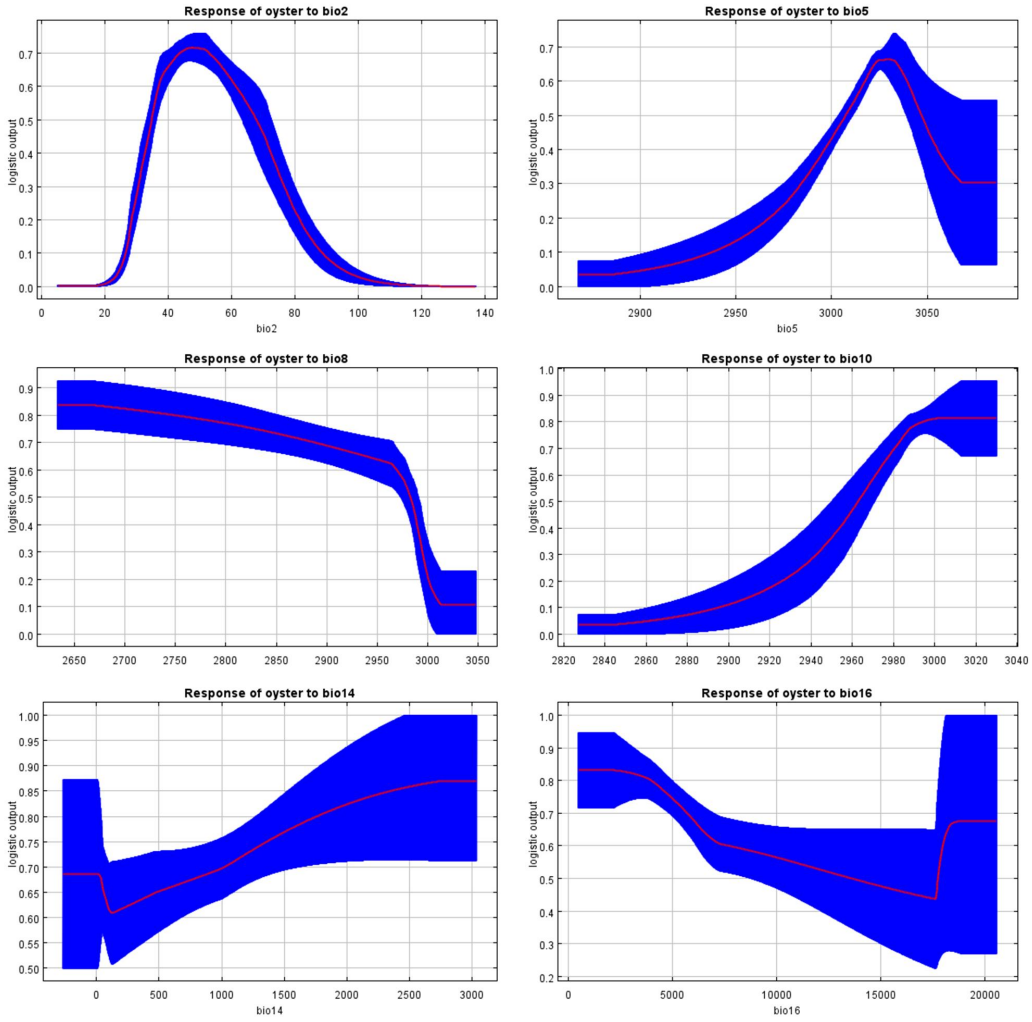
Supplementary Figure 8. (A) Jackknife of regularized training gain for oyster ; (B) Jackknife of test gain for oyster; (C) Jackknife of AUC for oyster (SSP1-2.6, 2010-2040).



Supplementary Figure 9. Spatial distribution of the Pacific oyster of suitable area (SSP1-2.6, 2010-2040).



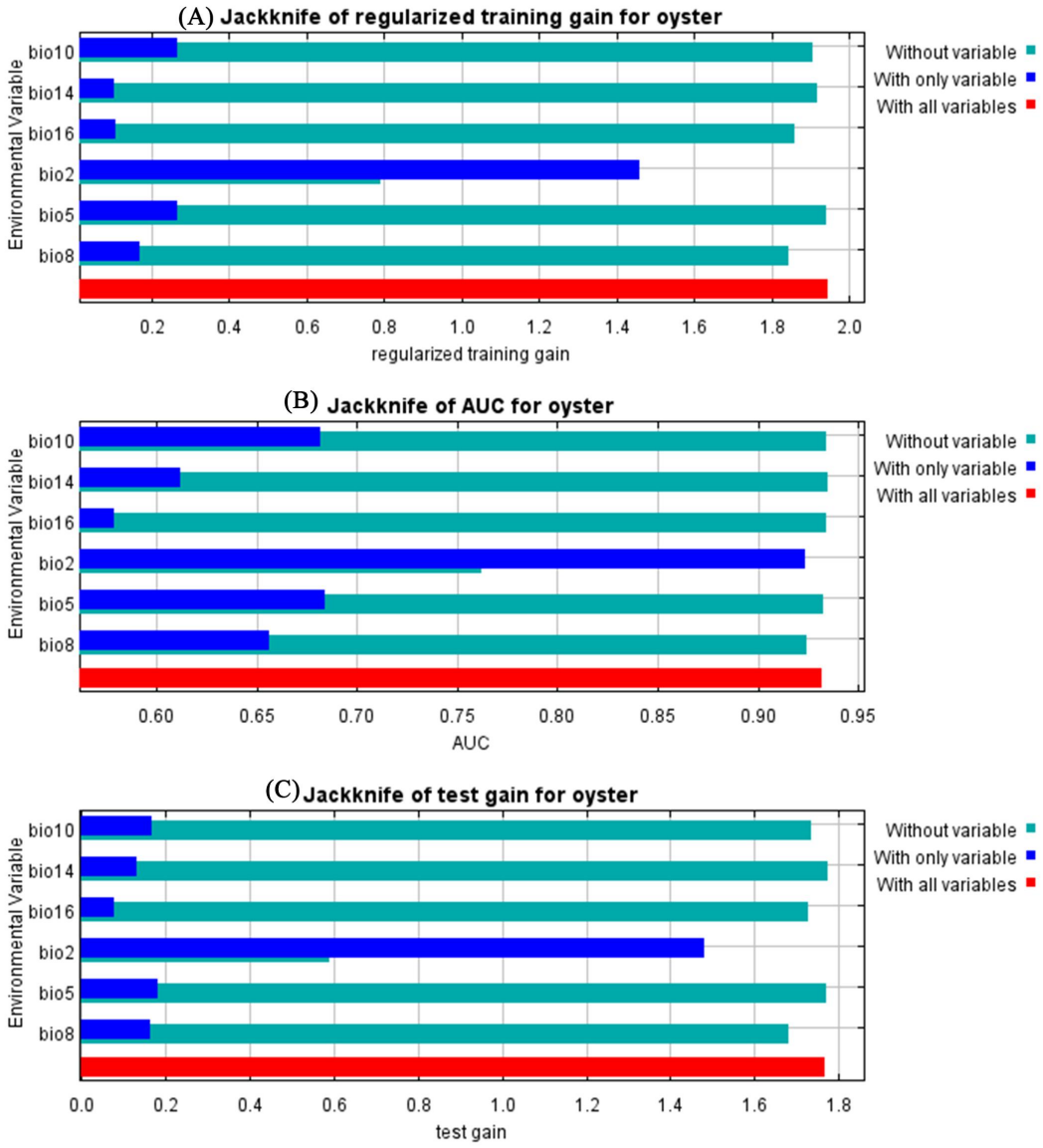
Supplementary Figure 10. Receiver operating characteristic (ROC) curve (SSP1-2.6, 2040-2070).



