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European white stork conservation efforts, animal representations, and images of expertise in postwar ornithology

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Argument

This article discusses two approaches to save the European white stork populations from extinction that emerged after 1980. Despite the shared objective to devise transnational, science-based conservation measures, the two approaches' geographical focus was radically different. Projects by the World Wildlife Fund and the International Council for Bird Preservation focused firmly on the stork's wintering areas on the African continent. Interventions by a second group of ornithologists at the Max Planck Institute for Ornithology in Radolfzell concentrated on the Middle East as a migration bottleneck. Based on archival research, interviews and correspondence with involved ornithologists, the article examines stork representations as an important lens for investigating the professional politics of ecology and conservation. It shows that representations of white storks, the birds' ecology, and derived conservation hotspots became part of the boundary work used by European ornithologist in the creation of changing scientific and institutional identities.

Introduction

From 1985 onwards, the German branch of the World Wildlife Fund (WWF) together with the International Council for Bird Preservation (ICBP) and the German Federation for Bird Protection (DBV, now NABU), conducted a white stork conservation campaign to tackle the birds' threatening decline. The main aim of the joint conservation and research project was

to identify the migrants' important resting spots and wintering areas to create a framework for international protection measures (Schulz 1989a, 77). The project painted a bleak picture of the white stork's future. In a leaflet designed by the French branch of the ICBP, a drawn white stork was shot in its back by a hunter, who carried the wings of a second bird, while armies of locusts marched past the fallen body. "The white stork population has diminished dangerously in four European countries, including France, the Netherlands, Germany, Denmark," the leaflet read, "help us," which could equally refer to the makers of the poster as to the stork (Terrasse 1986). The leaflet presented the white stork as a victim of human violence. This violence was geographically rooted. The painted landscape suggested that the stork was hunted not in its European breeding areas, but in places it visited during the European winter. With its grim and moralized message, the leaflet captured, in pictorial ways, a similar narrative to that of the WWF and ICBP white stork research projects from the 1980s, which firmly focused their conservation efforts on the African continent.

Fig. 1 Front of the leaflet by the French section of the ICBP (Terrasse 1986). Although designed for school projects in Mali and other parts of French-speaking Africa, the leaflet was eventually used for fundraising campaigns in Europe, as it was considered too controversial for its original purpose (Thauront, 2021). With kind permission of Michel Terrasse, Marc Thauront, and Landesanstalt für Umwelt Baden-Württemberg.

Currently, the European white stork (*ciconia ciconia*) is listed on the Red List of Endangered Species by the International Union for Conservation of Nature (IUCN) in the category "least concern" (BirdLife International 2021). The low urgency is however a recent development, resulting from European breeding programs and a slow recovery after a period of steep

decline observed since the early postwar years in both eastwards and westwards migrating storks (Kronenberg, Andersson, and Tryjanowski 2017; Tree 2020). European stork censuses have been conducted nationally and internationally since 1934. These early efforts were spearheaded by the Bird Observatory Rossitten in East Prussia, founded in 1901. After the Second World War, the political borders within Europe had significantly shifted, and new census data on white stork populations was difficult to interpret. Nevertheless, it was generally understood that the numbers attained during the international census of 1958 demonstrated a clear decline in overall counts, in northwestern Europe especially. Ornithologists in the Netherlands and Denmark, former strongholds of stork research, counted up to 80 percent fewer storks, while Switzerland and Sweden had recorded a total collapse of their stork populations already in the early 1950s (Schüz and Szijj 1960). In addition to numerous national and regional protection initiatives that had emerged in the 1950s and 1960s (Kuhk and Schüz 1956; Brinkmann 1959), by the 1970s the decline of the white stork was recognized as a Europe-wide problem. A growing number of European conventions focused more or less directly on birds, and by extension white storks. These included the bird protection regulations under the European Community, and the Bern Convention on the Conservation of European Wildlife and Natural Habitats from 1979, which aimed at the protection of biotopes, including those recognized as white stork breeding areas. Internationally, the Bonn Convention on the Conservation of Migratory Species of Wild Animals (CMS), which was opened for signature by the United Nations Environmental Program (UNEP) in 1979 and demanded regional treatise for border crossing animals, became important for stork protection efforts (Nowak 1995, 301–3). The urgency for such transregional treatise was yet again reinforced by the finding of the international stork census of 1984, which recorded further declines in both eastern and western stork

populations. At the meeting of the CMS parties in 1985, the white stork was discussed as a priority case (Rheinwald, Ogden, and Schulz 1989, 12). With the backing of new transregional and international conventions, the 1980s and 1990s saw the rise of several European stork projects. Not all, however, shared the WWF's and ICBP's conviction that the main cause of the bird's demise had to be sought in Africa.

In this article, I look at two approaches that emerged in the 1980s and 1990s to save the naturally occurring European white stork populations from extinction. Despite the shared objective to devise new, transnational, and science-based conservation measures, the two approaches' geographical focus was radically different. While projects by the WWF and the ICBP focused firmly on the stork's wintering areas on the African continent, a second group of ornithologists at the Max Planck Institute (MPI) for Ornithology in Radolfzell, the postwar successor of the Rossitten observatory, focused their interventions on the Middle East, a bottleneck on the birds' migratory routes. The projects partly based their claims on different research methods and technologies, namely bird banding and satellite telemetry. It would be wrong, however, to seek the main reason for the different localization of international conservation schemes in the use of different tracking technologies alone. Based on archival research, interviews and correspondence with involved ornithologists, I show that at least as important was the self-representation of experts and their perceived relationship with the bird. Representations of storks and their problems were essential in this self-fashioning by ornithological experts. Yet, so far, they have been disregarded as lenses for investigating the professional politics of bird ecology and conservation.

