Black-tailed Godwits (*Limosa limosa*) in southern Spain, habitat description and finding colour marked birds from 5 – 13 October 2023

Doñana, Bonanza, Algaida, Brazo del Este, Marismas de Cetina & Odiel

Expedition report, University of Groningen & Global Flyway Network, The Netherlands

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October 2023

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Acknowledgements

Miguel Medialdea, Quality and Environment Manager Veta la Palma, sustainable aquaculture. Thanks for arranging our admission to Veta la Palma and information about this great place. **Juan Antonio**, responsible for water management at Veta la Palma for sharing your valuable insights.

Enrique Martínez Montes, director of PN Marismas del Odiel. Thanks for allowing us to explore Marismas del Odiel freely.

Susana Mojarro Barreno, member of staff of PN Marismas del Odiel; thanks for arranging our meetings and permit.

José Manuel Sayago and José Manuel Mendez, members of the staff of Marismas del Odiel**,** bird experts. Thanks for the excellent assistance with searching and finding the godwits in the NP, and for sharing numerous old ring sightings you made yourself indispensable.

Juan Carlos for granting us access to Hato Blanco Nuevo and the staff at Hato Blanco Viejo for permission to check their properties for godwits.

Francisco Hortas, thanks for arranging access to Marismas de Cetina saltpans at such short notice.

Contents

Chapter 1. in this report is based on and partly identical to previous reports about searching and finding Black-tailed Godwits in Spain that can be found on:
https://www.globalflywaynetwork.org/publications

0. Summary

In this expedition from 5 to 13 October 2023 we visited the most important areas for wintering Black-tailed Godwits in southern Spain. Our aim was to resight individual colour marked birds, describe the habitats used by godwits and to gain information on threats and opportunities by field observations and meetings with local experts. In this report we present a daily overview of our findings with photos, locations we visited, numbers present and the first conclusions and recommendations. More reports from expeditions to Iberia and West Africa in previous years can be downloaded at: https://www.globalflywaynetwork.org/publications

The main goal of this week of fieldwork was to get as many resightings as possible in exactly the first half of October. The reason for the timing of this fieldwork was that in these two weeks one has the best chance to identify godwits that do not migrate to Africa at all, but stay in Europe for the entire non-breeding season. Based on tracks from geolocators and satellite tagged godwits we know now that godwits start returning from sub-Sahara Africa on a continuous scale between October and March, and that when the first ones are arriving the last ones are still on their way there. Thus, the first half of October is the best period to find non-trans-Saharan migrants among the godwits; that is: the period with the least chance that the birds are still on their way to, or have already returned from Africa. These belong to the roughly 10% of all godwits that spend the entire northern winter in Europe - although some trans-Saharan migrants actually spend most of the non-breeding season in Europe too.

Resighting godwits in early October is not particularly easy: the birds spend a lot of time resting (on one leg in dense flocks) between 9:30 and 18:30 and since most rice fields have not been mown yet (or have not been used at all), they mostly forage in shallow water where they find Chironomid larvae. Yet, if the water is not shallow enough, one will end up staring at swimming godwits without seeing any legs. The weather can be a spoiler too; with temperatures above 30C it is almost impossible to clearly see the rings between 12:00 and 16:00 due to heat haze.

In 9 days, we scored only 95 resightings of 70 colour ringed individual birds of our own scheme and 31 of 24 individuals from other schemes. This is way less than we usually have seen in recent years. Last year we saw 127 individuals (172 resightings in 9 days) and in 2021, 134 (325 in 10 days). So even if you correct for the number of days, it is a much lower result, but still comparable to 2018 (64 individuals (52) in 6 days). Numbers were only a bit lower but resighting opportunities were definitely less good compared to the two last years. At Odiel the situation was more or less the same at 700 birds (~800 in 2022) but 2 additional sites were checked at Salinas de Bacuta (200) and Estera Domingo Rúbio (200). The biggest decline in numbers was at Bonanza, Algaida and Codo de la Esparaguerra: only 100 birds after the already considerable decline in 2022 to 500 for no obvious reason. At Veta la Palma numbers grew from ~1400 on 6 October to 3000 on the 12th, comparable to last year. But again, they were concentrated in a less accessible pond (A5) compared to 2021 and earlier. The water level was quite high, they did not forage there for a long time but left at dusk for the rice fields at Hato Blanco where the legs could not be checked for rings. But on the east side of the Guadalquivir, a group of ~1000 birds was found at Brazo del Este, a comparable number to the rice fields of Finca Casudis, where we could easily score a lot of rings last year. We saw just a few dozen at the new water reservoirs at Veta la Palma. Based on resightings and information from birds with a satellite transmitter, birds were also using the lucio behind the Valverde visitor center but these were not visible from the public roads. A flock of 370 birds at Marismas de Cetina near Puerto Real was too far away to be checked for rings. There was a hint of an influx from Africa as we saw on the last days more birds with badly stained rings but this could not be backed up with movements of satellite tagged birds.

