



## **Recent changes of the Zogon beach on the island of Hvar (Eastern Adriatic, Croatia)**

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The shorelines of the island of Hvar are primarily rocky and the majority of the beaches are formed in proluvial fan material. Consequently, here the geomorphological system composed of a torrent and a beach was analysed with the aim to define natural and anthropogenic processes which influence on recent changes in beach morphology. This research focuses on the Zogon beach at Sveta Nedjelja which was created by the processes of gullyng and by the regressive erosion of Quaternary breccia in which the beach was shaped. The geomorphological assessment of beach decadal morphological change, conducted for the period of about 60 years (from the 1960s in the last century till the present days) was based on three basic methods that are combined and supplemented: the method of repeat photography using Geographic Information System (GIS), georeferenced ortho-photos from 1968 and 2011, and GPS mapping.

This work is centred on defining the difference in the size of the beach between two generations of ortho-photos (1968 and 2011). Since on these photographs coastal margins cannot be accurately determined this method is combined with repeat photography method for the reconstruction of the beach boundary in the sixties of the 20th century as well as with the fieldwork to supplement the data of actual situation.

For the purpose of reconstruction of beach surface in the 1960s using the method of repeat photography, 8 photographs from 1959 to 1964, were used on which the benchmarks were defined. The method of repeat photography cannot provide the same type of quantitative data that can be obtained by satellite images and aero-photogrammetry, but it can be an excellent supplement or can be used in combination with them, an example of which we provide here. The current situation was defined by field mapping which took place in 2017 with the help of the Garmin GPS receiver.

Impacts of anthropogenic activities were considered by tracking changes in land use in the wider research area and recording newer construction works. Data on land use changes from the 19th century were obtained by georeferencing the maps of the Franciscan Cadastre from 1834 and by georeferencing ortho-photos from 1968 and 2011. Maps and ortho-photos are digitized to define trends of land use changes in the investigated area through the three mentioned periods. All analyses were made using the ArcGis 10.2.

It was found that between the 60s of the last century and the present, the Zogon beach reduced in size by approximately 50%. As the beach is an accumulative relief form by its definition, its current erosion testifies the reversal in the evolution of the beach, which is highly influenced by natural and by anthropogenic processes.

Anthropogenic processes are related to construction works and to the land use changes. On the other hand, climate changes lead to the recent relative sea level rise in the wider area which directly affects the erosion of the beach. They synergically have an effect on the negative balance of sediment on the Zogon beach today.