

Water Sports Activities and their Effects on the Avifauna of the Danube Floodplains National Park, Austria - First Results

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Abstract: Sustainable management of protected areas requires combining standardized ecological observations with quantitative data about the number of visitors and their behavior. Austria's Danube Floodplains National Park is a prime example for the importance of accommodating a high volume of recreational use with concerns about ecological integrity. Wetland ecology is of particular concern to park management. Within the scope of this study, boaters in the old branches of the Danube were observed en route and questioned when leaving the area. These observations provided quantitative data, such as the number of boaters, their spatio-temporal distribution and their behavior. At the same time, disturbances to water birds were inventoried using standardized ecological observation techniques. These observations were interlinked with visitor use data provided by a constant video recording of the recreational activity at the main entry point. Thus, data on the number and the temporal distribution of the boaters for the overall observation period was made available. The result of this study was, that through the simultaneous presence of different user groups, there is a permanent burden placed on the old branches by boaters, which scarcely permits rest for the avifauna.

INTRODUCTION

Impact of recreational use on fauna in the Danube Floodplains National Park

Uncontrolled and intensive leisure time pressures lead to an extreme burden being placed on the sensitive fauna of an area. Animals are able to compensate - up to a certain level - for disturbances resulting from anthropogenic leisure time activities. This can occur through a temporary change of location, a spatio-temporal modification of activities or through becoming accustomed to human presence (the so-called "national park effect"). This familiarization effect, however, is dependent on the predictability of the sources of disturbance and their parameters such as frequency, intensity and remoteness (Frühauf, n.d.).

The specific sensibilities of individual species, over the year, influences the reaction modus and the magnitude of the disturbance. Brooding birds, for example, have inhibitions about leaving their nests or, as a result of the disturbance, can not return to their clutch. Parent birds are more inclined to take risks with the incubation and raising of their young, swarms of birds flee more readily than individual animals. Several disturbances often occur at the same time which amplifies these effects (Kempf, Hüppop 1998, Schemel, Erbguth 1992).

In the Danube Floodplains National Park the large variety of leisure time activities which are carried out results in disturbances to the various species and their habitat. An ecological competition has developed, particularly in the old

arms and side arms, between animals and park visitors. Two sources of disturbances principally interfere with the avifauna of the old-arm systems.

- Passing paddlers or walkers briefly startle the birds
- Anglers and swimmers burden the fauna through their long, continuous presence.

According to Eichelmann (1993), the flight distance is that distance below which a bird takes flight when startled. Prior to this, the disturbance manifests itself through nervousness and an increase in the heartbeat rate. Grey herons (*Ardea cinerea*) stretch out their necks, mallards (*Anas platyrhynchos*) quack first of all before swimming away; as a final consequence they take flight. Mallard ducks have a critical flight behavior in straight watercourses because boaters, through their permanent startling, practically drive them continuously onwards before their boats. If several canoeists are en route in the same old arm, these birds suffer permanent stress. During the main molting period (from the middle of May to the beginning of June), ducks are completely incapable of flying for 3-4 weeks. At this time, mallards suffer the most stress caused by disturbances (Eichelmann 1993). Zwicker (1983) observed grey herons in the Danube Floodplains that went looking for food not near to their colony but much further afield. He attributed this to the fact that the birds were unsettled by the presence of visitors and disturbed during their food intake.

Experiments using rowing boats, in the old arms of the National Park, showed that stationary sources

of disturbance were more intense than moving ones. The radius of disturbance around an angler in his boat was much greater than that of a moving dinghy (Eichelmann 1993).

Eichelmann (1993) was able to show considerable differences between the flight behavior of birds in protected areas and those in fishing sections or areas open to boating in the region under observation. Those birds in the areas which were used for leisure time activities showed a reduced flight distance and thus, a familiarization effect.

Linkage of visitor behavior and disturbance influence

Deblinger et al. (1991) linked ecological and social influences on the habitat of shorebirds in a coastal area of the USA. Due to their proximity to major urban regions and their scenic quality, these beaches were strongly frequented by boaters, which led to the destruction of the ecosystem and also influenced the quality of the impressions gained. Based on the results of the survey and observations of shorebirds, a management plan was developed to restrict boaters from areas frequented by these birds. Educational programs were implemented to increase the boaters' awareness of the impacts they caused.