Animal representations have long been a topic of interest in the field of human-animal studies. Here animals have for instance been discussed as metaphorical points of reference for types of human differentiation (Buller and Morris 2007; Burgess 1993; Lévi-Strauss 1968). In the history of science, animals have mostly been studied as representatives of particular ideas of nature or wilderness (e.g., Mitman 2012). The focus has often been on purposefully staged representations, part of carefully constructed aesthetic experiences for popular audiences, somewhat separate from the scientific work of experts. For instance, Stefan Bargheer, has shown how twentieth-century birders in Britain and Germany used images of birds as diverse and rare or as useful and abundant to publicly justify different conservation strategies and emphases (Bargheer 2018). Similarly, Jens Lachmund has discussed how in the 1960s, professional ornithologists used the appearance of the collard dove in wide parts of Europe to encourage a public fascination with birding (Lachmund 2015). Here, too, representations of birds have been studied as part of scientists' public engagement rather than strategies to buttress their own scientific profile.

In this article, I explore how representations of storks were used to undergird scientists' self-representation and claims for expertise. I do so by studying the representations of white storks, the birds' migration ecology, and derived conservation hotspots as part of the boundary work, the "ideological style" used by proponents of both approaches to demarcate their scientific claims about stork migration and protection strategies in the creation of scientific and institutional identities (Gieryn 1983, 781; Mahony 2013). Boundary work, in the traditional sense, is the work that scientist perform to map their expertise vis-à-vis other knowledge claims outside of the scientific realm. Yet, boundary work is not limited to the science-non-science divide. It is equally present in the demarcation between different

scientific approaches or orientations (Gieryn 1983, 792). Boundary work between scientific approaches has been acknowledged as an important tool for environmental scientists, often dependent on political decision making and pressed for funds. Here, tropes of scientific neutrality and objectivity, for instance, have played an important role in asserting expert authority (e.g., Eden, Donaldson, and Walker 2006).

When it comes to boundary work in the history of conservation sciences, so far, most scholars have focused on the ways in which experts used their observation skills and their mastery of technological tools to track and monitor wildlife to assert expertise over other epistemic communities (Benson 2010; 2012), to bolster national scientific prestige (MacDonald 2002), or to reinforce international hierarchies in expertise, often against a colonial backdrop (Jacobs 2015; Jacobs 2016). Instead, this article looks at how representations of storks themselves, crafted with rhetoric and imagery, have been part of the argumentative repertoire in the self-fashioning of European ornithologists (Browne 2003; Beiermann and Wesseling 2020; Carson 2003). By analyzing two representations of storks in approaches to science-based stork conservation that commenced in the 1980s, I demonstrate a shift in the personae of the European ornithologist from authoritative expert to scientific diplomat. By placing these two representations in longer research traditions and expert cultures, this article, moreover, contributes to a comprehensive scientific history of European and particularly German, ornithology, so far less developed for the twentieth century (De Bont 2010; Lachmund 2015; Wöbse 2017).

Rescuing storks by educating Africans

Migratory birds, such as the white stork, had played an important role in the work of the ICBP since its foundation in 1922 (Grimmet 1987; Boardman 1981, 160). Alarmed by declining white stork population numbers in the 1970s and 1980s, the ICBP, together with the German branch of the WWF initiated several projects that focused on the white stork's stay in Africa during the European winter (Schulz 2021a). In 1981, the ICBP created the Stork, Ibis and Spoonbill Specialist Group (SIS-SG) to coordinate data gathering and understand the status and need for protection of these birds internationally (ICBP 1983). The SIS-SG was founded at a meeting at the German bird park Walsrode in West Germany, at the time the world's largest, owned by Wolf W. Brehm, an important funder of research, protection and breeding programs of birds. From 1982, the Brehm Fund for International Bird Conservation, financed the SIS-SG's activities (Luthin 1986). The connection to Germany was not coincidental. Since the early twentieth century, German ornithologists had been leading in migratory bird research with a strong focus on the white stork (De Bont 2010). In many ways, the white stork had become a mascot for German ornithologists, amateurs and professionals alike. In May 1983, just prior to the fifth international white stork census, the DBV organized a symposium in Baden-Württemberg in Southwest Germany, on the "threatening decline" of the white stork, the heraldic animal of the organization. According to the conference organizer, Jochen Hölzinger, the decline of breeding pairs in West Germany by 76 percent since 1934 could be explained by looking at the changes in the birds' habitat. Since the Second World War, white storks had been victims of changing landscapes in their European breeding areas and, more recently, of landscape development in their wintering areas in newly independent African states, which lay outside of the scope of most European conventions. It was in Africa that chemicals and pesticides, promoted by local

governments and international development agencies, paired with an ignorance of conservation principles, affected the birds directly or indirectly through the eradication of the insects on which they fed, Hölzinger explained (Hölzinger 1986, 7, 14).

In 1983, the ICBP launched a survey together with the International Waterfowl Research Bureau on habitat requirements within the Palearctic-African flyway system, the migratory trajectory annually followed by the European white stork. The concept of the flyway had emerged in the United Sates during the 1920s, in the context of the United States Biological Survey as a way to connect and protect wetlands, thought to be crucial for the protection of migratory waterfowl (Wilson 2010, 27–28). Rather than connecting habitats along the migratory route, however, the ICBP survey strongly focused on the storks' wintering grounds on the African continent. In the years of 1984, 1985, and 1986, the questionnaire was distributed widely through the ICBP's and the WWF's networks in both Europe and Africa. The English and French questionnaire was sent to about 300 ornithologists, to the largest extent white researchers "of European descent, or Europeans who know Africa," asking them for their input on 39 African countries (Grimmet 1987, 1–2; 7–9). The survey suggested as the main concern land changes caused by resource extraction, agricultural intensification, pesticide use, and industrial infrastructure, such as dams or electric wiring that were rapidly developed in many parts of post-independent Africa (Grimmet 1987, 3–4; Ledant et al. 1986). Geographically, the questionnaire focused particularly on Sahelian Africa, defined as the region between 27°50'N and 30°50'S, between the Atlantic Ocean and the Red Sea (Grimmet 1987, 62). In particular Mali and Sudan were identified as important stopovers and wintering sites for migratory stork populations on the eastern and western routes, due to seasonal flooding and river deltas, which provided the waterbirds with sustenance in the

form of fish and insects. Since the 1970s, both areas had been subject to unparalleled agricultural intensification, bolstered by foreign investment and technological aid by international organizations (O'Brien 1981). According to the ICBP, the consequences of reckless development had been excessive pesticide use, and, in the case of Sudan, where compared to Mali local standards of living had improved only minimally, increased bird hunting by local farmers (Grimmet 1987, 79–80, 95–97).

