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Amphibian & Reptile Conservation
16(1) [General Section]: 76–85 (e303).

Climate change and the fate of endemic Beyşehir Frog, *Pelophylax caralitanus*

[1]Akın Kıraç, [2]Müge Gidiş, [3]Ahmet Mert, and [4,*]Eyup Başkale

[1]Çanakkale Onsekiz Mart University, Çanakkale Technical Sciences Vocational College, Çanakkale, TURKEY [2]Kütahya Dumlupınar University, Faculty of Arts and Science, Department of Biochemistry, Kütahya, TURKEY [3]Isparta University of Applied Sciences, Faculty of Forestry, Isparta, TURKEY [4]Pamukkale University, Faculty of Science and Arts, Department of Biology, Denizli, TURKEY

***Abstract.*—Global warming and the decline in precipitation threaten wetlands worldwide, and lakes in some regions are in the process of drying. Amphibians, since they are water-dependent, will be the creatures most affected by the rapid habitat losses due to climate change. Especially for amphibian species which are endemic, the situation will be more serious in terms of its impact on biodiversity. Therefore, in this study, we determined the climate characteristics specific to the habitats of an endemic amphibian species, *Pelophylax caralitanus*. According to the Representative Concentration Pathways (RCP) climate change scenarios of the ICPP, we analyzed whether the climatic characteristics specific to these habitats will exist in 2050 and 2070 under the criteria of RCP 2.6, RCP 4.5, RCP 6.0, and RCP 8.5. The results are quite alarming for *Pelophylax caralitanus*. According to the RCP climate change scenarios, the climatic conditions in the present habitats of this endemic amphibian species will not remain stable in that the potential habitats in Southwestern Anatolia will be dramatically reduced and the appropriate habitats of *P. caralitanus* around the Turkish Lake District will completely disappear, while some new potential habitats will emerge in the Northwest Aegean region of Turkey.**

Keywords. Amphibian, climate change scenarios, habitat loss, MaxEnt, RCP, Representative Concentration Pathways, Turkey

Citation: Kıraç A, Gidiş M, Mert A, Başkale E. 2022. Climate change and the fate of endemic Beyşehir Frog, *Pelophylax caralitanus. Amphibian & Reptile Conservation* 16(1) [General Section]: 76–85 (e303).

Accepted: 7 November 2020; **Published:** 31 March 2022

Introduction

The Beyşehir Frog, *Pelophylax caralitanus*, is an endemic species of Turkey which is distributed across the Mediterranean region of Turkey called the Turkish Lake District (Arikan et al. 1994; Ayaz et al. 2006; Baskale et al. 2017; Düşen et al. 2004; Kaya et al. 2002). According to the literature on the distribution of *P. caralitanus*, it inhabits permanent wetlands with rich aquatic vegetation, including permanent ponds, rain pools, streams, rivers, and irrigation channels. *Pelophylax caralitanus* prefers abundant vegetation around lakes and ponds as habitats (Başkale and Çapar 2016). In particular, emergent vegetation present in the water and the presence of bushes and weeds around the water body constitute an ideal area for the release of eggs and seeking shelter from predators. *Pelophylax caralitanus* is listed by IUCN as Near Threatened (NT) because of ongoing threats from habitat loss and overexploitation (Öz et al. 2009). Since it has a relatively wide distribution and presumed large populations, it is unlikely to experience declines that are rapid enough to qualify it for listing in a higher Red List category.

Climate change is one of the greatest problems threatening biodiversity and ecosystems in the 21st century, leading to the extinction of many species (Sinervo et al. 2010; Walther et al. 2002). The habitat preferences of amphibians are closely related to temperature, precipitation, and wetlands, so amphibians are one of the most sensitive animal groups to changes in climatic conditions (Enriquez-Urzelai et al. 2019; Ortiz-Yusty et al. 2013). Temperature was found to be positively correlated with the detection probability of *P. caralitanus* (Başkale and Çapar 2016). Wetland ecosystems, in which amphibians complete their life cycles, are among the areas most affected by climate change, which creates inhospitable conditions for amphibian reproduction (Desta et al. 2012; Hopkins 2007). According to the literature, the losses of amphibian habitat will be high due to the increase in annual temperatures in the Mediterranean basin, and it is predicted that there will be new gains in the north (Araújo et al. 2006). In addition

Correspondence. **ebaskale@pau.edu.tr*

to the difficulties amphibians face from possible climatic changes, the pathogens that cause amphibian deaths, such as *Batrachochytrium dendrobatidis* in the southern part of the world, have been detected with increasing frequency in the north due to climate change (Berger et al. 1998; Cohen et al. 2019; Erismis et al. 2014).

The IPCC (Intergovernmental Panel on Climate Change), which has been investigating climate change for 30 years, presented new climate change scenarios under the name of "Representative Concentration Pathways" (RCP) in its *Fifth Assessment Report* (IPCC 2014). These scenarios estimate that global warming will change atmospheric CO_2 concentrations by 2100 to levels of 1,370 ppm for the RCP 8.5 scenario, 850 ppm for RCP 6.0, 650 ppm for RCP 4.5, and 490 ppm for RCP 2.6. These scenarios predict that temperatures in the world may increase by anywhere from 1.5 °C to 5.8 °C (IPCC 2014).