Within the scope of a visitor monitoring project in the Danube Floodplains National Park (Arnberger et al., in print), visitors to the park were observed, counted and questioned. Because of the large number of visitors to the National Park, other people seeking recreation avoid high visitor loads by using side-roads or by visiting the area in the

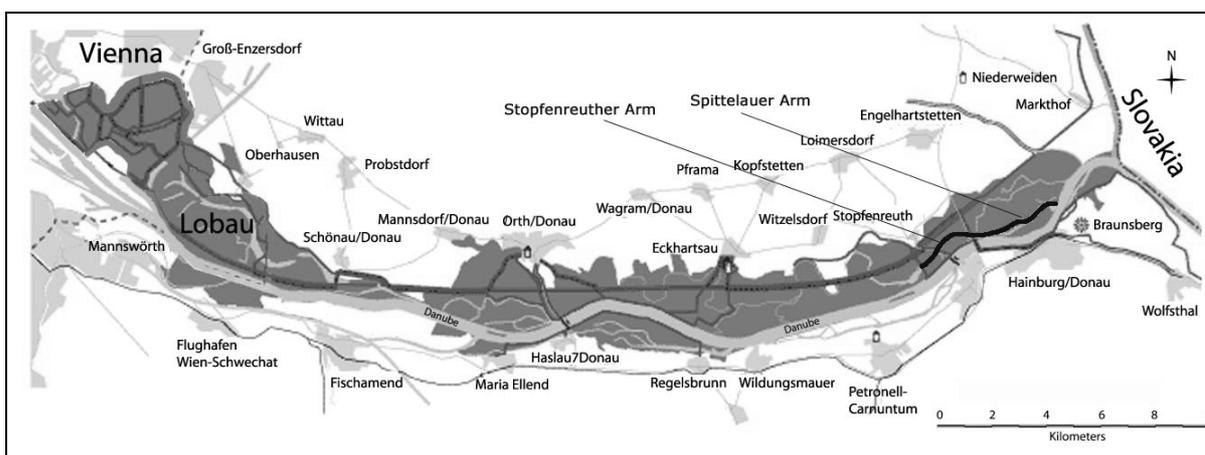
evening or early-morning hours. This increases the spatial and temporal stress placed on the fauna of the National Park. Future management measures will have to take visitor behavior in highly-frequented protected areas into consideration.

Therefore, in conservation areas with a strong visitor frequency it is particularly important to have accurate information on the visitor structure. It is only possible to arrive at acceptable management measures for all concerned when there is a linkage of the data available on those seeking recreation with ecological data on the anthropogenic disturbances to the natural area.

STUDY AREA

The Danube Floodplains National Park lies between the two conurbations of Vienna and Bratislava and extends over a length of 38 kilometers. The floodplains cover 65% of the area of the National Park, 20% are watercourses and the remainder fields. The management of the Danube Floodplains National Park faces many special challenges in dealing with leisure activity demands, resulting from the traditional usage patterns of people living in the vicinity and the easy accessibility by land and water.

In the eastern section of the National Park lies an old-arm region (the Stopfenreuther and Spittlauer Arm), which represents the longest connected stretch of water, where boating is permitted, in the Park. The Stopfenreuth Floodplain lies to the southwest of the village Stopfenreuth and is easily accessible over an asphalt road.



Map 1: The Danube Floodplains National Park (Source: Nationalpark Donau-Auen, n.d., modified)