The survey was not the only ongoing project proposing that a focus on Africa was crucial for European white stork conservation efforts. In the 1980s, the focus on Africa was seemingly reconfirmed by advances in data analysis, which allowed a new evaluation of historical ring finds. From the early twentieth century onwards, the territoriality of the stork had been a question of scientific interest for ornithologists in the European centers of bird banding. By the 1920s, stork banding had become a popular pastime among European amateur ornithologists, yet with little transregional or transnational synchronization (Schüz 1930; 1938b; von Lucanus 1919; De Bont 2010). In the 1970s, the establishment of a European databank for ring data, by the European Union for Bird Ringing (EURING), triggered the standardization of ring records. In 1977, an attempt was made at computerizing historical data going back to the 1920s. In 1982, these efforts were advanced with additional funding by the European Community in 1982 (du Feu et al. 2016). The synchronized data, and the evaluation and analysis of more than 10,000 white stork ring recoveries that had been collected in the framework of the EURING project, including new rings returned between 1963 and 1983, seemed to show that almost three quarters of the white storks ringed in France and recaptured in French West Africa had been shot or trapped (Thauront 1986, 10).

These findings seemed to reconfirm that European white storks were mainly threatened during their stay on the African continent.

The new ring data was used to underpin theoretical reflections and additional research into the hypothesis that nutritional shortcomings in Africa were at the core of the European stork problem. In 1985, a second Walsrode symposium on international stork conservation, convened jointly by the ICBP and the WWF, discussed the work of two Dutch ornithologists, Hans Dallinga and Martin Schoenmakers which suggested exactly this (Schulz in Rheinwald, Ogden, and Schulz 1989, 229; Dallinga and Schoenmakers 1984). According to the two ornithologists it was unlikely that breeding conditions in Europe were the cause behind the decline in population numbers, as in that case, there should have been no difference between the populations of eastern and western storks in places where breeding areas overlapped (Dallinga and Schoenmakers 1987; 1989, 237). Yet, the western population had declined more rapidly and reasons had thus to be sought in the distinct wintering areas of the two populations. According to Dallinga and Schoenmakers, fluctuations in plague intensity – the availability of locusts and other insects – in wintering areas of the eastern white stork population, located in East and South Africa, corresponded clearly with fluctuations of stork numbers in the breeding grounds of eastwards migrating birds in Schleswig-Holstein and Oldenburg. Similar correlations could be found for the western stork population, breeding, for instance in Southwest Germany (Dallinga and Schoenmakers 1989, 239–43). Hence, for Dallinga and Schoenmakers it was “obvious that we must look first to Africa for the main causes, in view of the large influence of conditions in the wintering areas on the annual fluctuations in numbers” (Dallinga and Schoenmakers 1989, 250). Similar conclusions were drawn at the Walsrode symposium. It would be wrong however, to assume

that the focus on Africa resulted chiefly from newly analyzed ring data from the 1970s and 1980s. This becomes clear when looking at the ways in which new findings simply revived a representation of the European white stork that had been present in leading ornithological circles in Europe at least since a decline of the population had first been noticed. In the 1980s, this representation gained new significance in the context of European conservationists' criticism of rash and presumably ecologically unsound development in the global South.

The origins for this place-based problem definition can be found in a long tradition of European centers for ornithology and their difficulties to connect to the peripheries of their networks, which after all, accommodated the birds half of the year. From the beginning, banding efforts were firmly rooted in Europe. Although to a large degree based on amateur participation, ornithology had for a long time been linked to the prestige of European scientific communities, with fewer links to colonial Africa. This was perhaps most visible in Germany, were by 1932 the network of licensed ringers counted more than 50,000 members (Vogelwarte Rossitten 1933). In these ornithological networks, Africa had long been a "dark continent" (Schüz 1948). From the limited correspondence with a handful South African birders not much was known about the wintering areas' role in the healthy return of the European white stork. From the 1950s onwards, with the postwar revival of ornithological affairs and first registered declines in population numbers, the little-known condition of stork during the European winter, became a topic of concern. This concern was reinforced by stories about local hunting traditions and sighting of "arrow storks," which, since the nineteenth century, not only seemed to provide evidence for the location of the storks wintering areas, but also encouraged ideas about African hunting as a major threat for the

winged European travelers (Schüz 1948; Jacob 2015). Hunting was one explanation that foregrounded the storks' besetment; low quality nutrition was another. In the 1950s, Ernst Schüz, the former director of the Rossitten observatory, suggested that "disturbance years", years with lower counts of breeding pairs, could stem from parasites in locusts, consumed by the birds during their winter stays (Schüz 1959a). Other causes that Schüz speculated about, were shooting for pleasure and locust poisoning, two problems linked to the birds' African winter range (Schüz and Szijj 1961; Schüz 1948, 15–16). Similar to Dallinga's and Schoenmakers's conclusion from the 1980s, Schüz suggested in 1959, that solutions "to the decrease in numbers in many places must be sought in African parks," as in Europe the birds were protected from harmful activities by "the Christian and Mohammedan religion" (Schüz 1959a, 338–39).

Stork research in the first half of the twentieth century was not limited to European ornithologists. A handful Africa-based ornithologists, though few in number and predominantly linked to white, colonial networks, tried to counter the accusations by birders based on the European continent. In fact, since the 1940s, a number of South African ornithologists had researched the digestion of storks of invested or poisoned locusts to prove that their ingestion had no negative health effects (e.g., Milstein 1966; Jacobs 2016, 116–18). Into the early 1970s, the former British colonial officer and ornithologist Reginald Moreau, suggested that human land changes had not been detrimental to Palearctic migrants, that even some migratory bird species, adapted to human land changes, might have benefitted from the changes (Moreau 1970, 95–103). However, the concerns by Europe-based ornithologists about the African condition remained. These concerns were not limited to German birders. In 1966, the well-known British ornithologist David Lack, after

examining stork data from Oldenburg in northern Germany, suggested that main factors causing the decline in European stork populations should be sought in Africa. Lack could not detect any noticeable difference in the numbers of young annually produced per breeding pair during the previous 31 years of data. Mortality, he concluded, occurred either in young birds, in adults, or in both and "this almost certainly means that the critical mortality occurs in the [European] winter in Africa, […]." At least, "these findings suggest that one should seek first in Africa for the factors causing the current overall decrease in the numbers of the White Stork in Europe," Lack proposed (Lack 1966, 228).