It is important to know the climatic requirements of a species in order to predict how that species will respond to climate change. The MaxEnt approach and software have been widely used in recent years to determine the current climatic demands of a species and to predict changes in that species' habitats in the future (Hendrick and McGarvey 2019; Kıraç and Mert 2019; Untalan et al. 2019; Zhang et al. 2018). MaxEnt gives more accurate results with less data in smaller areas compared to other methods, e.g., DOMAIN, BIOCLIM, and GARP (Hernandez et al. 2006; Wisz et al. 2008). In addition, MaxEnt allows categorized and continuous data to be processed together (Phillips et al. 2006; Phillips and Dudík 2008) and it creates habitat suitability maps in addition to the outcome outputs (Elith et al. 2006, 2011; Hernandez et al. 2006, 2008).

The aim of this study is to investigate the ecological niche of *P. caralitanus* and evaluate the consistency and variations in the predicted potential distributions of this endemic species in the Turkish Lake District in the Southwest of Turkey under the IPCC's four future climate scenarios (RCP 2.6, RCP 4.5, RCP 6.0, and RCP 8.5). The results will help us to understand how this endemic amphibian species will experience the effects of climate change in relation to distributional shifts.

Materials and Methods

Study site. The Turkish Lake District (Fig. 1) is located in Southwest Turkey and includes the western part of the Taurus Mountains. This region contains many different tectonic water bodies such as Beyşehir Lake, Eğirdir Lake, Burdur Lake, Akşehir Lake, Salda Lake, and Acıgöl Lake. The Turkish Lake District is a transitional region between the Mediterranean and continental climates (Baskale et al. 2017; Düşen et al. 2004).

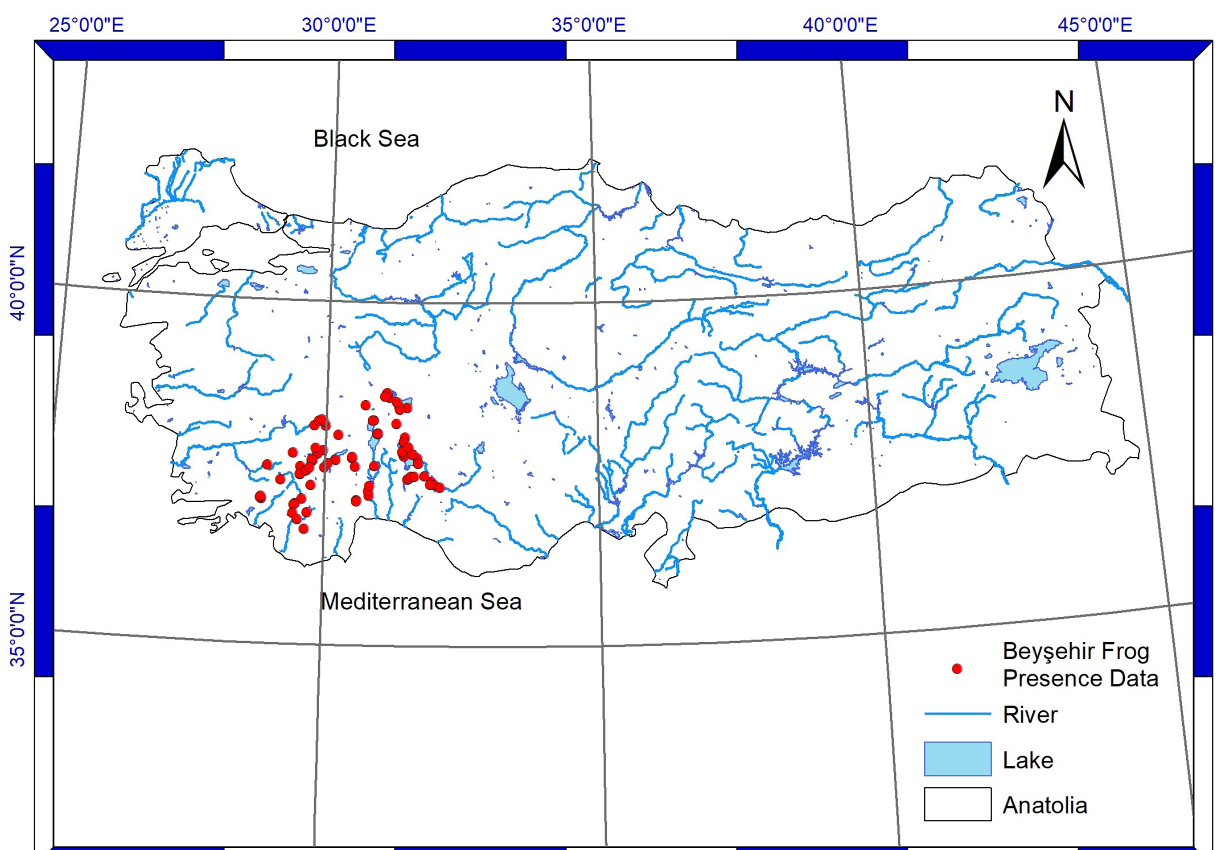

Fig. 1. Turkish Lake District and species presence data.