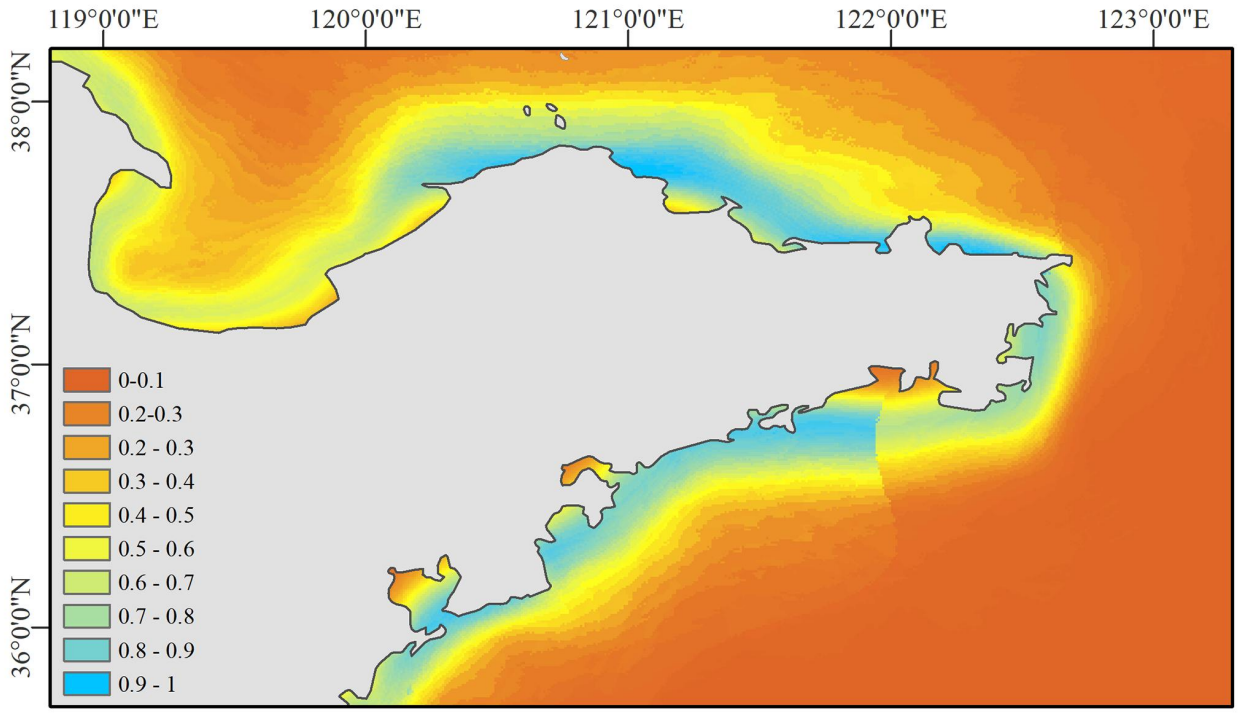
Supplementary Figure 11. Response curves (SSP1-2.6, 2040-2070).

Supplementary Table 5. Variable contributions (SSP1-2.6, 2040-2070).

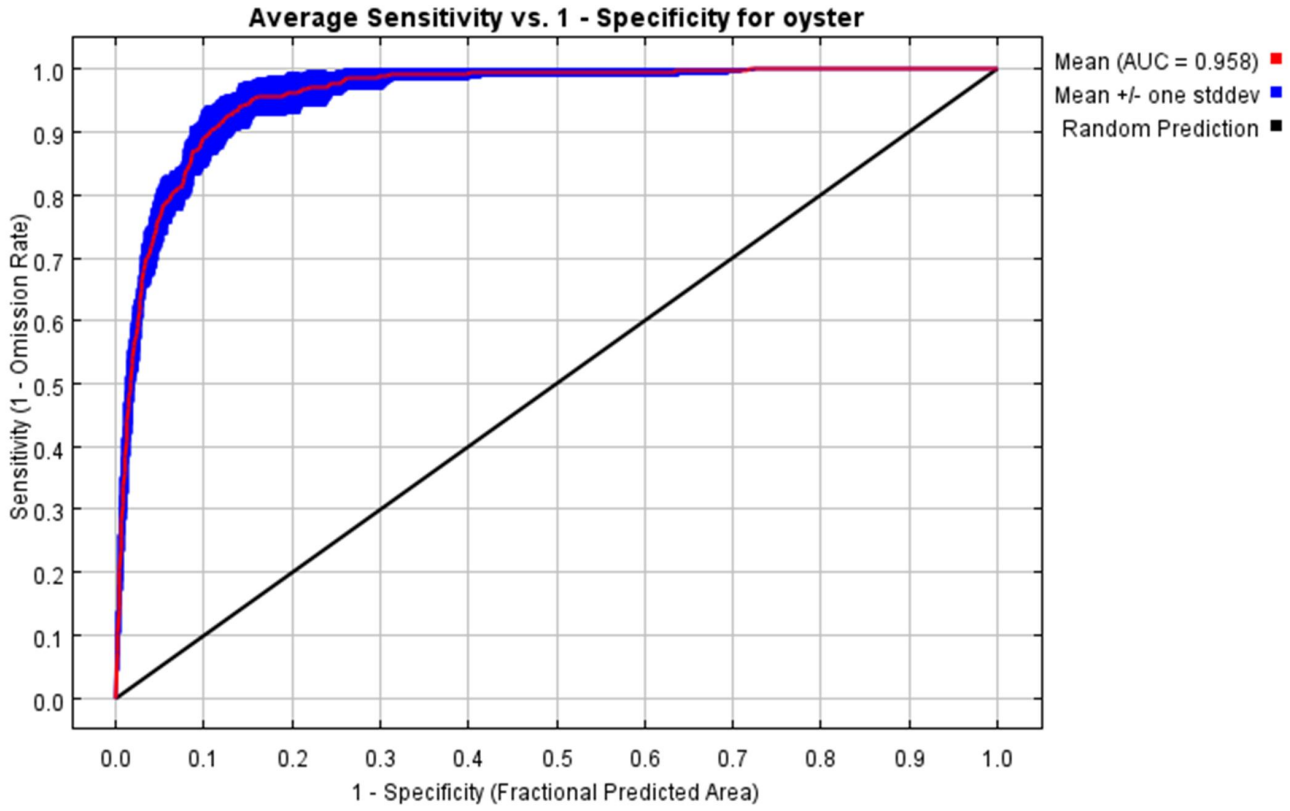
Variable	Percent contribution
Bio2	76.2
Bio10	12
Bio8	5.8
Bio16	3.1
Bio14	2.2
Bio5	0.7



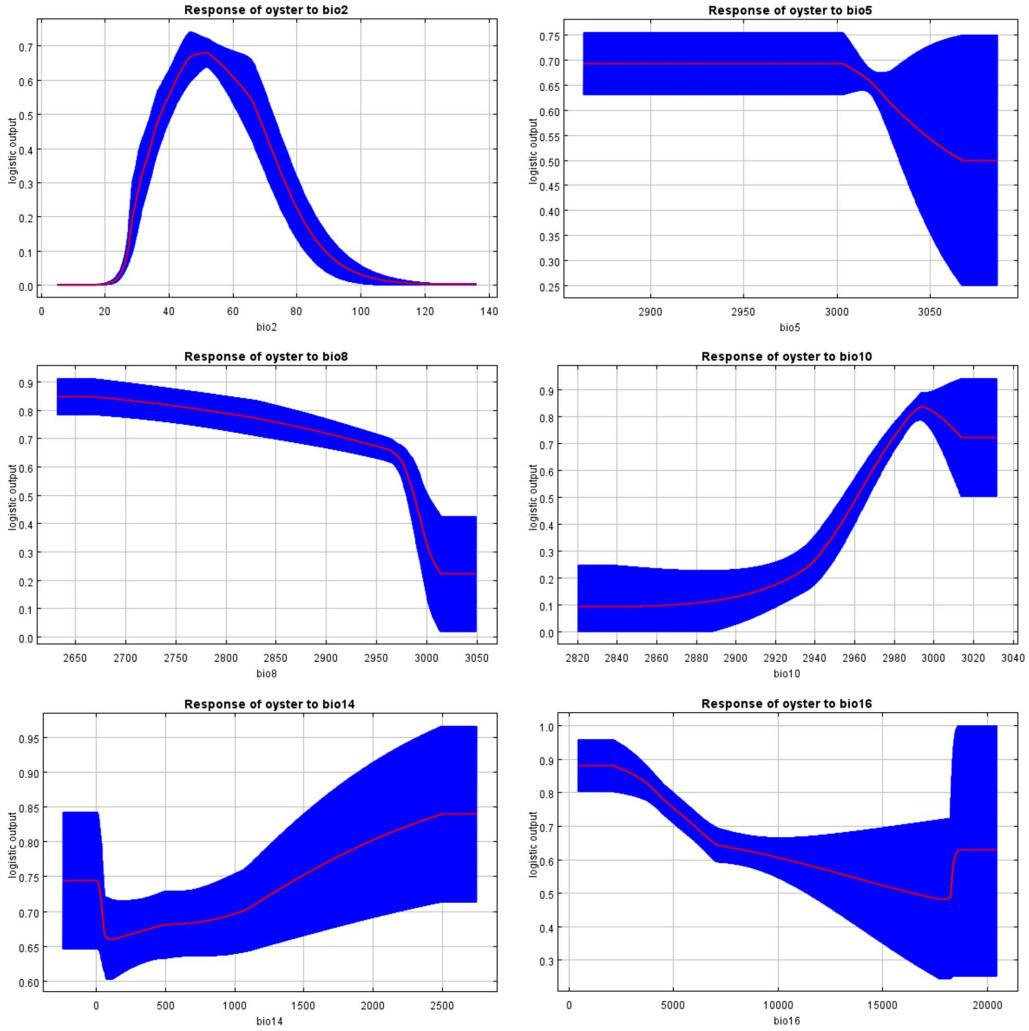
Supplementary Figure 12. (A) Jackknife of regularized training gain for oyster ; (B) Jackknife of test gain for oyster; (C) Jackknife of AUC for oyster (SSP1-2.6, 2040-2070).