In the 1980s, the synthesized banding data, and climatic changes in the Sahel region especially, seemed to reconfirm these older representations of European birds as victims of a generalized African state of affairs. In the autumn and winter of 1986 and 1987, Holger Schulz, a German ornithologist, conducted field research on white storks wintering in Africa for the WWF. Schulz had been the chairman of the ICBP/IUCN world working group on bustards and had spent several months in Africa on a project for the United Nations' German Technical Cooperation (GTZ) working on "pest bird control" (Schulz 2021b). In 1986 he was asked by the WWF to instead study the effects of insect pest control on birds. Schulz visited South Africa, Zimbabwe, Lesotho, Kenia, Tanzania and Sudan, where he worked with Wilhelm Kühle from the WWF Germany and the Sudanese conservationist Ahmed Elmalik whose work Schulz knew from the 1985 Walsrode symposium. During the expeditions, Schulz and his colleagues observed the behavior of white storks with binocular telescopes. In Sudan, Schulz, Kühle and Emalik moreover interviewed 23 herders and famers. Farmers who had hunted storks were interviewed independently to obtain information on their methods. In addition, the team collected samples of tissue of dead storks to test the presence of

pesticides (Elmalik 1989; Schulz 1987). Reporting on the results, Schulz reconfirmed that threat factors in Africa, including hunting, droughts, and pesticide use, had a significant effect on regional stork populations. In particular, hunting threatened storks resting in the West African Niger delta, where only a few hundred west storks remained each year, Schulz explained. On the eastern route, hunting was a problem in Lebanon, Syria and Sudan. In Sudan, farmers and herders caught resting storks with "primitive means" such as boomerangs, canes, stones, and snares (Schulz 1987). While bird conservationists and ornithologists condemned the hunting of migratory birds also within Europe (e.g., Greer 2020), here, concerns about hunting became part of a bigger campaign to highlight the need for European ecological expertise on the African continent post-independence. Schulz stressed, for instance, that I Sudan hunting had only emerged with the intensification of state sponsored sorghum agriculture from the 1960s onwards (Schulz 1987). Due to changes in the climate, the storks' risky migration across Sahara and Sahel was becoming longer, while the availability of locusts became less certain. This explained why the western population was affected more strongly on average, as eastern storks could usually follow the annual rain fronts further south. Yet, Sudanese farmers, too, reported to have seen hundreds of dead storks near seared water holes during drought years. A third factor which played into the decline of the western population was the control of locusts in West Africa, which had increased since the 1970s, reducing an important food source for white storks. Schulz's expedition to the Sahel regions showed that eastern storks were affected by similar developments (Schulz 1989b, 12–13). Schulz's project, thus reconfirmed that hunting, drought, and pesticide use were the biggest problems for wintering storks in Africa.

The WWF and ICBP projects tied in with a larger discourse that promoted the responsibility of conservation NGOs in Africa based on a long tradition of European expertise and moral authority in international conservation questions (Grimmet 1987). By referring to the work by Schüz and his contemporaries, ornithologists in the WWF and the ICBP put themselves directly in this tradition. Similar to earlier projects, the focus on Africa served to highlight European competences. At the same time, by creating images of storks as victims of African land development, this need for expertise gained new relevance in the context of 1980s development projects. In many ways, the focus on Africa, and other parts of what was considered the developing world, was part of a larger trend within international NGOs, concerned with environmental protection, such as the WWF, which steadily increased their presence in the global South during the 1980s (Brockington and Scholfield 2010, 554). The text of the Bern Convention of 1986, too, put strong emphasis on the integration of some African countries into the convention to protect European natural heritage abroad, which was celebrated by many European conservationists. For this, representations of the bird were used in the boundary work, the rhetorical style, by ornithologists to stress the need of continued involvement of European experts. While the white stork had previously been protected as a close cohabitor of human landscapes, Hölzinger explained, the onset of modernized agriculture changed the ways in which the birds could live harmoniously with humans (Hölzinger 1986, 7, 14). Not only storks, but also human landscapes, to which the stork had adapted, were being poisoned. The decline of the white stork seemed to represent the estrangement of people from their environment and their non-human cohabitants. The stork, in this regard, was both an indicator and a victim of this unhealthy process, which was captured on the ICBP poster in the form of the invasion of vermin, following the killing of the

birds, whose usefulness the hunter seemed to have forgotten (Rheinwald, Ogden, and Schulz 1989, 9). This representation, too, predated the 1980s, however.

Already during the 1950s, in line with pessimist environmental visions of the postwar period, ornithologists like Schüz, to whom the 1985 Walsrode symposium was dedicated, had presented modern technology and growing discrepancies between human societies and nature as one of the main reasons for animal extinctions (Schüz 1953; Lorenz 1950). Schüz promoted the idea that the decline and partly the local extinction of wildlife on the African continent could only be stopped with far reaching educational campaigns (Schüz 1953). During an Africa trip to Second Pan-African Ornithological Congress in 1964, Schüz, continued to campaign for more educational work in Africa (Schüz 1964). A very similar language can be found in published material resulting from the 1980s projects. In a report of his work in the WWF project for the Austrian journal *Vogelschutz in Österreich* in 1989, Schulz explained that while in the European breeding areas, the recreation of nature areas was important for the recovery of the population, in Africa, educational work was required to convey to the human population the biology, usefulness and thus protection worthiness of white storks, using a rhetoric from the early twentieth century in Europe to convince farmers of the usefulness of certain bird species (Nowak 2005, 33–48). The educational campaigns focused on designing information posters and leaflets. For the ICBP, the ornithologists Gerhard Nikolaus, who, together with his wife, had been working almost continuously in Sudan between 1976 and 1984, designed a poster, which had been distributed with the help of the Wildlife Conservation Forces Central Administration Khartoum after a Sudanese wildlife protection seminar in March 1985 (Heckenroth 1986; Nikolaus 1987). Earlier in the 1980s, an educational campaign by the French branch of the