Data collection. Presence data for *P. caralitanus* were recorded from 89 sites in the Turkish Lake District area based on our field studies performed between 2010 and 2016, as well as previously published papers (i.e., Ayaz et al. 2006; Başkale and Çapar 2016; Baskale et al. 2017; Düşen et al. 2004; Kaya et al. 2002) (Fig. 1). The sampling sites and their coordinates are given in Appendix 1. Sampling from habitats during this study was approved by the General Directorate of Nature Conservation and Natural Parks in the Ministry of Agriculture and Forestry, Turkey (protocol number 18.10.2010/61288) and the Animal Care and Use Committee at Pamukkale University (protocol number 20.09.2010-PAUHDEK-2010/021). Individuals of the target species were identified in their natural habitats and were not exposed to stress. No measurements or experiments were performed on the species.

Bioclimatic data. The current bioclimatic data (Bio1 to Bio19, for years 1950–2000) were downloaded from version 1.4 (30 arc-sec, or ~1 km) of the WorldClim website (http://worldclim.org, Hijmans et al. 2005). The varible definitions are given in Table 1. In Version 1.4, HadGEM2-ES (30 arc-sec, or ~1 km) based data for 19 bioclimatic variables were available for the future (2050 and 2070) climate projections based on the RCP 2.6, RCP 4.5, RCP 6.0, and RCP 8.5 scenarios. These data sets are provided on a global scale, and were optimized to the size of Turkey with the help of ArcGIS 10.2 and converted to ASCII format.

Habitat suitability model. Due to the narrow study area, high correlations can exist between bioclimatic variables which may pose a problem during the analysis. To eliminate the problem of multi-collinearity, we applied Pearson Correlation Analysis ($r^2 < 0.8$) for the 19 bioclimatic variables. If a pair of variables has a correlation coefficient of greater than 0.8, they were considered to both represent a similar phenomenon, so one of the pair of variables was excluded from the analysis.

MaxEnt 3.4.1 software was used to estimate the climatic conditions limiting the current distribution of *P. caralitanus* and to compare the current situation with future climate scenarios (Phillips et al. 2017). The presence data of *P. caralitanus* in CSV format were entered into the "Samples" section of MaxEnt 3.4.1 software. The current bioclimatic data in ASCII format were entered into the "Environmental layers" section. Then, 2050 and 2070 bioclimatic data files (RCP 2.6, RCP 4.5, RCP 6.0, and RCP 8.5) were entered in the "Projection layers directory/file" section to compare the future scenarios. MaxEnt analysis was run using 90% of the records as training data to build the model and the remaining 10% for testing the model. Ten repetitions were made for each model so that different training and test data would be processed in the analysis. Any bioclimatic variables (Bio1 to Bio19) that did not contribute to the model obtained as a result of the analysis, were excluded in the next analysis. Replicated run type Crossvalidate was selected for the analysis along with the settings: maximum iterations 500, convergence threshold 0.00001, log file maxent.log, and the default prevalence was set to 0.5. The analysis process continued until the best model was obtained. We used the "Area under the receiver operating characteristic (ROC) curves" (AUC) values to determine the best

Table 1. Bioclimatic variables obtained from the WorldClim website (http://worldclim.org).

Code	Bioclimatic variables	Unit
Bio1	Annual Mean Temperature	ºC
Bio2	Mean Diurnal Range (Mean of monthly (max temp - min temp))	ºC
Bio3	Isothermality ((Bio2/Bio7) * 100)	unitless
Bio4	Temperature Seasonality (standard deviation *100)	C of V
Bio5	Max Temperature of Warmest Month	ºC
Bio6	Min Temperature of Coldest Month	ºC
Bio7	Temperature Annual Range (Bio5-Bio6)	ºC
Bio8	Mean Temperature of Wettest Quarter	ºC
Bio9	Mean Temperature of Driest Quarter	ºC
Bio10	Mean Temperature of Warmest Quarter	ºC
Bio11	Mean Temperature of Coldest Quarter	ºC
Bio12	Annual Precipitation	mm
Bio13	Precipitation of Wettest Month	mm
Bio14	Precipitation of Driest Month	mm
Bio15	Precipitation Seasonality (Coefficient of Variation)	C of V
Bio16	Precipitation of Wettest Quarter	mm
Bio17	Precipitation of Driest Quarter	mm
Bio18	Precipitation of Warmest Quarter	mm
Bio19	Precipitation of Coldest Quarter	mm

