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edited by
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Riassunti: Comunicazioni e Poster

edited by
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Riassunti: Comunicazioni e Poster

On the way back home: predicting the natural expansion of the otter in north-eastern Italy using habitat suitability models

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P085

The Eurasian otter (*Lutra lutra*) was once spread throughout Italy, but during the late '900 Century the species gone extinct from all the north and central Regions, mainly due to river pollution, habitat loss and poaching. In recent years, the legal protection of the species as well as habitats in which it lives, allowed a recovery in Europe. Nowadays the otter is classified as "Near Threatened" by the International Union for the Conservation of Nature (IUCN). In NE Italy, the neighbouring Austrian and Slovenian population are increasing, thus allowing the natural expansion in Friuli Venezia Giulia (hereafter, FVG) and other Italian Regions. In FVG, the presence of otters is confirmed in the Alps and Pre-Alps till 2011, and after about 50 years of absence also in the Friulian plain. Using presence-only data obtained from the species monitoring, a Habitat Suitability Model (HSM) was developed to understand which factors mostly affect the presence of the species and, consequently, predict the species' expansion. Considering the increase of neighbouring populations, identifying the ways of expansion used by the species assumes remarkable importance. We would expect that both the Alps and Pre-Alps are the most suitable areas for the species' expansion because of the presence of natural areas. Conversely, lowlands are expected to be less suitable as a consequence of the high anthropic pressure.

To calibrate the HSM for our study area, we used MaxEnt algorithm with presence-only data obtained from systematic surveys conducted between September 2020 and March 2022, as well as opportunistic data. During the surveys, the FVG Region was divided into 113 10×10 km grid cells, and within 53 cells the bridge survey was conducted, searching for signs of presence under four bridges in each cell (on average). Moreover, in 23 grid cells, four transects of 100 or 500 m were conducted for each side of the riverbanks, starting from the surveyed bridge. To avoid model overfitting, the presence-only data were spatially thinned using the `spThin` R package (R Software, v. 4.1), considering a minimum distance of 0.5 km. Considering the species' ecological needs, seven covariates within a 200 m buffer around rivers were used to build the model: land cover; fish communities, using data from surveys and the suitability map for FVG; water quality of the rivers, considering the biological and physiochemical and chemical quality elements; Strahler order, indicating the hierarchy of tributaries; slope of riparian areas; elevation; human population density. The correlation between covariates was assessed through the Variance Inflation Factor (VIF). Covariates were represented as 100 m raster layers. To find the best settings configuration, we tested for different regularization values and feature classes using `ENMeval` R package, resulting in 48 model combinations. We used "checkerboard2" as a partitioning method and sampled 10000 background points. The model with the lowest Akaike Information Criterion corrected for small sample sizes (AICc) value was considered as the best model and evaluated through the Area Under the Curve (AUC).

From bridge and transect surveys 75 and 69 signs of presence were collected, respectively, mainly spraints (number of spraints: 68 and 55, respectively). Moreover, 39 signs of presence were opportunistically sampled. Overall, 183 signs of presence were collected. Most of these were collected in the Julian Alps (n=90), bordering with Austria and Slovenia, as well as in the morainic hills (n=45). Secondarily, in the Julian Pre-Alps (n=27) and in the eastern part of the Friulian plain (n=14), along the border with Slovenia. As for the covariates, the VIF values were all <5. Therefore, none of these were discarded. The best model had a regularization multiplier set to four, included linear + quadratic + hinge + product feature classes and showed predictive performance based on the AUC (0.828, var=0.004). The covariates with the highest percent contribution to the model were the slope of riparian areas (36.36%), land cover (24.58%), elevation (21.37%) and fish communities (8.86%). The remaining covariates together contributed to less than 10%, with the human population density which did not produced any contribution. The mountain area revealed as suitable (n=44, cells with suitable areas), due to the presence of natural land cover and steep riverbanks. These findings match those reported in other studies realized in Southern Italy. The HSM indicates the upper and medium course of the rivers of the Friulan Alps and Pre-Alps as the most suitable. Some of these, are already inhabited by otters, such as in the Julian area where, as reported in a recent study, a reproductive nucleus is established. Individuals were also reported in the Carnic area, but during our survey no signs of presence were collected, except for a road-killed juvenile. For what concerns the hilly areas, most of the suitable areas (n = 10) include the morainic hills, which are already occupied by otters. However, also a nearby river basin could be considered as attractive because of the presence of fish communities and suitable land cover. In the upper plain there are no natural rivers with constant flow, whereas in the lowland plain there are only three suitable rivers inside n=6 cells, even if an historical colonization was reported, when the area was mainly composed by wetlands. Nevertheless, the landscape has changed since the otter disappeared in the area 50 years ago, mainly as a consequence of urbanization. In this context, the recent colonization of the lowlands bordering with Slovenia (within which the otter population is reported as in expansion) could drive the recolonization of the low plain from its eastern part. To conclude, our model showed that in FVG there are suitable areas for the species, but mainly concentrated in the mountainous areas, where the anthropic pressure is lower. Conversely, in lowlands, suitable areas are scanty. Therefore, there is a lot to be done to encourage the otter expansion.