Supplementary Figure 13. Spatial distribution of the Pacific oyster of suitable area (SSP1-2.6, 2040-
2070).



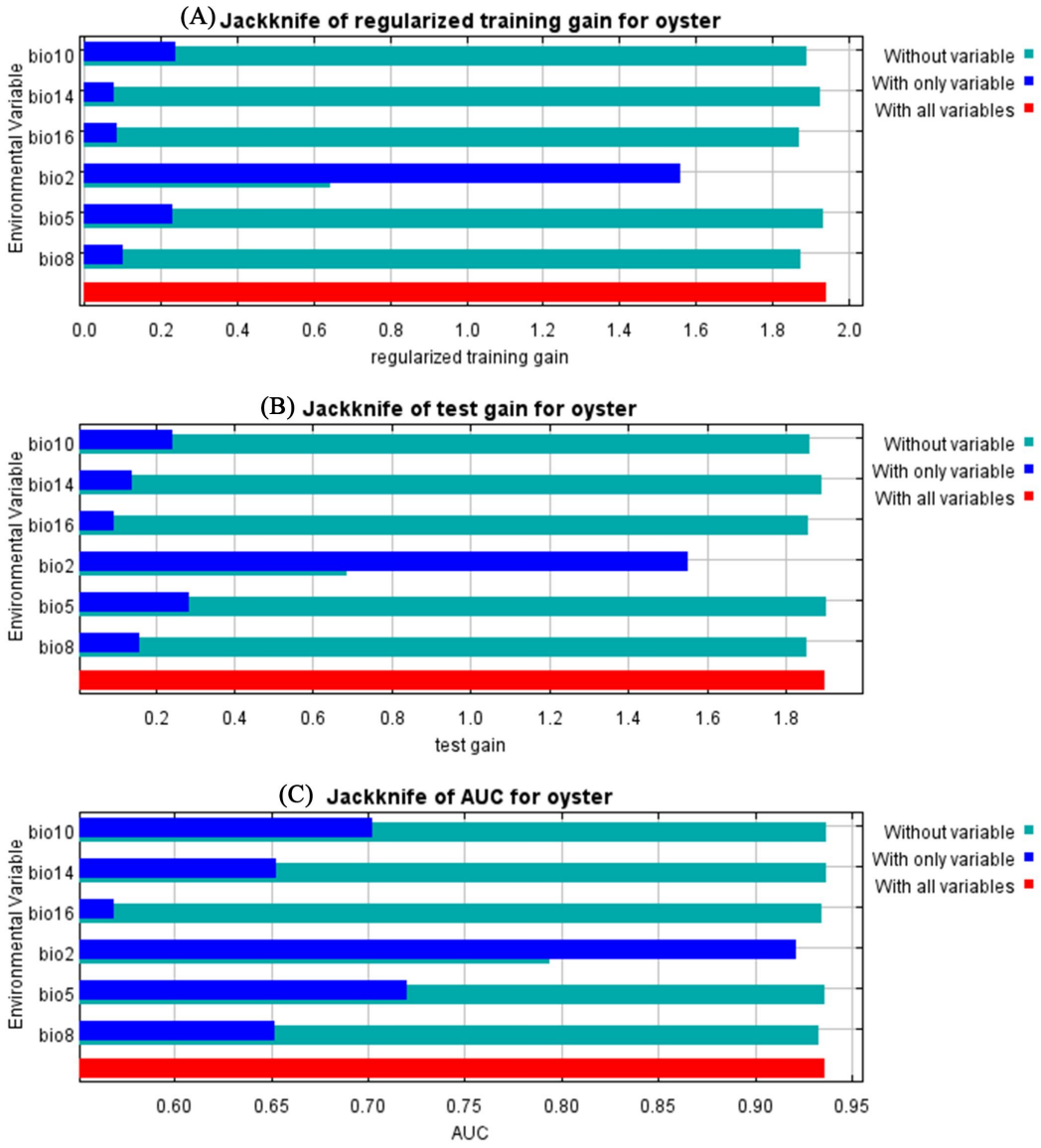
Supplementary Figure 14. Receiver operating characteristic (ROC) curve (SSP1-2.6, 2070-2100).



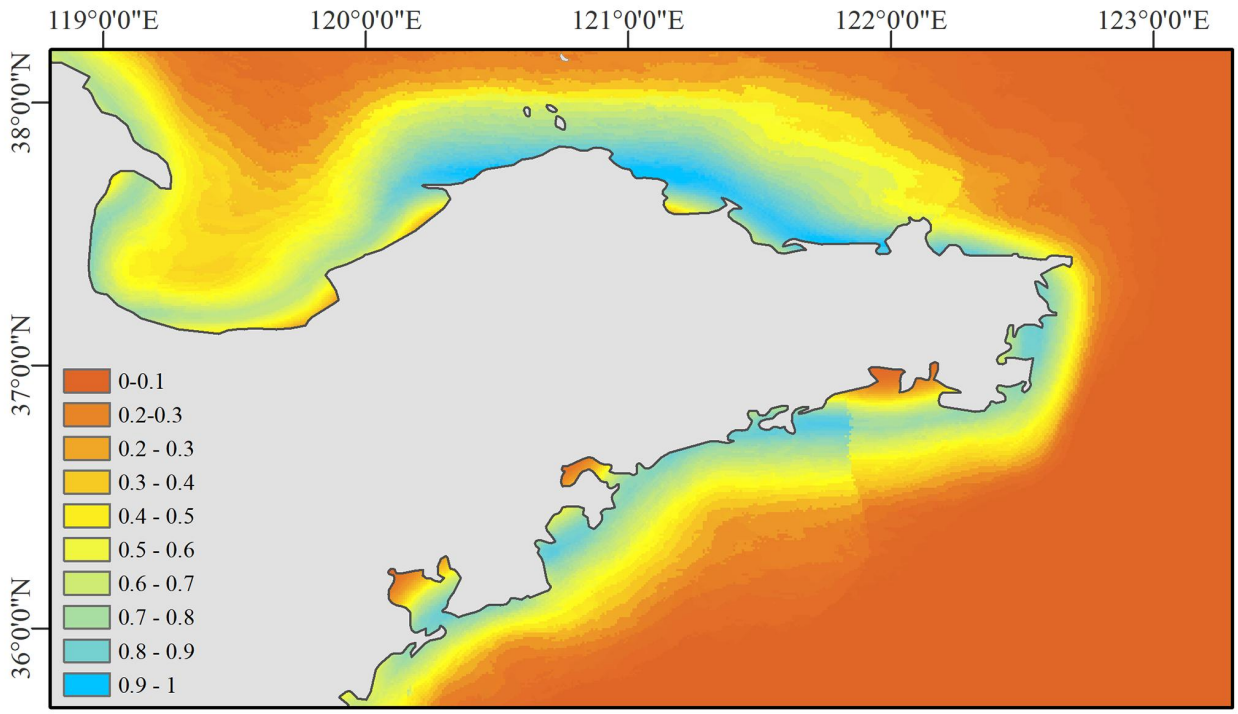
Supplementary Figure 15. Response curves (SSP1-2.6, 2070-2100).

Supplementary Table 6. Variable contributions (SSP1-2.6, 2070-2100).