Abdominal profile indexes as a proxy for body condition were way lower than previous year on average 2.58 (n=95) compared to 3.26 (n=97) in 2022 on a 1-5 scale, where 1 is very lean and 5

extremely fat. But that was still comparable to 2.59 in 2021. Intake rates were very high: 25.6 (n=36) compared to only 10.4 Chironomid larvae per minute (n=16) in 2022 and 18.7 in 2021 (n=37). The low body condition and high intake rates might point at compensatory foraging for the lack of suitable rice fields this year?

A second goal of this trip was to gather information on habitat selection and to recognize threats and opportunities in these wintering sites of the godwits in Spain.

This year was the driest year in Spain of the last decade and even worse than 2022. Less than 1000 of the 40.000 hectares of **rice fields in the Guadalquivir basin** could be cultivated and both nature and agriculture are suffering from that. In 2022 the surface of cultivated rice fields was already reduced to 30%; fallow land overgrown with weeds is a common phenomenon nowadays. Only rice fields irrigated with groundwater (at Hato Blanco Nuevo and Hato Blanco Viejo) are still cultivated, and attract huge numbers of birds.

The **Doñana National Park** is nowadays no alternative for them. Here the situation is even worse as all natural lagoons have dried out as a result of the ongoing and persistent drought, the effects of which have been extremely aggravated by the depletion of the underlying aquifer due to intensive and sometimes illegal farming practices in the wider surroundings (see resources in Appendix B for further background). Indeed, the park's largest 'permanent' lagoons have now dried up for two consecutive summers for the first time in recorded history, whereas these same lagoons didn't dry up during an even more severe drought in the mid 1990's.

At **Veta la Palma** the situation seems unchanged compared to 2022. Almost all intensive, netted, small fishponds have been abandoned and the focus is now on the large ecological ponds. The Andalusian government is set to complete the purchase of Veta la Palma in December, whereby it will be added to the National Park. In a sense it seems positive that the protected status of these wetlands will be formalized, but they can't serve as a full compensation for the loss of natural wetlands, and it is important to recognise that Veta la Palma mainly serves as a (daytime) roost site, while the same birds roosting here go to forage on rice fields at night. Moreover, we learned from independent reports that the water quality/salinity in Veta la Palma has been changing recently, emphasizing the need for a long-term management plan for these wetlands.

The birds at **Brazo del Este** were disturbed several times by an airplane spraying pesticides on adjacent farmland. Birds staying here seemed to be dependent on the meanders day and night, staying at the roost well into dusk.

The huge flocks of waders, herons, storks, ibisses, spoonbills and ducks in the remaining water bodies and rice fields are at the same time impressive and depressing when you realize that it's the shortage of flooded areas throughout the region that causes birds to occur in such strong concentrations. The important numbers of birds at Veta la Palma and Brazo del Este make it clear that these strongholds should be well managed as key refuges for waterbirds until the Doñana wetlands will (hopefully) be restored.

At **Odiel** the situation is still favorable as long as the estuarine mudflats offer foraging opportunities, and the water management in the salt pans is continued. However, it is unclear whether estuarine habitats and salt pans could accommodate the large numbers of godwits wintering and staging in and around the Doñana, if the rice fields there would disappear entirely.

At **Bonanza** tourism seems to be increasing and the track along one of the main saltpans used by godwits in the past, is now heavily used by motor bikes and even guided biking tours.