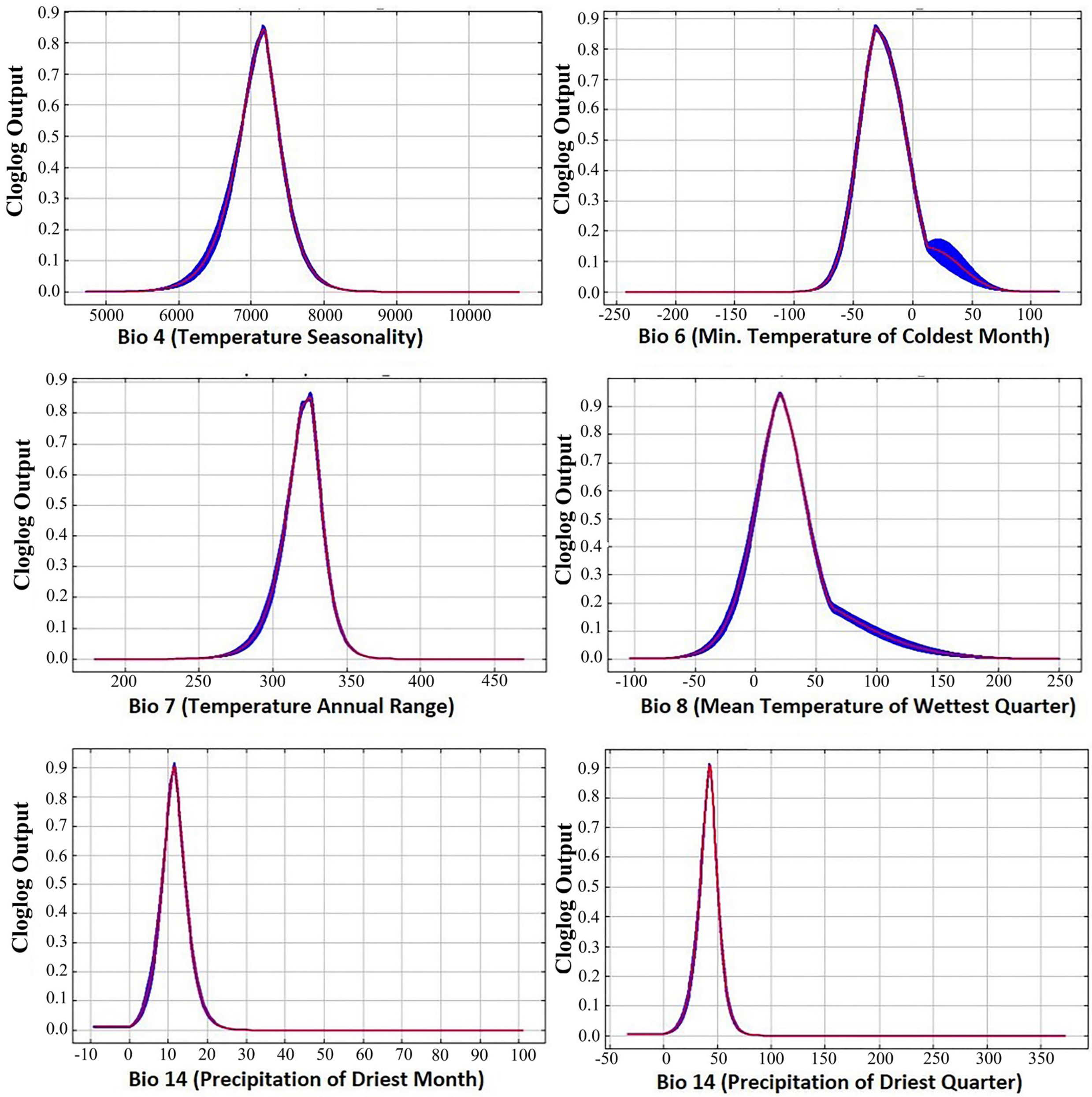

Fig. 2. Variables with the highest contributions to the potential distribution of *P. caralitanus* according to MAXENT with the standard errors in blue. The Y-axis indicates the probability of presence (based on the Cloglog, or complementary log-log transform, values) and the X-axis shows the contribution of each variable.

model performance. An AUC value close to 1 indicates that the model is in a perfect performance and a value of 0.7 or higher indicates that the model is descriptive, while a value of 0.5 indicates that the model does not provide useful information (Phillips et al. 2006). Among the models with the highest AUC values, the one with the lowest standard deviation was selected as the best model.

Results

The results of the analysis indicate that the AUC value of the training data is 0.965, while the test data AUC value is 0.964, and the standard deviation is 0.012. We found that the climatic factors limiting the distribution of *P. caralitanus* were: Bio4 (percent contribution: 22.3%, Temperature Seasonality), Bio6 (16.4%, Min Temperature of Coldest Month), Bio7 (17.9%, Temperature Annual Range), Bio8 (19.9%, Mean Temperature of Wettest Quarter), Bio14 (15.5%, Precipitation of Driest Month), and Bio17 (8%, Precipitation of Driest Quarter). According to these results, *P. caralitanus* prefers habitats with precipitation in the driest months, and those where the average temperature of the coldest three months does not fall below -5 °C, the seasonal temperature difference is high, and the humid months are 0–5 °C (Fig. 2).