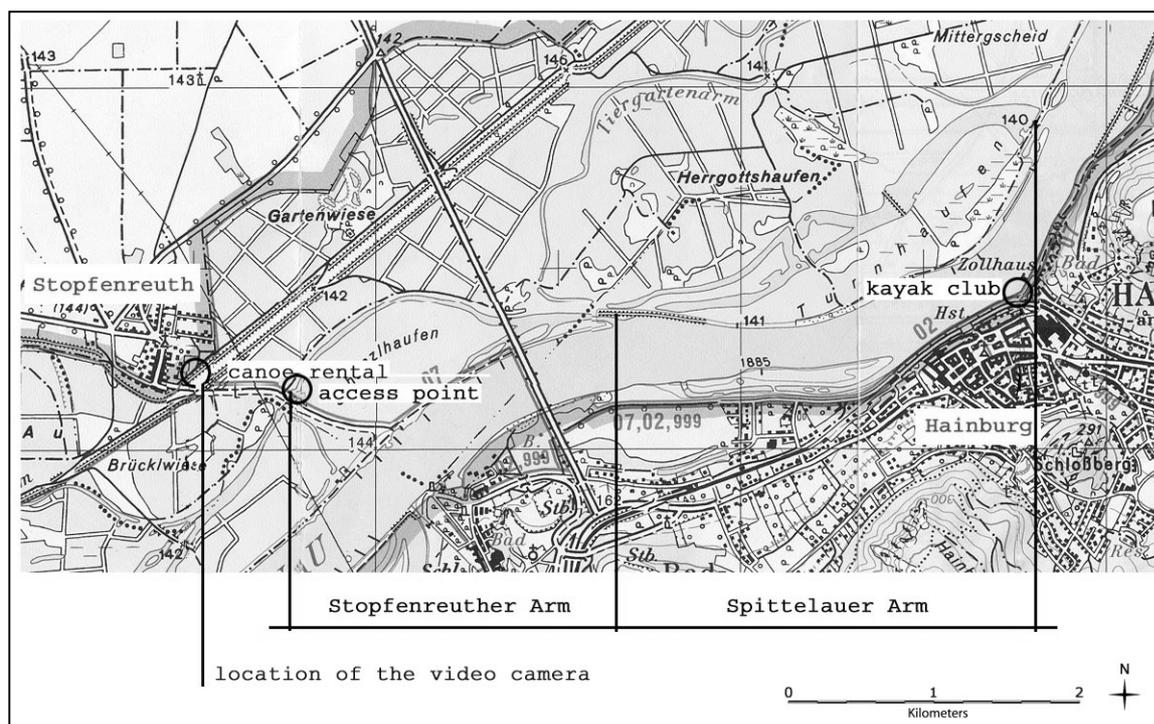


Fig.2 Study area Stopfenreuther and Spittelauer Arm (Source: ÖK.25, n.d., modified)

This accessibility for boaters is further facilitated by an entrance with a ladder. After approximately 2 kilometers, the arm reaches the Danube, where it is easily possible to traverse into the next arm, the Spittelauer Arm. This arm is interrupted at three points by traverses and stretches for a length of approximately 2.5 kilometers to the northwest before reaching the Danube.

The immediate proximity of the main entry point to a canoe rental (in Stopfenreuth) and to a kayak club in Hainburg on the opposite bank of the Danube has led to these two old arms having the highest boater frequency in the National Park region and, therefore, there is a much higher stress placed on this old-arm system than on other waterways in the National Park where boating is permitted. This was the reason for carrying out the first investigations into the impacts of leisure time activities on fauna in this old-arm system.

METHODS

For this study, the combination of monitoring and survey data, obtained by various methods, allowed a thorough analysis of boater activities in the National Park.

Survey

On eleven days, boaters leaving the old arm were interviewed, using a standardized questionnaire, to obtain data on their route, duration of their journey, origin, motif for the visit, behavior and impressions. Only one member of each group was questioned. In addition, the type of boat was recorded in order to blend this survey data with the

results of personal observations and video surveillance. The total sample size was 77 boaters.

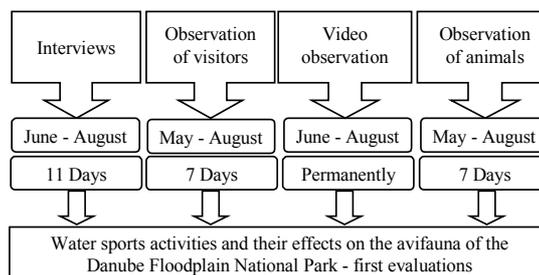


Figure 2: Types of data collection

Visitor monitoring

The monitoring took place throughout the day. A total of 63 boating groups was observed on 7 days. The observations were intended to record the behavior of the visitors and the reaction of the animal world to individual human behavior patterns. The size of each group was documented on the questionnaires; place and time of the encounter, size of the group, its composition (male and female persons, children, dogs), the type of vessel and activity were also recorded.

Observation of the disturbance reaction of the animals

During the observation days, not only the behavior of the visitors, but also the reaction of the animals to this was observed by boating in the old branches. This survey was carried out on seven days. The goal was to observe the bird species (mallards and gray herons) and to use this to arrive at conclusions concerning the level of disturbance.