1. Black-tailed Godwit Habitat and Demographic Studies

Introduction and backgrounds

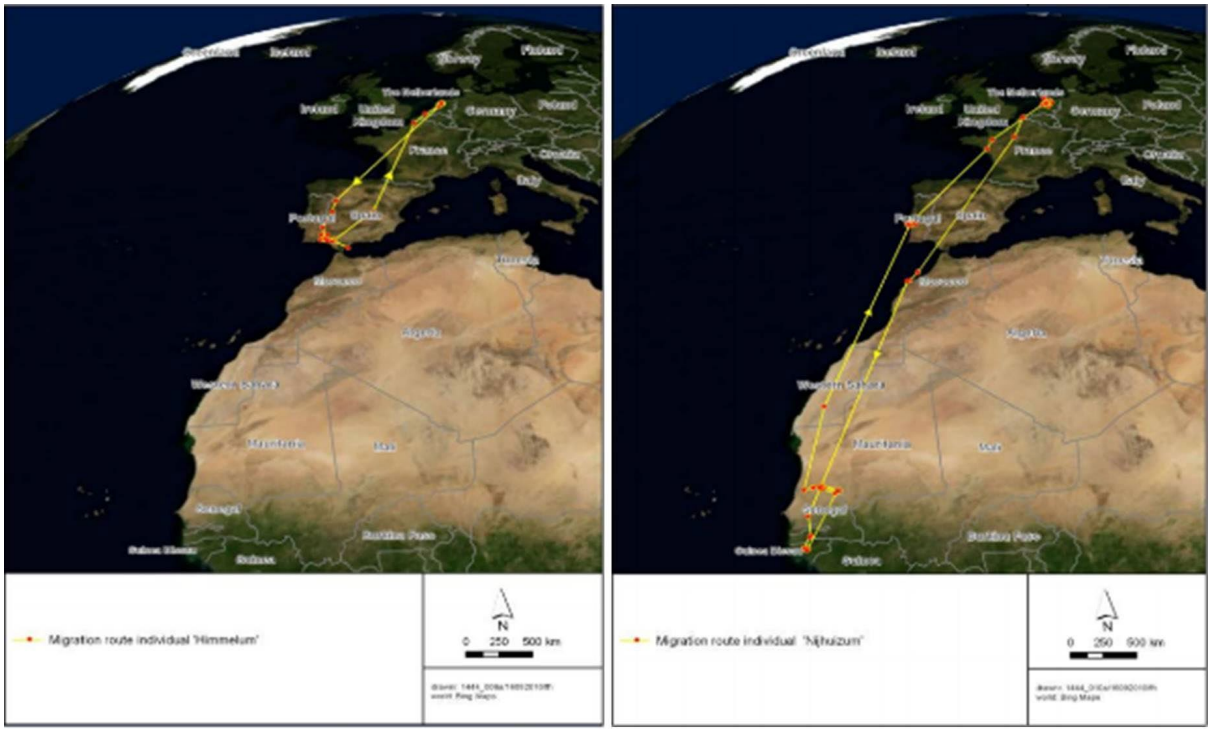
The Black-tailed Godwit (*Limosa limosa*; BTG) is a farmland bird that predominantly breeds in The Netherlands (Verstrael 1987; Thijsse 1904). The current Dutch population is estimated at 25.000 breeding pairs (extrapolated from Kentie et al. 2016) but still represents an important part of the total continental BTG population *Limosa limosa limosa*. However, the number of breeding pairs have declined rapidly over the last decades, as compared to the 120.000 pairs in the 1960s (Mulder 1972). This is mainly caused by a change in agricultural land use. Intensification and rationalisation have led to degradation of the breeding habitat, resulting in low reproduction. The population in the Netherlands cannot produce enough chicks for a stable population (Vickery et al. 2001; Newton 2004; Tscharnke et al. 2005; Teunissen & Soldaat 2006; Roodbergen et al. 2012). After the breeding season godwits migrate to southern Europe (Spain and Portugal) and West-Africa where they stay for wintering (Márquez-Ferrando et al. 2011; Hooijmeijer et al. 2013), mainly in agricultural areas such as rice fields. Throughout their annual cycle godwits select for farmland with a low to moderate land use intensity which makes them a key species to indicate routes towards sustainable agriculture. The Black-tailed Godwit qualifies since 2006 as “Near Threatened” on the IUCN Red List.

Demographic research Southwest Friesland

To measure the changes in population numbers and the causes, the University of Groningen started in 2004 a long-term research project in the south-western part of Fryslân, The Netherlands. In 2007 the research area expanded to 8400 hectares and since 2012 it increased again with another 1600 hectares (Groen et al. 2012). A colour-marked population of godwits was set up to make them individually recognizable. The knowledge that has been collected with this research has been implemented by policy makers and nature conservation organisations. Since 2020, the project has expanded into the Godwit Landscapes Project, still studying the godwit as a main focal species, but in context of the whole food-web of which it is part. Therefore, studies on soil macrofauna, predators, insect availability, vegetation changes and human land use management have been included (Hooijmeijer et al., 2022).