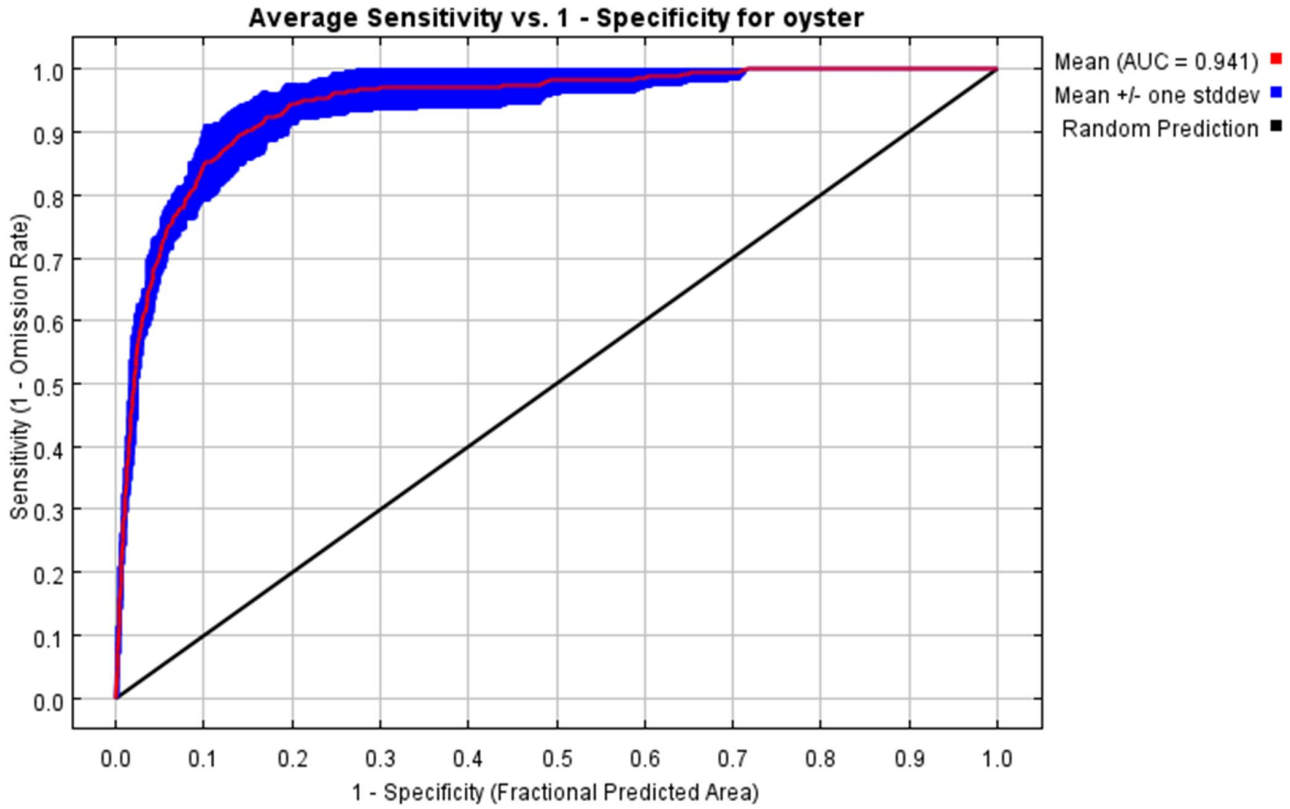
Variable	Percent contribution
Bio2	81.5
Bio10	10.1
Bio8	2.9
Bio16	2.4
Bio5	1.6
Bio14	1.4



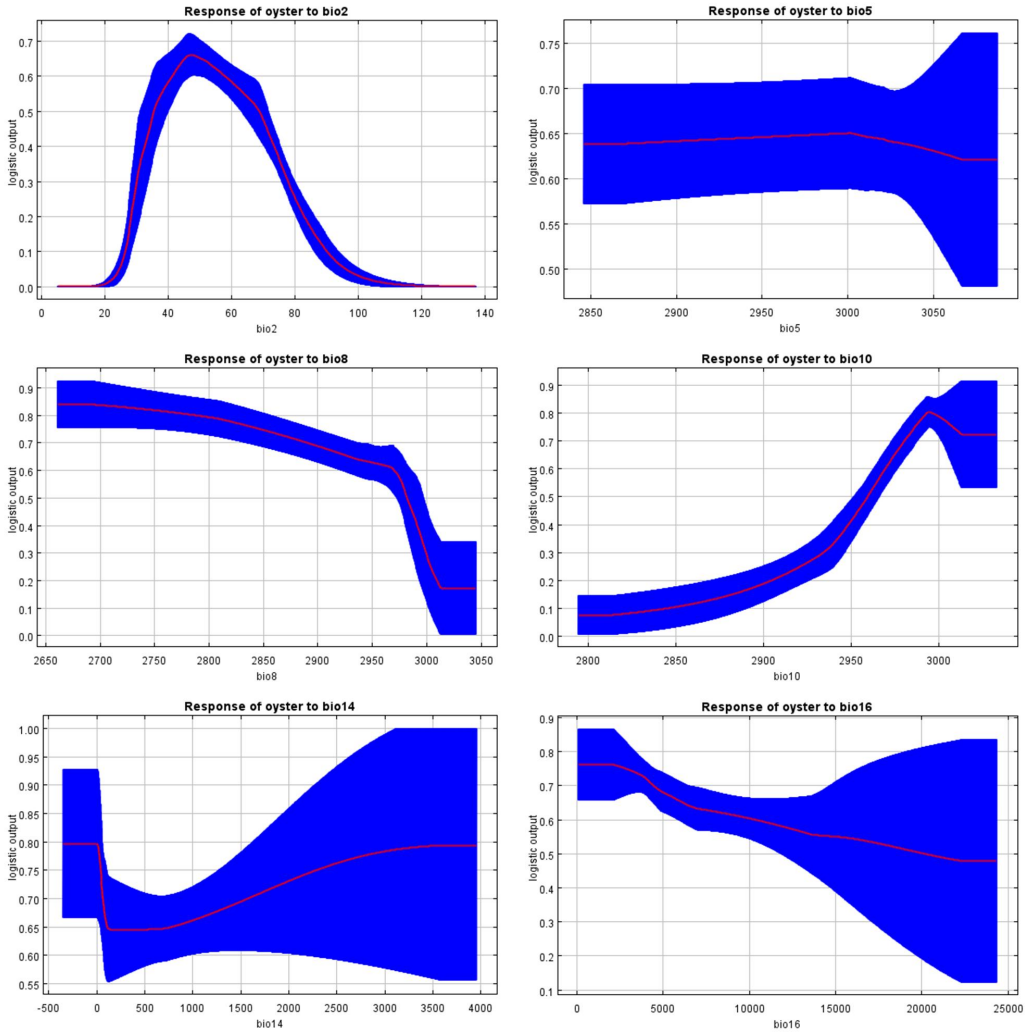
Supplementary Figure 16. (A) Jackknife of regularized training gain for oyster ; (B) Jackknife of test gain for oyster; (C) Jackknife of AUC for oyster (SSP1-2.6, 2070-2100).



Supplementary Figure 17. Spatial distribution of the Pacific oyster of suitable area (SSP1-2.6, 2070-2100).