ICBP had aimed at protecting the white stork in West Africa. In 1986, 15,000 French posters, leaflets and cartoons were sent to contacts in Mali, and 2,000 Arabic ones to contacts in Tunisia, Senegal, Ivory Coast, Niger, Republic of Upper Volta (now Burkina Faso), and Mauritania, in order to contribute to the protection of European, in this case French, national heritage (Terrasse 1986, 343). Looking at some of the posters and educational material such as cartoons that were distributed in leaflets, the message was clear. While African support seemed crucial to save the European white stork, African conservation hotspots were in need of support by European conservationists to do so.

Overall, then, the projects that emerged in the 1980s to tackle the decline of the European white stork on Africa revived older representations of the white stork as a victim of African ignorance and of European conservationists as experts. The estrangement of African rural population from their ecological condition required the intervention of European bird experts and educational campaigns. This place-based problem entailed a clear representation of the role of the scientists and researchers involved in stork research and conservation as being able to restore disturbed African ecological relationships. The superiority of European expertise was highlighted by the suggested need for educational campaign against rural hunting and the need for additional cooperation of European bird experts with international development NGOs present in Africa, which in part financed the use of pesticides and agricultural transformations.

Bridging Middle Eastern fault lines with migration ecology

In the course of the 1980s and 1990s, a change in the approach to stork conservation emerged, accompanied by a noticeable change in rhetoric. Again, German scientists, this

time researchers at the MPI for Ornithology in the German Radolfzell, took the lead. The geographical focus of the MPI projects was however not centered on African wintering areas, but on bottlenecks of migration, nodes through which the majority of migratory birds passed on their annual roundtrip. Such bottlenecks were deemed significant for studying migration ecology, including the birds' requirements for resting and feeding, but also for research on physiological and behavioral questions related to the birds' orientation and navigation. As such, bottlenecks were important locations for observation and experimentation. The Rossitten observatory had been located on one such bottleneck, the Kurish Spit, a Baltic salient (De Bont 2015). Another particularly important bottleneck for the eastern population was located in the Middle East, between the Black See and the Mediterranean, allowing migratory birds, such as the white stork, to access the African continent over land rather than water. Tracking technology, this time satellite telemetry, which allowed for the continuous tracing of individual birds, played a role in justifying the geographical focus by MPI ornithologists on migration pathways and on *en route* stopovers rather than wintering areas. At the same time, the choice was motivated by a wish to revive fundamental research into migration ecology and older visions of international scientific prestige. Envisioned research cooperation crossed the political barriers of the time, including the lifting iron curtain and the fault lines in the Middle East (Berthold 1999, 6; Müller & Nowak 1992). In this approach, representations of storks as true internationally migrating birds, interlinking continents and bridging political divides, were used to bolster the image of science-based conservation as a means of international rapprochement.

At the MPI in Radolfzell, especially Peter Berthold, at the time director of the institute, lobbied for an integration of the white stork as a case study in the framework of the CMS, to

gain financial support for an international project to study and protect the birds along their migration route (Berthold 1988). From the beginning, the MPI's proposals focused on migration ecology, resulting in a focus on the eastern population in which the migration instinct was considered to be still intact. Breeding and reintroduction programs, focusing mainly on the western population, for instance in Switzerland, seemed to interfere with the storks' migratory habits, essential to the scientific endeavors of the MPI ornithologists (Schulz 2021). The last 20,000 pairs of the western population were seen as interspersed by semi-domesticated, non-migratory, bred storks which meant the end of "the natural population" (Berthold 1999, 7). This representation of storks put their long-distance migration center stage. In a lucky turn, the German reunification allowed for a new cooperation with the ornithological station Loburg, which had been founded in 1979 in Brandenburg, East Germany, as a white stork rescue center (Berthold 2020). At the same time, MPI researchers sought additional international cooperation that could give access to crucial migration bottlenecks. From the late 1980s onwards, the MPI established links with Israeli researchers. Israel was uniquely located "at the junction of three continents – Europe, Asia and Africa" with "450,000 storks flying the country each spring," and "in autumn about half this number" (Renner, Gianti, and Leshem 1990, 1). In 1989, Yossi Leshem, an Israeli PhD candidate at the University of Tel Aviv reached out to Eugeniusz Nowak from the Federal Agency for Nature Conservation (BfN), Bonn. Nowak, an ornithologist with Polish roots, was one of the negotiators of the CMS and a key contact for Berthold in German conservation politics (Leshem 1989). Leshem's work was concerned with bird-airplane collisions, financed with military money to save human lives, but in the coming years the Israeli military would finance studies on stork migration and coalition warning systems between Turkey, Israel, Egypt, and Jordan (Leshem 1999, 550–51). While Nowak facilitated the cooperation with

Eastern European countries through which the eastern population passed, the new cooperation with Israel soon became an important branch and flagship project in Radolfzell stork research.