The habitats for *P. caralitanus* were primarily in

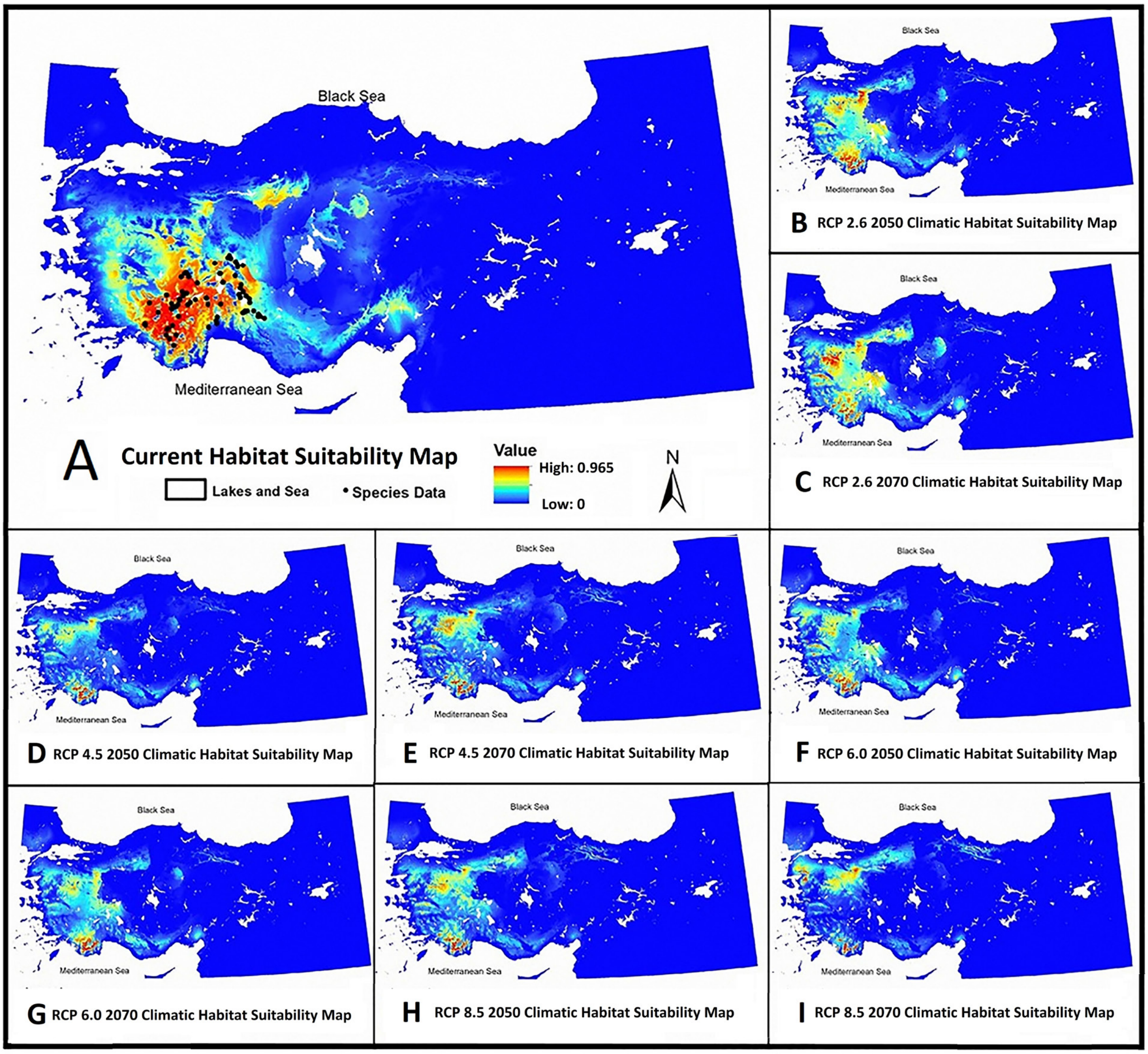

Fig. 3. Current climatic habitat suitability map **(A)** and the eight RCP climatic change scenario maps for *P. caralitanus* based on RCP 2.6 **(B–C)**, RCP 4.5 **(D–E)**, RCP 6.0 **(F–G)**, and RCP 8.5 **(H–I)** for either 2050 or 2070 as indicated.

Southwestern Anatolia, in the region between Central Anatolia and Western Anatolia, and around the western Taurus Mountains (Fig. 3A). A large part of the map reflects the distribution areas of *P. caralitanus* reported in the literature. Although its presence has not yet been reported from the new potential areas, these areas are climatically potential habitats.