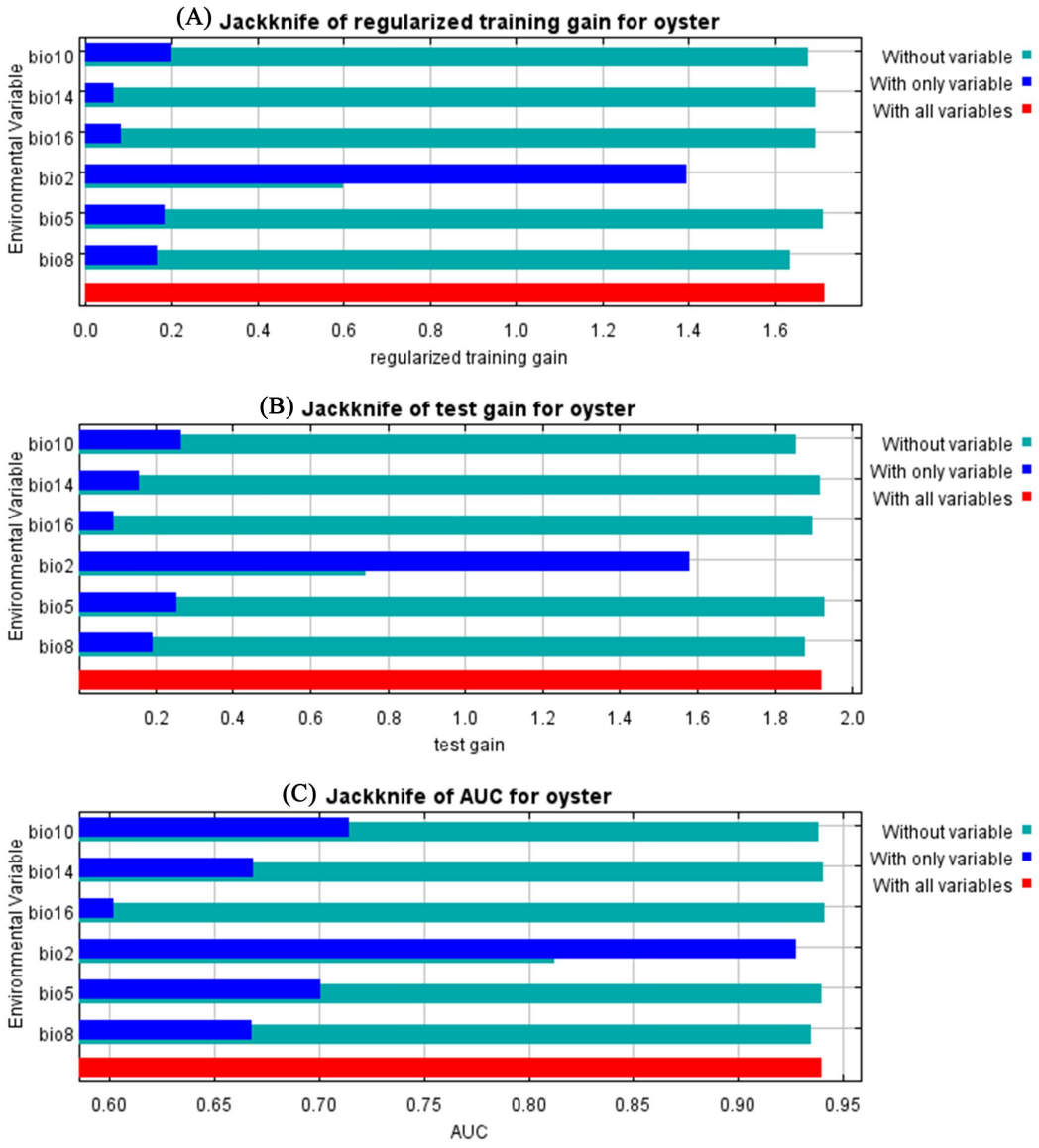
Supplementary Figure 18. Receiver operating characteristic (ROC) curve (SSP5-8.5, 2010-2040)



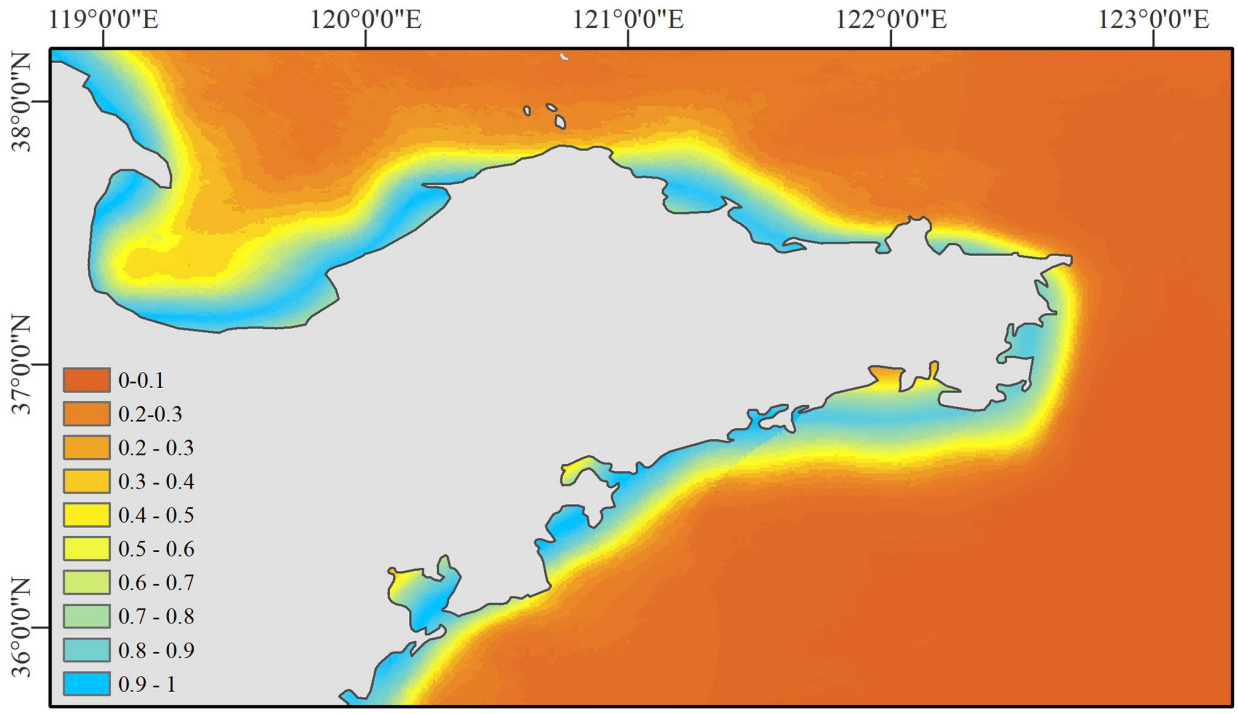
Supplementary Figure 19. Response curves (SSP5-8.5, 2010-2040).

Supplementary Table 7. Variable contributions (SSP5-8.5, 2010-2040).

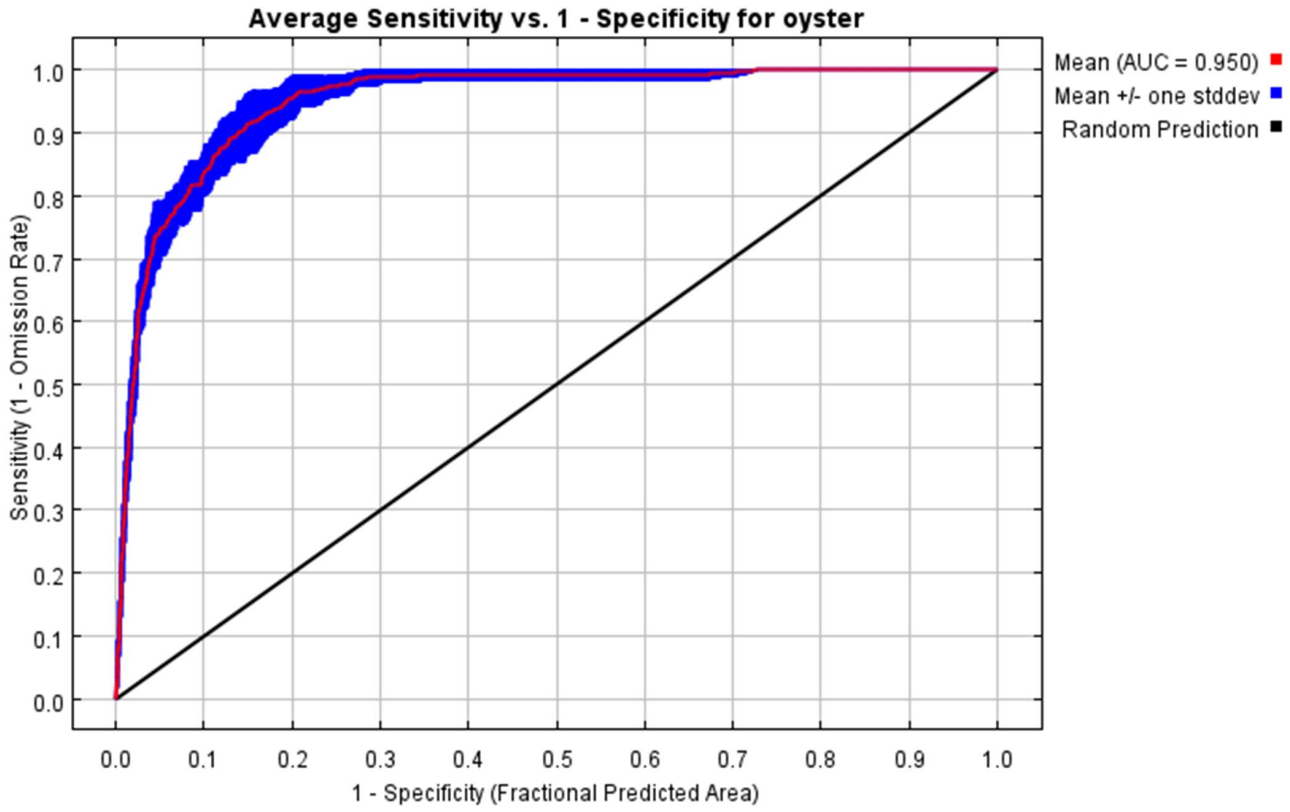
Variable	Percent contribution
Bio2	81.4
Bio10	10.5
Bio8	5.2
Bio14	1..8
Bio16	0.7
Bio5	0.4