According to Berthold, Nowak, and Leshem, the conservation of migratory birds required new research into questions that bird banding was unable to answer (Berthold, n.d. [late 1980s], 1; & Nowak & Berthold 1987). Stork conservation efforts connected to the WWF-ICBP projects were based on ring data. This meant the research focused on places of aggregation where many rings had been found, although it was known that migrants did not stay in any one place for long. Often, fieldwork based on ring data had focused on wetlands where congregates of ducks and water birds tended to gather for some period of time (Grimmet 1987, 8). According to a growing number of bird ecologists, this was a faulty approach, as it revealed little about the actual routes that birds took and the feeding places that were most relevant for their energy budget, crucial especially for long-distance migrants, such as the white stork. For both MPI researchers and their partners in Israel, satellite telemetry held the promise of overcoming these known biases in ring data. Telemetry, tracking birds with electronic senders attached to their backs in real time and by satellite, it was hoped, would help to identify importing resting spots along the birds' migratory routes, this way enabling more ecological research into the ground conditions of migratory stork trajectories in ways that ring finds, always dependent on the presence of willing human collectors, could not. Telemetry would allow testing whether areas believed to be important for white storks in Europe, Africa, and along the way, were as important as assumed (Berthold 1988). Stork telemetry, Berthold suggested, could serve as a pilot project

to underline the CMS's interest in science-based conservation efforts across national borders. In these efforts, he envisioned the MPI to play a leading role.

Telemetry had emerged in wildlife management in the 1970s. However, early transmitters were bulky and heavy devices and their use was confined to larger animal species, such as caribous and bears in North American national parks (Benson 2010; 2016). In 1984 and 1985, scientists at John Hopkins University conducted first successful experiments with birds using two TIROS-N satellites and an Argos data recording system, with transmitters of about 200g (Benson 2012). Research with Argos mini transmitters on birds was also conducted by Monty Priede at the University of Aberdeen. However, before long-distance migrants such as storks could be tracked, lighter transmitters with longer battery lives had to be developed. In the late 1980s, the MPI contacted the Technical University (TU) Berlin to develop transmitters of 100g with solar recharging. At the same time, plans were made for ethological experiments with storks with dummy transmitters to see whether the extra load would affect their behavior ("Forschungsvertrag TU Berlin und MPG," n.d. [late 1980s], annex 2, 2-6). The TU Berlin, at the time was building a research satellite, TUBSAT1, which was to be launched into space in the summer of 1988. The project was delayed, however, after the Challenger disaster of 1986. The project was eventually rescheduled for April 1993, when the D2 mission of the German Society for Radiation and Environmental took off (Keller and Schiewe 1990). In the meantime, first German-Israeli telemetry studies commenced in Israel, following tracked birds by airplane. In March 1990, four wild white storks were caught, attached with transmitters and released (Renner, Gianti, and Leshem 1990, 5). In 1991 and 1992 first stork tracking experiments took place with birds caught in former East Germany, migrating via the Middle East to their wintering areas in Uganda, followed by plane and

truck. It was hoped that in a few years, the processes of migration would be known for smaller populations in much more detail than banding had ever allowed (Berthold 1994). By the mid-1990s, regular telemetry studies by satellite had finally commenced. For the first time, whole migration cycles could be tracked (Berthold 1994). In the years 1994, 1995, and 1996, each year between 10 and 15 white storks were fitted with Argos senders that transmitted several locations per day. By now, the project was officially linked to the CMS.

The telemetry approach challenged several assumptions on which bird conservation as pursued by the WWF and ICBP projects had been built. Wouter Van den Bossche, a PhD candidate, supervised by Berthold in Radolfzell and working with Leshem in Tel Aviv, found that contrary to previous beliefs, storks spent only short periods of time in one location during their winter migration. The data also revealed significant differences between individual birds which further problematized the approach based on banding data to focus on sites with the most ring finds (Van den Bossche 1994). A tracked autumn migration in the fall of 1995 moreover refuted that east and west storks returned home on similar routes to their outward migration, which complicated the notion of a single Palearctic-African flyway (Schulz 1999; Schulz 1989b, 15). While storks on the outward migration rested only shortly and required only little food intake, they used every opportunity to feed on the inward migration from Africa to Israel. It was, moreover, unclear, why most storks migrated back extremely famished when passing through Israel. If the birds lacked protein, which would have had an effect on their breeding successes and to some degree could explain declining numbers in Europe, this problem could not be solved by focusing on the availability of food in wintering areas alone, for instance by preventing the use of pesticides to eradicate locusts. Telemetry findings questioned the centrality of the need for refuges in the African

wintering areas. They also highlighted the necessity to pay attention to the "stepping stones" that the birds used to fill up their fat and protein reserves on the way to their breeding areas, requiring additional international and transregional cooperation with both Middle Eastern and Eastern European countries (Berthold 1999, 4–6; 8–9; Berthold et al. 2001).

Based on these early findings, the German-Israeli project was extended into the early 2000s to create a targeted conservation policy for the eastern stork population during their migration to their winter territories and back. The renewed project tracked between 10 and 15 white storks every year, using solar transmitters by the company Microwave Inc. The localization of the birds on the migration out and in occurred at least once per day, via three satellites, a direct modem connection to the institute in Radolfzell, and via cars and light airplanes fitted with antennas in the larger Mediterranean region and in Israel, especially. Using bird aviaries in Radolfzell and at the stork station Loburg, the weight and fat reserves of wild, captured storks was measured during migration periods with the help of MRI scans. Blood test were conducted to measure protein reserves. These measurements from captured birds were compared to data obtained from migrating birds tested in Israel during the outward and inward flights, and from birds that had returned safely after to their breeding area (Berthold 1999, 9–10). From this research it seemed that storks migrated to Sudan within two weeks, without longer breaks to feed. They stopped only shortly in Turkey and Israel, where there was a need for undisturbed resting spots, but not necessarily feeding areas (Berthold 2001). On their way back to Europe, wild storks of the eastern population required many stopovers in Northern Africa, especially Egypt, in the Middle East, Eastern Europe, and the Mediterranean region. It was in these places that wetlands needed

protection, while the role of Africa in filling up the birds' protein storage was considered less significant (Berthold et al. 2002; Van den Bossche et al. 2002, 166–73). The data collected from tagged storks did moreover not suggest a specific problem of hunting in Africa. Instead, most casualties, the data suggested, occurred in Europe and the Middle East (Berthold et al. 2002; Van den Bossche et al. 2002, 166–73). This, of course, was a very different approach compare to the one followed by the WWF-ICBP projects, resulting in partly opposite findings.