These animals were chosen to be the indicators for this study, because they are easily distinguishable and because of the research which has already been made into their reactions to disturbance (Eichelmann 1993). The observation record on the animals reaction to disturbance is linked with observation records on the visitors, using date and group number. The following data were registered: species, group size, flight distance (estimated) and reaction.

Video observations

In addition to the questionnaires and observations, day-long permanent video surveillance was carried out over a period of three months which registered visitors entering the National Park. The evaluation of these recordings provided information about the means of transportation the visitors used to arrive at the Park, their number, as well as of the number of boats and their temporal distribution. The classification of visitors, according to the type of boat, enables a linkage of this data with that obtained from observations and questioning.

INTENSITY OF LEISURE TIME USAGE

The goal of the three-month-long video observation was to document the quantity and temporal distribution of boating, according to boat type, in the old arms. This determined, on the one hand, the magnitude of the influence of leisure time usage on the fauna in the old arms and, on the other hand, the linkage of video data with the results of questioning could determine the temporal distribution of boat and visitor categories.

In the three months under investigation, 689 boats entering the National Park were identified. The categories included small canoes, large canoes, rubber rafts and kayaks. Small canoes accounted for 80% of all boats registered. The most boats were observed in June. On an average, 3-7 boats entered the National Park each day during the week, on the weekends and holidays this rose to 12-18 boats.

Boat type/ month	Canoes for 2-3 persons	Canoes for 10 persons	Dinghy	Kayak	Total	Mean per day
June	198	58	1	14	271	9.0
July	139	20	2	2	163	5.3
August	229	8	11	7	255	8.2
Total	565	96	14	23	689	

Table 2: Boat types recorded in the National Park per month (Video recording)

The average daily progression of the temporal appearance of boats represents the daily boat frequency in the old arm. On the average, on every weekday between 9 a.m. and 6 p.m. there is at least one boat en route in the old arms. On weekends,

between 9 a.m. and 5 p.m., there are at least two and an average of three or four boats en route.

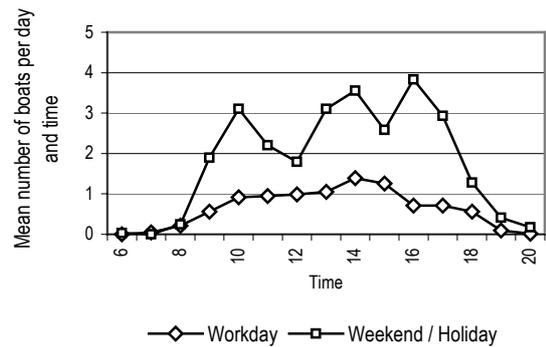


Fig. 4: Average daily number of boats entering and leaving - ordered according to weekdays and weekends and holidays (Video recording).

The average duration, ordered according to type of boat (see table 3), permitted an exact calculation of the number of hours all boats spent in the old arms. During the week, boats were, on the average, en route 11-24 hours in the old arms. At the weekend this increased to close to 50 boat hours per day and, on the holidays, to almost 65 boat hours. This shows that, on holidays, on the approximately 4.5 km long old arm section, one must reckon permanently with one boat hour per old arm kilometer between 8 a.m. and 8 p.m. It follows that, during this period the avifauna has no - not even a brief - period of tranquility.

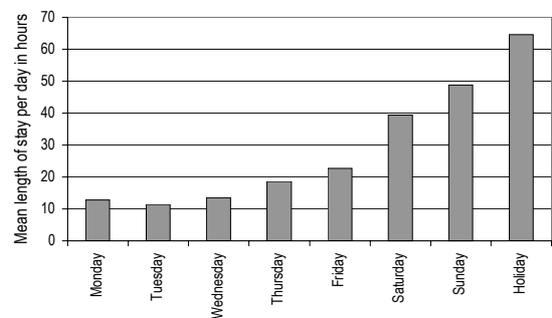


Fig. 3: Average weekly number of boat/hours in the old arm (Video recording).