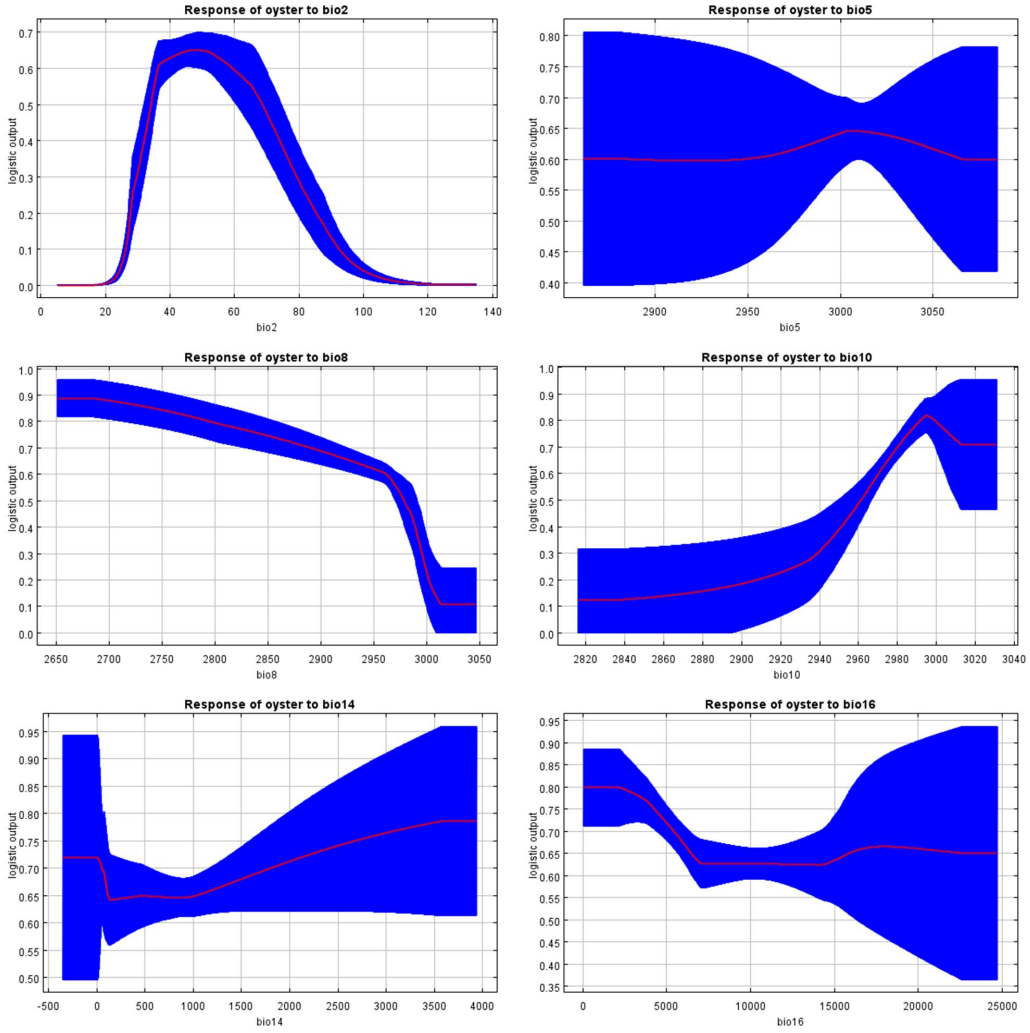
Supplementary Figure 20. (A) Jackknife of regularized training gain for oyster ; (B) Jackknife of test gain for oyster; (C) Jackknife of AUC for oyster (SSP5-8.5, 2010-2040).



Supplementary Figure 21. Spatial distribution of the Pacific oyster of suitable area (SSP5-8.5, 2010-2040).



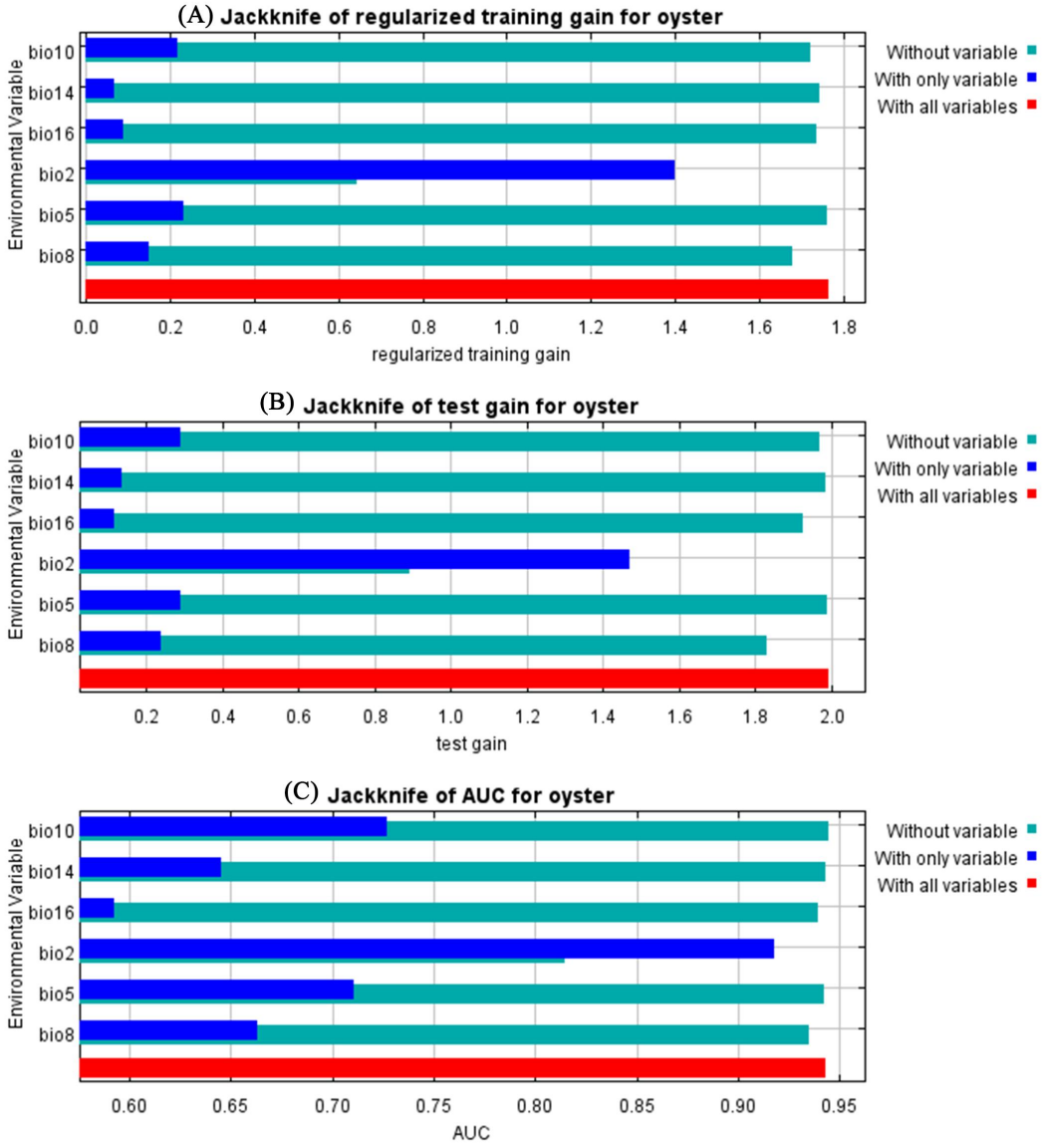
Supplementary Figure 22. Receiver operating characteristic (ROC) curve (SSP5-8.5, 2040-2070).