While telemetry data, thus, yielded new results, it would be wrong to suggest that the differences in approach can be explained by the use of technology alone. Again, looking at representations of storks allows us to understand the long-term ambitions underlying the turn to telemetry. Some of the tagged birds received celebrity status. A female white stork called Prinzesschen, hatched at the Loburg station, was tracked for five full return cycles. In the 1990s and 2000s, Prinzesschen was followed by German television reporters, while her location could be followed online by everyone with a computer and internet access. After her death in South Africa in the early 2000s, Prinzesschen was immortalized on a stamp and in form of a sculpture which decorates the courtyard of the stork station in Loburg since 2010 (Berthold and Querner 2002). Storks like Prinzesschen, Peterchen, or Caesar, were not presented as victims of an ecologically unsound progress. Instead, they were international voyagers, heralds for intercultural communication, scientific internationalism, and pioneers of tracking technologies. Yet, birds like Prinzesschen were more than mascots for telemetry. In many ways, the storks' representation as diplomats, improving international understanding, mirrored the MPI's scientists' self-understanding, a self-image rooted in tendencies which predated the arrival of telemetry by several decades.

Fig. 2 Migration pattern of the white stork Caesar via Turkey, Syria and Israel, tracked by satellite transmitter in late 1994 (Van den Bossche et al. 2002, 55). With kind permission of Willem Van den Bossche, and Bundesamt für Naturschutz (BfN).

Already in the first half of the twentieth century, German ornithologists at the station in Rossitten were internationally connected to birders in other European countries and beyond. In the 1930s, the networks of birders and ringers were so extensive, that it was felt necessary to inscribe German bird rings in English and Arabic, to facilitate the international exchange of recapturing reports (Schüz 1934; Hornberger 1943). International cooperation was not limited to networks of amateur observers. In the late 1930s, just prior to the Second World War, German ornithologists participated in white stork translocation experiments, with British and Swiss stork experts to understand the birds' strategies for orientation and the processes of migration (Schüz 1938a). Rossitten, operating as a member of the German Ornithological Society, had been part of the Kaiser Wilhelm Society since 1923, as such concerned with both research into bird behavior and migration and the protection of birds (De Bont 2010). The white stork, especially, played a dominant role in this prestigious program. The scientific interest of Rossitten's ornithologists in the white stork increased in the course of the 1930s, when local numbers of breeding pairs grew to 750 couples and 62 nests per 100km^2, justifying a stork research project that involved the capture, banding, and release of local birds (Hornberger 1943). Next to more descriptive endeavors such as annual censuses and the mapping of migratory routes, ornithologists at Rossitten studied migration as an ecological phenomenon, researching for instance the ecological aspects of habitat

choice, including ground and soil conditions, quickly gaining international recognition for their work (Freiherr Geyr von Schweppenburg 1936).

Into the 1940s, Rossitten ornithologists were connected to German speaking stork researchers and volunteers through a wide network of observers, and were recognized abroad as internationally leading in bird migration and behavior research. During the war, ornithologists like Schüz, had entertained links to other internationally known, German-speaking biologists, such as Konrad Lorenz, who in the 1940s led German efforts in behavioral biology (Schüz 1949; 1942). Even shortly after the war, Rossitten's ecological research was praised by internationally renowned scholars, such as Ernst Mayr at Harvard University (Mayr 1947). Still in the mid-1950s, when corresponding with one of his frequent ringers, Schüz stressed the international character of all stork research: "one has to demonstrate that political borders are unfounded in such questions" (Schüz 1955a). However, in the postwar period, the German leadership in ecologically grounded ornithology and international migration research was lost, when territorial changes within Europe led to a shift in the German ornithological landscape and organization. The Rossitten observatory, located in East Prussia, was abandoned in 1945. Quickly a new station was founded at Schloss Möggingen, Radolfzell, close to Lake Constance. In 1949 the station in Radolfzell became part of the newly founded Max Planck Society. Yet, with insufficient funds and staff, ecological research did not proceed easily at the make-shift station (Schüz 1956).

While German ornithologists lost a leading position in the field, orientation research, which had previously been conducted with wild, migratory birds, such as the white stork, shifted into smaller scale laboratory settings. The orientation instinct rather than long-distance

migration strategies was studied with homing birds, such as pigeons, which were easier to breed and train (Yeagley and Whitmore 1947). Both the stork and the station had lost their dominant position in fundamental orientation research. Radolfzell ornithologists were aware of the backlog. In 1955, Schüz explained that if the institute had so far not conducted more experiments for orientation and physiological research, then because of a lack of birds, rooms, and employees, and because others had taken over leading positions in research topics such as orientation (Schüz 1955b). In the late 1950s, still a lot was unknown about the exact migratory routes of storks, for instance, the birds' main migration routes down the Nile, where no direct observation had ever been recorded (Schüz 1959a). Attempts to follow migratory birds by aircraft had remained unsuccessful (Dorst and Schüz 1948). In the second half of the 1950s, a new director, Gustav Kramer, who in the late 1940s had experimented with sun orientation in wild birds, was supposed to boost the station's international image. Yet, Kramer unexpectedly died in 1959. Next, the Dutch behavioralist Niko Tinbergen, at the time already working at the University of Oxford, was offered the position, but declined. During the 1960s, Lorenz, located in Seewiesen, close to Munich, took over as interim director. Lorenz pushed for more fundamental research on bird behavior, yet with 220 km between Seewiesen and Radolfzell, Lorenz only traveled to Radolfzell on rare occasions (Schüz 1959b; Lorenz 1960).