If the RCP 2.6 scenario occurs, there will be habitat losses in the Turkish Lake District until 2050, potential habitats in the Southwest will persist, and new potentially suitable bioclimatic habitats will emerge in the North Aegean region (Fig. 3B). By 2070, the situation in the Turkish Lake District will be slightly better than in 2050 and new potential habitats will be formed in a small area in the inner Western Aegean region (Fig. 3C). In the case of the RCP 4.5 scenario, suitable habitats in the Turkish Lake District will almost disappear, new habitats will appear in the Northern Aegean regions, and potential habitats in the Southwest will persist (Fig. 3D–E). The RCP 6.0 scenario map shows that a situation similar to the RCP 4.5 scenario in Fig. 3E will occur in 2050, but it reveals that the situation will be worse in 2070 (Fig. 3F–G). According to the RCP 8.5 scenario, which is the most dramatic result, potential habitats in Southwestern Anatolia will be reduced but some will continue to exist, and the appropriate habitats of *P. caralitanus* around the Turkish Lake District will completely disappear. On the other hand, new potential habitats not seen in the other scenarios will emerge in the Northwest Aegean region (Fig. 3H–I).

Discussion

Recent studies have provided important information on the extinctions of species due to climate change. Studies have reported that there could be a 15–37% loss of species by 2050 according to various climate change scenarios (Thomas et al. 2004). Even in the most optimistic climate change scenario, most of these losses will occur in endemic species (Dirnböck et al. 2011). In response to climate change, many species will present compensating mechanisms such as adaptation and migration; however, the success of these mechanisms against climate change will be related to the climate change velocity. In contrast to species which have large areas of distribution, endemic species distributed in a narrow region according to special climatic and topographic conditions will not be as successful, except in areas with a low climate change velocity. In areas with a high climate change velocity, endemism is either very low or does not exist. For this reason low climate change velocity areas will be essential refuges for many small-ranged species, such as endemic species (Sandel et al. 2011).

The current habitat suitability map (Fig. 3A) shows the distribution of *P. caralitanus* mainly in the Turkish Lake District region and is compatible with species observation data. It also indicates that there are suitable habitats for this species in the north-western parts of the Turkish Lake District (Fig. 3A), while recent studies have found that the most north-western distribution area of the species is Acıgöl and Işıklı Lakes (Baskale et al. 2017). These lakes are located at the north-western border of the Turkish Lake District. Although there are locations with similar climatic conditions, the distribution of the species in the northern part is geographically isolated due to mountains.

In the past two decades, some lakes in the Turkish Lake District have reduced water levels due to climatic changes (Göncü et al. 2017; Kantarcı 2008). Wetlands and lakes are the essential elements of the habitats of frog species such as *P. caralitanus* because they need water bodies to complete their life cycle. A significant reduction of snow in higher regions due to climate change, a reduction in the water storage basins and earlier melting of snow will have negative consequences for many wetlands in Turkey (Yılmaz et al. 2019). Potential distribution maps determined for *P. caralitanus* can help in prioritizing the planning of future wetland use management around the current populations, the discovery of new populations or the identification of top priority areas.

According to RCP scenarios that were created here for *P. caralitanus*, the climate change velocity will be high for the next 30 to 50 years (Fig. 3B–I), and habitat loss and fragmentation will be quite high in the distribution area of the species. For the survival of endemic species, we found RCP 2.6 to be the most optimistic scenario among the climate scenarios. However, even in this scenario, if *P. caralitanus* cannot migrate to the north-western Turkish Lake District, the distribution of the species will shrink in the next 30 years, and a very narrow distribution area will host the species in 2070. The IPCC, which is currently in its 6th assessment phase, reported "Global warming of 1.5 °C" towards the end of 2018, and emphasized that a temperature rise by 1.5 °C was better than 2 °C (IPCC 2018). According to our results, if the RCP 2.6 scenario is exceeded, most small-scale wetlands will begin to dry in the next 30 years, and irreversible changes may occur in the following years relative to the current distribution map of *P. caralitanus* (Fig. 3D–I). Although new locations with similar climate zones occur in the north and north-west of the Turkish Lake District, it would be very difficult for the frogs to migrate from the original habitats to the new climatically suitable habitats within the next 30 and 50 years because of geographic isolation. Moreover, if the RCP 8.5 climate scenario occurs, there will be no climatically suitable habitats for *P. caralitanus* in the Turkish Lake District, which we can categorize as a disaster.

We have shown that the MaxEnt model is a useful tool for creating a predictive distribution map of *P. caralitanus* in the Turkish Lake District, and it has allowed us to determine putative environmental constraints and successfully predict the species potential fate in the coming years. According to our results, *P. caralitanus* will move farther towards extinction in future, in the face of such problems as an increase in temperature, decrease in precipitation, loss of habitat, and reduction of water bodies. In order to ensure the continuation of this endemic species, the protection of habitat and the impact of climate change on the species should be investigated in detail with more environmentalist approaches.