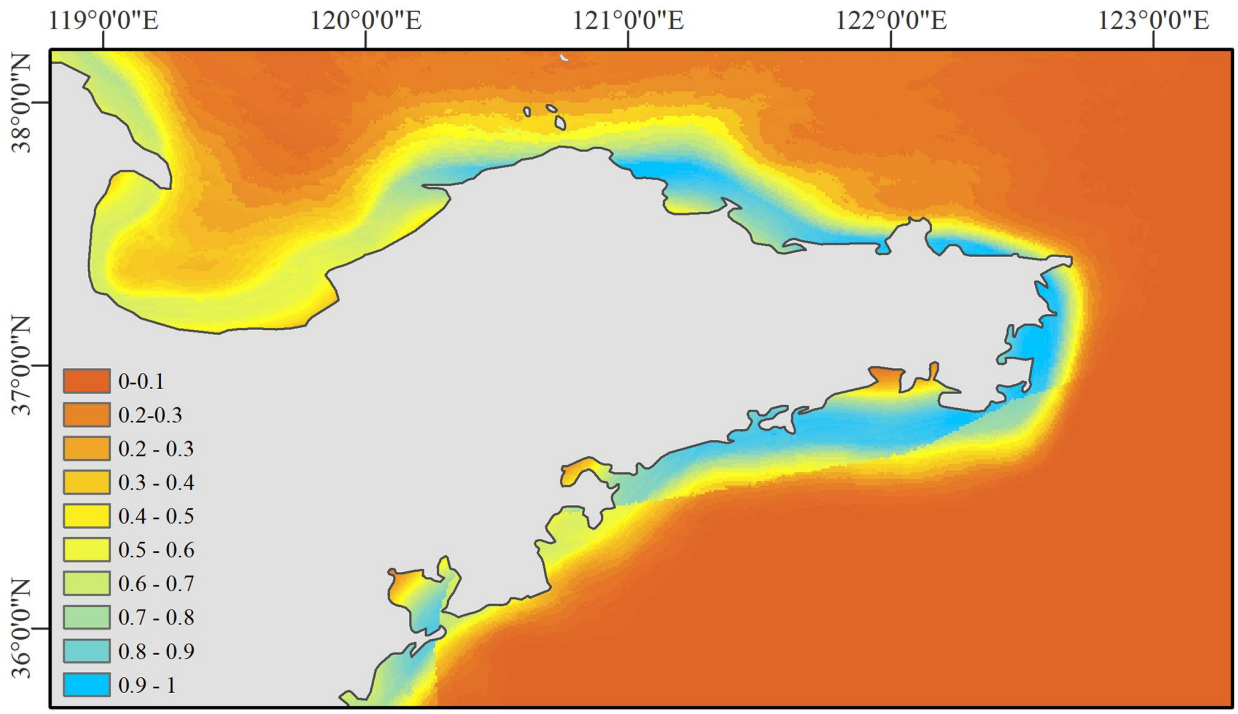
Supplementary Figure 23. Response curves (SSP5-8.5, 2040-2070).

Supplementary Table 8. Variable contributions (SSP5-8.5, 2040-2070).

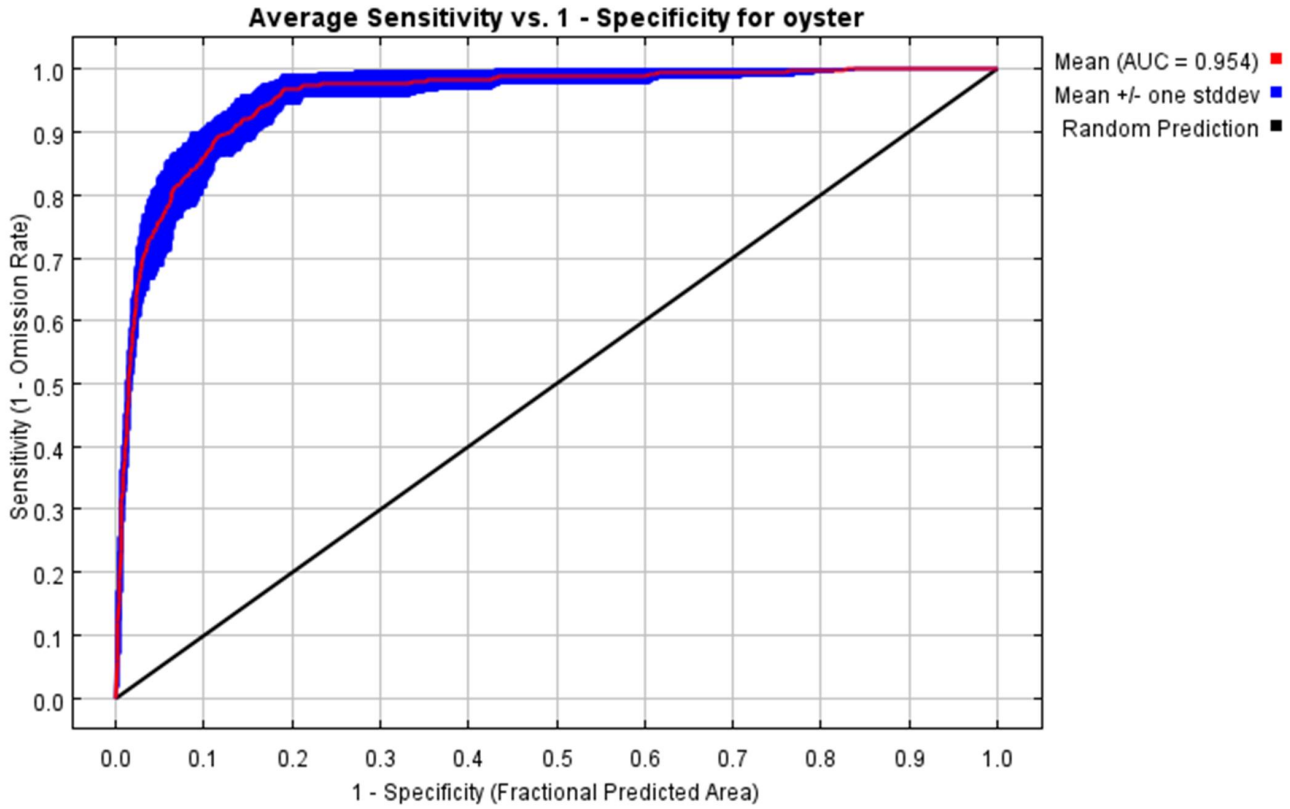
Variable	Percent contribution
Bio2	79.8
Bio10	9.9
Bio8	5.2
Bio5	2.2
Bio14	1.7
Bio16	1.1



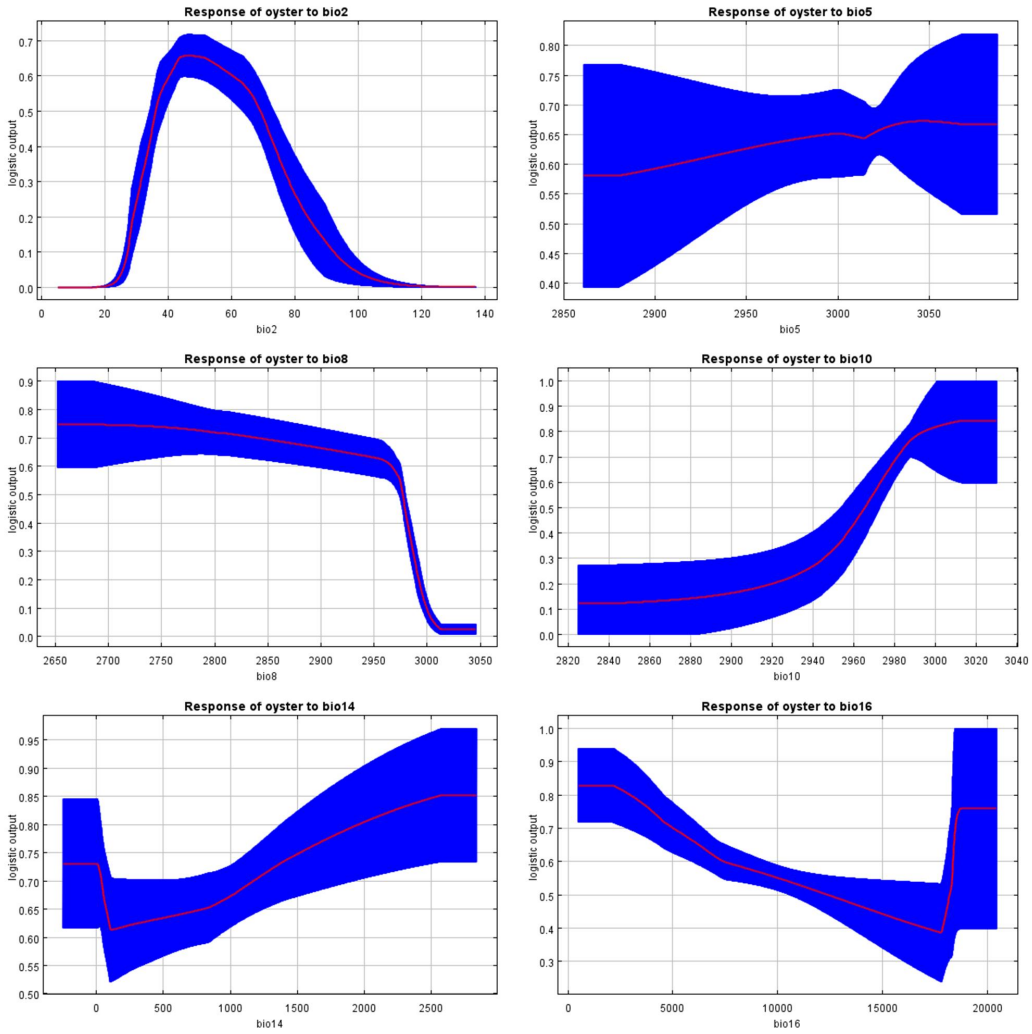
Supplementary Figure 24. (A) Jackknife of regularized training gain for oyster ; (B) Jackknife of test gain for oyster; (C) Jackknife of AUC for oyster (SSP5-8.5, 2040-2070).