Migration and wintering sites Black-tailed Godwit

In the 1980’s most godwits were wintering in rice areas along the West-African coast in Senegal, Gambia, Guinea-Bissau and further. Big numbers of godwits also occurred in the inner Niger delta in Mali (Altenburg & van der Kamp 1985), but they probably predominantly belonged to the eastern European population. Recently, the wintering behaviour has partly changed with an increasing number of godwits deciding to winter in southern Spain and Portugal. In the 1980s during the first counts, only 4% of the NW-European population used this area as a wintering site but recent estimates suggest a big change with up to 23% of the population wintering in Spain, mainly Doñana NP and surroundings. The most important reason for this is probably the creation of new artificial fishponds and rice fields. It is remarkable that this increase is not driven by climatic changes in the Sahel zone of West-Africa (Márquez-Ferrando et al. 2014). For godwits, staying in Iberia can be advantageous because they can skip a 3000-kilometre (v.v.) travel over the Sahara, a potentially dangerous migration route and save their fat stores for the next breeding season. The change in wintering grounds is remarkable and an important reason why we also want to do (demographic) research in West-Africa. We know now that juveniles are more likely to make these kinds of shifts than adults (Verhoeven et al. 2017) and that the genetic component of their individual migration strategy is limited (Loonstra et al. 2023). These aspects can have consequences for changes in migrations patterns and survival rate of both adults and juveniles. Moreover, they can lead to differences in reproductive success, for example due to differences in body condition upon arrival on the breeding grounds. Both are demographic parameters that can rapidly influence population dynamics.



Two classical migration routes of Black-tailed Godwits based on satellite tracking. The left map shows the route of an Iberian wintering bird. On the right an African wintering bird. Iberian wintering birds save a 6000 km flight and don't need to cross the Sahara twice (Hooijmeijer et al., 2013).

Habitat study

Anthropogenic alteration of natural wetlands is having a major impact worldwide with consequences (both negative and positive) for migratory species such as continental Black-tailed Godwits. On their migratory route Black-tailed Godwits pass through France and either stage or spend the non-breeding period in southern Spain and Portugal. Many will make the Saharan crossing to overwintering sites in West Africa, namely; the Senegal Delta and coastal region of Senegal, The Gambia, Guinea-Bissau, Guinea, Sierra Leone and central Mali. In all these countries godwits are heavily dependent on man-made habitats like water buffers, fish farms, saltpans and rice fields.

With remote sensing techniques and the locations indicated by godwits with satellite transmitters, we found out that during the non-breeding period Black-tailed Godwits show a preference for stable habitats within a relatively low productivity range (EVI value 0.1-0.2), which are associated with open wetlands, low vegetation cover and shallow surface water (Howison et al., 2019). Additionally, godwits spend much of their time foraging either on the mudflats of saline mangrove wetlands or in wet rice fields, however little is known of the nature of the prey items at different times of the year. However, remote sensing data is difficult to interpret without accurate ground-truthing information. In the past years we conducted surveys categorising and describing habitats, measuring environmental variables such as water salinity and soil penetration pressure, feeding efficiency of the godwits and carefully searching the substrate to establish the identity of godwit prey items.

Expeditions West-Africa and Iberia

In Southern Iberia godwits are largely confined to three major staging areas during northward migration: Doñana NP and Extremadura in Spain and the Tejo and Sado estuaries near Lisbon in Portugal.

Three main areas where many godwits can be observed during January-February; Extremadura (1), Donaña NP (2), Tejo-Sado (3)

Since 2005 we have started working every winter in those regions in close cooperation with local colleagues to study habitat use and collect resightings of individual godwits. Ring resightings in Iberia and West Africa are an important source of data for survival estimations in the different life stages of the godwits:

- If a godwit disperses outside our study area, the chance that it will be resighted elsewhere in The Netherlands is small. Without the resightings in the stopover areas, we would assume that this individual is dead and therefore underestimate annual survival, because in the breeding areas individuals have very different resighting probabilities.
- Secondly, with enough resightings from the Iberian Peninsula and West-Africa we can calculate seasonal survival. In other words, we can calculate in which period of the life cycle mortalities occur more often. Or we can find out if birds that cross the Sahara have a different survival rate than birds that stay the entire winter in southern Europe.
- By measuring the density of individuals with colour rings, we can monitor the population size of the western European part of the Black-tailed Godwit population (Kentie et al. 2016)

We also regularly visit southern Iberia, in particular Doñana in the first 2 weeks of October. The reason for the timing of this fieldwork is that in these two weeks one has the best chance to identify godwits that do not migrate to Africa at all, but stay in Europe for the entire non-breeding season. Based on tracks from geolocators and satellite tagged godwits we know now that godwits start returning from sub-Sahara Africa on a continuous scale between October and March, and that when the first ones are arriving the last ones are still on their way there. Thus, the first half of October is the best period for correct identification of godwits as a non-trans-Sahara-migrants; that is: the least chance to misidentify a bird. You could safely say that these birds winter in Europe but a trans-Sahara-migrant is not automatically a bird that winters in Africa!