Acknowledgements.—This research was supported by Pamukkale University Scientific Research Projects Unit- BAP (Project No: 2010BSP017). The permissions for field work and handling of the frogs were issued by the Animal Ethics Committee of Pamukkale University (Pamukkale, Turkey) and the Ministry of Agriculture and Forestry, General Directorate of Nature Conservation and Natural Parks (Ankara, Turkey).

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Akın Kıraç is an Associate Professor in the Technical Science Vocational School at Çanakkale Onsekiz Mart University, Çanakkale, Turkey. His primary research interests are mainly focused on habitat suitability models and climate envelope models, and he has conducted research in the field of species ecology and climate change. He has also authored or co-authored several articles in peer-reviewed scientific journals on insects, amphibians, reptiles, and mammals.

Muge Gidis is an Associate Professor in the Department of Biochemistry at the University of Dumlupinar in Kütahya, Turkey. She is interested in molecular ecology and the conservation biology of reptiles and amphibians. Her recent research projects involve the comparative phylogeography of amphibians and reptiles.

Ahmet Mert is currently working as an Associate Professor in the Department of Wildlife Ecology and Management at Isparta University of Applied Sciences in Isparta, Turkey. His primary research interests are mainly focused on modelling and mapping the habitat distribution of wildlife species using geographic information systems. He is an expert in using new and advanced technologies for wildlife species including mammals, birds, and reptiles. He combines and analyzes wildlife species data through traditional field work and novel technologies to provide a deeper knowledge and understanding of the factors that influence the distribution and abundance of wildlife species. Furthermore, he has authored or co-authored several articles in peer-reviewed scientific journals.

Eyup Başkale is a Professor in the Department of Biology at the University of Pamukkale (Denizli, Turkey). His current research seeks to understand animal ecology and distribution, with a special focus on the conservation of amphibians and reptiles living in Turkey. Eyup currently coordinates several research projects focusing on threatened species in Turkey.

Appendix 1. The list of localities of *Pelophylax caralitanus* in this survey.

Site No	Locality	GPS Coordinates		Altitude (m)
		Latitute	Longitute	
1	Acıgöl site 1/Denizli	37°46.375'N	29°50.680'E	845
2	Acıgöl site 2/Denizli	37°49.794'N	29°56.879'E	841
3	Acıgöl site 3/Denizli	37°46.348'N	29°50.581'E	840
4	Acıgöl site 4/Denizli	37°47.003'N	29°51.709'E	839
5	Acıgöl site 5/Denizli	37°50.942'N	29°59.452'E	840
6	Ağlasun site 1/Burdur	37°36.065'N	30°32.018'E	1,024
7	Ağlasun site 2/Burdur	37°35.967'N	30°32.420'E	1,023
8	Ağlasun site 3/Burdur	37°36.195'N	30°32.406'E	1,024
9	Akgöl site 1/Burdur	37°41.323'N	29°44.759'E	994
10	Akgöl site 2/Burdur	37°40.268'N	29°44.206'E	992
11	Akgöl site 3/Burdur	37°39.887'N	29°45.293'E	994
12	Aksu river/Antalya	37°14.896'N	30°47.431'E	103
13	Akşehir lake site 1/Konya	38°26.834'N	31°21.994'E	954
14	Akşehir lake site 2/Konya	38°32.596'N	31°22.835'E	954
15	Akşehir lake site 3/Konya	38°31.314'N	31°19.875'E	954
16	Belceğiz/Isparta	37°57.680'N	31°19.188'E	1,127
17	Beyşehir site 1/Konya	37°58.268'N	31°25.984'E	1,132
18	Beyşehir site 2 /Konya	37°53.332'N	31°30.742'E	1,126
19	Beyşehir Site 3/Konya	37°47.691'N	31°35.816'E	1,136
20	Beyşehir site 4/Konya	37°39.479'N	31°41.819'E	1,128
21	Beyşehir site 5/Konya	37°44.304'N	31°41.056'E	1,126
22	Bucak/Denizli	38°15.035'N	29°51.897'E	822
23	Burdur lake site 1/Burdur	37°41.411'N	30°03.452'E	910
24	Burdur lake site 2/Burdur	37°38.995'N	30°03.628'E	859
25	Burdur lake site 3/Burdur	37°38.225'N	30°05.685'E	865
26	Derebucak site 1/Konya	37°21.654'N	31°32.842'E	1,261
27	Derebucak site 2/Konya	37°25.667'N	31°30.631'E	1,281
28	Eber lake site 1/Afyon	38°36.832'N	31°13.561'E	971
29	Eber lake site 2/Afyon	38°39.140'N	31°14.515'E	970
30	Eber lake site 3/Afyon	38°42.375'N	31°11.501'E	970
31	Eber lake site 4/Afyon	38°37.808'N	31°04.053'E	970
32	Eğirdir lake site 1/Isparta	38°05.178'N	30°56.857'E	920
33	Eğirdir lake site 2/Isparta	38°16.532'N	30°51.581'E	921
34	Eğirdir lake site 3/Isparta	38°16.723'N	30°52.190'E	921
35	Eğirdir lake site 4/Isparta	38°01.231'N	30°48.872'E	921
36	Eğirdir lake site 5/Isparta	38°08.231'N	30°52.789'E	921
37	Eğirdir lake site 6/Isparta	37°50.550'N	30°51.913'E	921
38	Fele/Isparta	38°02.435'N	31°27.156'E	1,234
39	Gedikli/Isparta	37°53.334'N	31°20.392'E	1,127
40	Gencek/Konya	37°26.572'N	31°32.438'E	1,354
41	Gökgöl/Denizli	38°12.207'N	30°02.938'E	821
42	Gökhöyük/Konya	37°24.056'N	31°56.421'E	1,021
43	Gölcük site 1/Isparta	37°43.707'N	30°29.510'E	1,387
44	Gölcük site 2/Isparta	37°44.469'N	30°29.030'E	1,346
45	Gölcük site 3/Isparta	37°44.469'N	30°29.030'E	1,347