CATEGORIES OF BOAT USER AND VISITOR BEHAVIOR

The majority of visitors who go boating in Stopfenreuth come from Vienna or other areas close to the National Park. Almost all visitors arrive in their own car and, usually, in groups of two persons. The relationship between the sexes was balanced. The majority of the visitors is between 31 and 45 years old. More than one half of the visitors rented a boat on the spot. The main reasons for these boat trips are a family outing or to experience nature. The boaters are all satisfied and enthusiastic about their outing. Those questioned assumed that, through their presence, they caused no notable disturbance to the old-arm system.

During the week, comparatively few visitors came, the majority took advantage of the weekends and holidays to go boating.

The linkage of the results of questioning and observation (counting, video observation) permitted us to define four individual types of boaters. The type of boat was the main criterion which permitted the simple linkage of data obtained from observations and questioning with that from video observation.

Behavior of the boaters

In general, the observations of the groups showed no major deviations in the behavior of the visitors in respect to their influence on the fauna. The majority of the visitors behaved in a peaceful and appropriate way. However, the rules concerning swimming (only permitted in the

traverses) were not always respected. We could not establish any connection between inappropriate behavior and the type of boat and size of the group. The longer a group stayed in the old arms the more likely they were to have a rest or go swimming.

The boating experience of those seeking recreation was recorded on only one day, because it only became apparent, within the framework of our observation, that this also was an interesting parameter in characterizing the boaters. It can be summarized, without having observed it systematically, purely from the point-of-view of the observer, that those people who visit the Danube Floodplains with their own boat have experience in boating. Those who rent a canoe are difficult to categorize in respect to their experience; there are both experienced and inexperienced persons among them.

	<i>Family excursions</i>	<i>Hobbyists</i>	<i>Large groups</i>	<i>Regularly coming solo paddlers</i>
<i>Type of boat</i>	<i>Small canoe, for 2-3 persons</i>	<i>Kayak, canoe, rubber boat (also suitable for white-water rafting)</i>	<i>Large canoes (for up to ten persons)</i>	<i>Kayak</i>
<i>Boat private / rented</i>	<i>rented from the canoe rental in Stopfenreuth</i>	<i>private</i>	<i>rented from the National Park</i>	<i>private</i>
<i>Users</i>	<i>Twosomes, small groups</i>	<i>Groups of 2-3 persons</i>	<i>School classes, company excursions, organized tours</i>	<i>mainly single elderly men (or women)</i>
<i>Motivation for the visit</i>	<i>Recreation, family outing</i>	<i>Nature experience, sport, recreation, partially family outing</i>	<i>Nature experience</i>	<i>were only observed, not asked</i>
<i>Type of route</i>	<i>Short routes, radius of action - mainly the Stopfenreuther Arm</i>	<i>Travel throughout the entire old-arm system and also the Danube</i>	<i>Short routes, radius of action - mainly the Stopfenreuther Arm</i>	<i>Cross the Danube near Hainburg, travel through the old-arm system and then return.</i>
<i>Boating experience</i>	<i>None - medium</i>	<i>Experienced</i>	<i>Experienced – inexperienced (except the guide)</i>	<i>Experienced</i>
<i>Arrival time</i>	<i>All day</i>	<i>All day</i>	<i>Usually arrive in the morning one hour before the other boaters</i>	<i>All day</i>
<i>Duration</i>	<i>Approx. 3 hours (mean 3.2 hours)</i>	<i>Up to 6 hours (mean 4.2 – 4.6 hours)</i>	<i>Up to 4 hours (mean 4.3 hours)</i>	<i>Short periods (approx. 2 hours)</i>
<i>Arrival</i>	<i>Car</i>	<i>Car</i>	<i>Car, bus</i>	<i>Boat</i>
<i>Knowledge of the surroundings</i>	<i>None, or map provided by the renter</i>	<i>Map, good knowledge</i>	<i>The guide has good knowledge</i>	<i>Good knowledge</i>
<i>Percentage of boaters</i>	<i>82%</i>	<i>6%</i>	<i>12%</i>	<i>/</i>

Table 1: Type of boat journeys (Wagner et al. 2001, video-recording)

DISCUSSION

Particularly on the weekends and holidays - which accounted for approximately one third of the days under observation - the stress is extremely high. Lengthy periods of time when the water-dependent fauna, such as water birds, can come to rest did not exist in the three months of our survey in the old arms. Boats are constantly in transit in the old arms and this results in the water birds being permanently scared up and driven in front of the boats through the linear old-arm system. Eichelmann (1993) determined that, during a one-hour canoe tour, mallards were disturbed 3-4 times by the same boat. This means a disturbance every 15 to 20 minutes for the birds. On holidays, during the periods we researched, where on the average 2 to 4 boats are en route each hour, the birds are not even granted this brief respite.