In the early 1970s, Hans Löhrl was appointed director of the institute and immediately concerned himself with strengthening its research profile. At the time, birding was at times seen as amateurish, and Radolfzell, little concerned with fundamental biological questions, was not different in this regard. While some publications focused on new research into the ground ecology in particular regions along migration pathways (Schüz et al. 1971, 90), much

of the station's work was outdated. Löhrl wanted more European cooperation, more fieldwork, and a closer integration of laboratory and field methods (Löhrl 1971). For this, ecological research into long-distant migrants such as white storks, was regarded as key (Löhrl 1968). When, in the 1970s and 1980s, new international conventions highlighted the need for the protection of migratory birds across country borders, ornithologists in Radolfzell, including Berthold, at the time on a postdoctoral fellowship under Löhrl, saw this as a chance to regain a new leading position in international migration ecology and white stork conservation (Nowak 1995, 303–6). The goal was to develop a new method for stork migration research, which would deliver detailed data on the course of the migration, including exact time and location data, was embraced by researchers at Radolfzell (Berthold 1994). Working with "true migrants," birds flying distances of more than 1000km, would enable transregional protection, environmental research, and international cooperation with countries of what was then the first, second, and third world (Berthold 1987). Migration ecology, including stork telemetry, but also other methods, such as field observations and experiments with captured birds were hoped to increase the support for this type of fundamental research. In the 1990s, with the development of smaller senders that could be fitted on the backs of migrating white storks, these long-term goals of science-based migration research and cross-border cooperation finally seemed realizable.

In 1995, Radolfzell's Israeli partners, including Leshem, together with Tel Aviv University, founded an International Centre for the Study of Bird Migration located at the Armoured Corps Memorial in Latrun in central Israel, halfway between Tel Aviv and Jerusalem, bordering the West Bank. Research conducted together with the MPI Radolfzell was one of the key tasks of the center. Real time information was transferred to aviation companies and

air forces of participating neighboring countries. MPI researchers, together with the scientists involved in one of 14 associated field stations in Israel, Palestine, and Jordan saw themselves as promoters of the regional peace process (Leshem 1999). As Berthold later recalled, “we were so successful in this Peace Process […] that we for instance had the permission […] to organize a ringing workshop with Palestinians […] in the rose garden of the Knesset,” the house of parliament of the State of Israeli government (Berthold 2020, [author’s translation]). The self-understanding of ornithologists had become that of politically neutral diplomats. Stork conservation programs based on telemetry, too, were integrated in educational campaigns. However, these, including the representations of storks they used, took a quite different form compared to those by the WWF-ICBP projects aimed at educating African peasants. In education, too, the focus was on international cooperation. Berthold and his colleagues, envisioned the participation in a world education program in which school children from different nations could follow tracked and border crossing migrants like Caesar online, using modern computer technology, learning about bird biology and conservation (Berthold 1999, 9–10). In Israel, Leshem shared these ambitions. With financial support by the William H. Gates Foundation (now Bill and Melinda Gates Foundation) and the German Ministry for the Environment, Leshem set up a cross-cultural program called “Migrating Birds Know No Boundaries,” which, based on data produced in cooperation with Radolfzell, aimed at jointly educating schoolchildren from Israel, Palestine, and Jordan in bird ecology (Leshem 1999). The project was an internationally celebrated, regional success, albeit only for a short period between 1998 and the beginnings of the Second Intifada in 2000.

Overall, then, the projects by MPI ornithologists and their Israeli partners not only focused on a different technology. Many of the assumptions and ambitions underlying stork migration research in Radolfzell and collaborating institutes dated back to postwar attempts to revive German ornithologists' international standing and international cooperation in migration ecology. This becomes clear when looking at the ways in which researchers in Radolfzell represented migratory white storks. Images of storks as border crossing, cosmopolitan birds, in this regard, mirrored MPI researchers' self-understanding and served their self-fashioning, placing the institute's work in longer traditions of scientific excellence and international diplomacy.

Conclusion

This article has been concerned with representations of the European white stork, used by two groups of ornithologists in their attempts to protect the migratory bird's declining population from the 1980s onwards. The two representations of the iconic bird differed significantly. Projects initiated by NGOs such as the ICBP and the WWF focused on white storks as part of European natural heritage, threatened by land-use changes in the global South. Representations of storks as victims were used to bolster the need for European involvement in African conservation questions. In contrast, researchers at the MPI in Radolfzell, presented the birds as scientific pioneers in ecological migration research by satellite telemetry, resulting in a focus on migration bottlenecks in the Middle East. Birds as border crossing diplomats were used to present ornithologists at Radolfzell as politically neutral experts, internationally leading in the field of migration ecology. Both projects and their respective representations, then, give insights into the different ways in which migratory bird research has been anchored institutionally, intellectually, and geographically.

So far, authors in the history of science-based conservation have often focused on the use of technological or observational skills in the boundary work of experts. Instead, this article has shown that looking at the ways that European ornithologists represented the white stork as an object for conservation and research can help us understand diverging problem definitions and designated conservation hotspots as part of two longer research traditions, including ideas about the role of science and expertise in environmental conservation, rather than the outcome of technological choices alone. At the same time, the changing representations of white storks as objects of research and conservation studied here reveal a corresponding shift in the personae of the European scientist, specifically the German ornithologist, in the last quarter of the twentieth century from postcolonial authority to intercultural peace maker.

With its focus on stork representations as lenses to study the self-understanding of European ornithologists, this study, then, adds to the history of science in at least one more dimension. It corresponds with the findings by historians concerned with science and conservation in post-independence Africa, who have highlighted a rhetorical shift from mythical visions of an Africa that needed defending "even against the people who have lived there for thousands of years" (Adams and McShane 1997, xviii; Mavhunga 2018, 10) towards landscape and community-based conservation since the 1990s (e.g., Goldman 2003; Macekura 2015). Yet, while in the literature the focus has often been on the continuation of forms of fortress conservation in international projects on the African continent (Brockington 2002; Adams and Mulligan 2003; Bluwstein 2018), this article shows that at least within the white stork research community, the rhetorical change was accompanied by

a change in the scientific personae of European ornithologists. The rhetorical and pictural representations of European white storks, and the framing of stork conservation problems presented by the two groups make this changed self-representation visible.

Animal representations, then, deserve more attention in the examination of scientific authority and self-fashioning. Looking at representations of animals, and that of the animals' relationship with respective researchers, can provide new insights into integrated assumptions and visions about environmental problems, their localities, and hierarchies of knowledge, including values of accountability and culpability. They need to be recognized as part of the boundary work of environmental experts and the framing of conservation problems, including normative agendas for environmental governance, and the perceived role of science in political decision making.

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