Supplementary Figure 25. Spatial distribution of the Pacific oyster of suitable area (SSP5-8.5, 2040-2070).



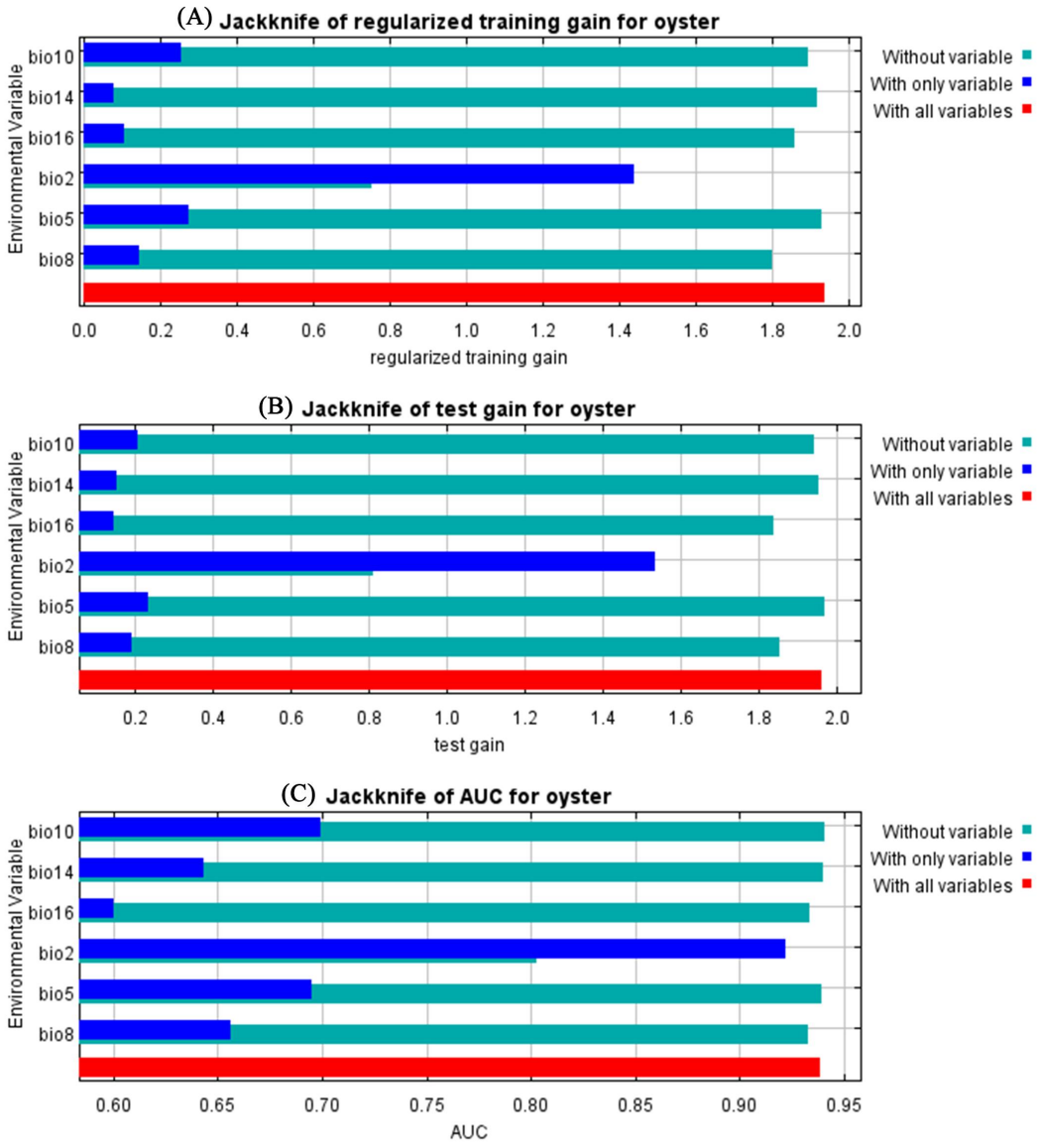
Supplementary Figure 26. Receiver operating characteristic (ROC) curve (SSP5-8.5, 2070-2100).



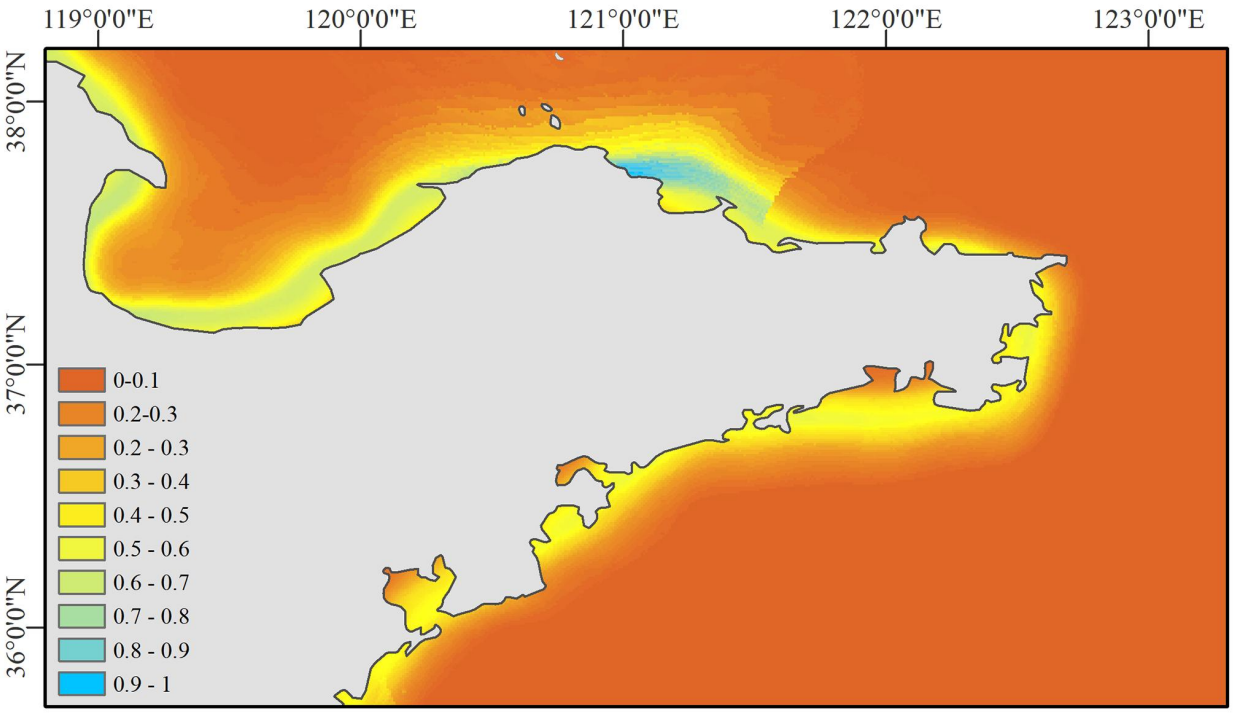
Supplementary Figure 27. Response curves (SSP5-8.5, 2070-2100).

Supplementary Table 9. Variable contributions (SSP5-8.5, 2070-2100).

Variable	Percent contribution
Bio2	75.8
Bio10	11.6
Bio8	6.1
Bio16	2.9
Bio14	2.1
Bio5	1.5



Supplementary Figure 28. (A) Jackknife of regularized training gain for oyster ; (B) Jackknife of test gain for oyster; (C) Jackknife of AUC for oyster (SSP5-8.5, 2070-2100).



Supplementary Figure 29. Spatial distribution of the Pacific oyster of suitable area (SSP5-8.5, 2070-2100).