Other groups of boaters, who were not recorded by our video observations because they entered the old arm at other points, further increase the stress placed on the fauna of the region. Based on the observations and results of another study (Arnberger, Brandenburg 2001), kayak paddlers were almost as frequent as canoeists using boats for 2-3 persons.

The group of dinghy owners, who visit the old arm for angling, could also not be registered because their dinghies are moored permanently in the old arms. These dinghy owners usually carry out their hobby in the early morning or in the evening - even during inclement weather - increasing the stress placed on the fauna of the old arms.

The results clearly show that the potential of the old-arm system as a habitat for species and individual animals can not be exhausted if there is more intensive exploitation. This exploitation is the result of the spatio-temporal interaction of various categories of users - particularly during the weekend and holidays.

Inevitably, as the results of observations into the disturbance behavior of animals show, some species have become adjusted to the high number of visitors. The average flight distance of mallards - observed by the authors - is 10 - 60 meters, that of gray herons 20 - 60 meters (Wagner et al. 2001). Approximately 10 years ago Eichelmann (1993) calculated the flight distance of mallards as 100 - 370 meters and, 80 - 250 meters for gray herons, if startled by a paddler. The sample size of the observed flight distance is, however, too small to provide an authoritative statement. The reduction of this flight distance, as shown within the framework of the authors' studies is due, to a large degree, to the usually peaceful behavior of the visitors.

Even though the potential of the old arm can not be fully utilized, due to the large number of visitors who, therefore, only see a limited number of animals, satisfaction was still very high. The

attractive environment and the, compared with urban waterways, smaller number of visitors, could also play a part. It could also be because only a portion of visitors come to experience nature; many boaters gave a family outing or recreation as their motive for the visit. However, they would not need a national park to satisfy those desires.

MANAGEMENT

We could discuss many possible management scenarios but, in mainly, the protection of nature and the leisure time demands of the population should be taken into consideration, particularly because this area is an important regional recreation area for the inhabitants of Vienna and Lower Austria. When discussing limitations of leisure time usage in the old arm; the possibility of boating in the old arms should, however, still be made available, as the Spittelauer and Stopfenreuther Arm are, more or less, the only possibilities for boating. Consequently, all paddlers are concentrated here, but most of the other old branches of the national park are not stressed by recreational use.

Quantitative and temporal limitations of leisure time usage in the old arm

Even though the visitors all behave in an appropriate manner, the high boating frequency in the summer months leads to disturbances to the avifauna. In principle, the time when the old arms can be used should be more compressed to grant more peace for the fauna. A ban on boating on specific days, or a limitation to certain times of the day, based on further studies on the affect of the implication of leisure time usage on the avifauna, could be other considerations. If a temporal concentration of boat usage is considered, this would lead to a major diminishing of recreational quality and the nature experience of the individual because he would come across fewer varieties of animals but even more boaters. An additional limitation on the number of boats would, therefore, seem desirable.

A further approach could be to include the Danube in the boaters' routes. If all the boaters in Stopfenreuth first had to travel downstream on the Danube the old arms would only be reached at a later time and the boat frequency would be halved because the boaters would not travel in both directions over the same route. Admittedly, security considerations speak against this solution because one needs a certain skill to boat on the Danube.

An additional possibility would be to offer regular trips to the old arms in a large canoe - every two or three hours at the weekends. The large capacity of such a boat would reduce the number of individual trips and the visitors could be informed about the ecological system of the old arms by qualified personnel.

Information

According to the results of our survey, 75% of the visitors to the National Park did not know their way around. It is, therefore, necessary that tourist maps be placed at neuralgic points to show more clearly which arms can be traveled and, in general, to provide more information on what is permitted, particularly regarding boating. An additional important indication of "dos and don'ts" could be signposts at critical points of the waterway system. An information center at the entrance to the National Park and old arm in Stopfenreuth could provide facts on the impacts of leisure time activities on the old-arm system.

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