Appendix 1 (continued). The list of localities of *Pelophylax caralitanus* in this survey.

Site No	Locality	GPS Coordinates		Altitude (m)
		Latitute	Longitude	
46	Gölhisar channel/Burdur	37°02.734’N	29°27.960’E	1,022
47	Gölhisar dam/Burdur	37°01.385’N	29°26.687’E	1,068
48	Gölhisar Lake/Burdur	37°06.711’N	29°35.376’E	947
49	Gölyaka/Konya	37°41.825’N	31°26.898’E	1,126
50	Gölyüzü/Konya	37°21.225’N	31°55.425’E	1,099
51	Huğla/Konya	37°28.112’N	31°34.050’E	1,370
52	Işıklı lake site 1/Denizli	38°11.014’N	29°46.840’E	816
53	Işıklı lake site 2/Denizli	38°15.332’N	29°51.811’E	819
54	Işıklı lake site 3/Denizli	38°11.176’N	29°59.554’E	821
55	Işıklı lake site 4/Denizli	38°14.403’N	29°57.245’E	821
56	Işıklı lake site 5/Denizli	38°16.443’N	29°54.415’E	821
57	Işıklı lake site 6/Denizli	38°12.368’N	30°01.774’E	821
58	Işıklı/Denizli	38°19.255’N	29°51.375’E	829
59	Karaköy site 1/Burdur	37°28.333’N	29°32.717’E	996
60	Karaköy site 2/Burdur	37°28.561’N	29°32.385’E	991
61	Karamık site 1/Afyon	38°27.915’N	30°52.449’E	1,004
62	Karamık site 2/Afyon	38°23.005’N	30°45.394’E	1,004
63	Karamık site 3/Afyon	38°26.173’N	30°53.148’E	1,004
64	Karaöz/Antalya	37°11.067’N	30°48.640’E	55
65	Kavakköy/Denizli	38°09.254’N	29°38.271’E	811
66	Kırkgöz site 1/Antalya	37°06.600’N	30°34.828’E	304
67	Kırkgöz site 2/Antalya	37°05.669’N	30°35.125’E	307
68	Kırkgöz site 3/Antalya	37°05.526’N	30°34.997’E	302
69	Kovada/Isparta	37°36.755’N	30°53.886’E	906
70	Kumluca site 1/Burdur	37°38.270’N	30°02.836’E	860
71	Kumluca site 2/Burdur	37°38.518’N	30°03.275’E	860
72	Salda lake site 1/Burdur	37°31.391’N	29°38.159’E	1,158
73	Salda lake site 2/Burdur	37°31.142’N	29°37.493’E	1,161
74	Salda lake site 3/Burdur	37°31.725’N	29°39.414’E	1,145
75	Salda lake site 4/Burdur	37°31.133’N	29°37.405’E	1,160
76	Salda lake site 5/Burdur	37°31.499’N	29°36.912’E	1,168
77	Sarayköy/Konya	37°19.247’N	32°07.011’E	1,102
78	Sarıkaya/Isparta	37°56.404’N	31°18.464’E	1,127
79	Seydişehir site 1/Konya	37°28.588’N	31°48.769’E	1,135
80	Seydişehir site 2/Konya	37°28.519’N	31°49.462’E	1,131
81	Seydişehir site 3/Konya	37°27.094’N	31°51.634’E	1,110
82	Sugözü/Isparta	38°14.227’N	31°17.231’E	1,226
83	Suğla lake site 1/Konya	37°21.501’N	31°59.413’E	1,222
84	Suğla lake site 2/Konya	37°18.965’N	32°06.145’E	1,096
85	Suğla lake site 3/Konya	37°21.232’N	31°55.516’E	1,098
86	Taşağıl/Konya	37°22.702’N	31°53.321’E	1,101
87	Tepearası/Konya	37°28.233’N	31°37.855’E	1,387
88	Yalıhüyük/Konya	37°19.256’N	32°06.284’E	1,101
89	Yeşildağ/Konya	37°35.087’N	31°30.154’E	1,125