Until recently, West-Africa was the only area along the migratory flyway from which we didn't have many observations of colour-marked individuals. In the past, only small numbers of colour-ringed birds have been reported, mainly by birdwatchers and, more recently, by local scientists. Therefore, in November 2014 the University of Groningen, in cooperation with Global Flyway Network and financially supported by Birdlife Netherlands, embarked upon their first expedition to the wintering grounds in West-Africa and since then we visited the region 2-3 times per year till 2019. This has yielded a great number of resightings. The most important goal of the first missions was to get a good overview of the wintering grounds, resighting conditions, local facilities and knowledge and to make a start with setting up a dataset of individually recognizable godwits that winter in West-

Africa. Secondly, we made a pilot study of habitat choice and prey choice to collect ground truthing data for spatial analyses combining satellite imagery with GPS-tracking information. In the near future we aim to continue demographic research and set up habitat study and restorations projects in this area in close cooperation with local scientists, volunteers and conservation organisations as part of the EU LIFE-IP Project Grass-Bird-Habitat. Moreover, a postdoctoral researcher received a MAVA-fellowship to study how godwits are responding to rapid wetland loss in one of the most important areas for Black-tailed Godwits in the Iberian Peninsula, the Doñana National Park in the Guadalquivir River basin of southern Spain.

In this expedition from 5 to 13 October 2022 we visited the Doñana NP, Brazo del Este, Odiel NP and the Bonanza & Algaida saltworks. Our aim was to resight individual colour marked birds, describe the habitats godwits used and to gain information on threats and opportunities by field observations and meetings with local experts. In this report we present a daily overview of our findings with photos, locations we visited, numbers present and the first conclusions and recommendations.

Overview of Veta la Palma and the numbering of the ponds.

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2. Birds and habitat, daily overviews 5 – 13 October 2023

5 October
Very hot afternoon with 36C maximum and no wind. Mostly clear blue sky, strong breeze in the late afternoon/evening.
Total number of godwits: 0 (Venta el Cruce, El Rocío)

Wouter arrived a day early and took the opportunity to pay a quick visit to EBD for a brief meeting with Javier Bustamente, who is coordinating the publication of EBD's census data. We learned that EBD's aerial waterbird counts are now publicly accessible (https://censos-aereos.icts.ebd.csic.es/) and Wouter got advice on how to best analyze and interpret long-term trends in godwit counts. At the coffee corner, a chance encounter with Andy Green revealed that already early this summer, in June, the Veta la Palma basins showed unusually high salinity values, while a markedly low quantity and diversity of prey items was recorded in droppings of Black-headed Gulls foraging in these basins. A bad omen for our visit to Veta la Palma later this week?

Ahead of Jos' arrival in the evening, Wouter quickly passed by the rice fields at Venta el Cruce, which were not yet harvested. No godwits to be seen there, even though as a result of the severe ongoing drought only 500-1000ha of the 40.000ha of rice fields in the Doñana area are cultivated this year. The barman of Venta el Cruce clarified that these rice fields are - in fact - irrigated with groundwater, rather than surface water from the Guadalquivir River.

In the evening, a quick visit to El Rocío revealed that the laguna there was completely dry. Only two dozen Yellow Wagtails and a dozen Cattle Egrets could be seen foraging alongside the horses, cows and deer on the arid ground of the laguna.

The only godwit and waders to be found at El Rocío

Jos and Wouter finally met up at their 'headquarters' in Villamanrique de la Condesa, to the north of Doñana. They were met by their kind host Ana Carrasco - who mentioned there had been a sharp decline in ecotourists visiting the Doñana area. Likely a result from the increasing awareness among birdwatchers and other nature lovers about the dire state of Doñana and the ongoing drought and heat in the area.

6 October
Day started relatively warm but nice. Later very hot for the time of year with 36C maximum and no wind. Mostly clear blue sky, nice breeze in the late afternoon/evening.
Total number of godwits: ~1100 (Bonanza, Algaida, Brazo del Este)

We left Villamanrique early in the morning to explore the saltpans of Bonanza at the southernmost end of the Guadalquivir delta, the most distant study site on our itinerary for this trip. As usual the salt pans held a great amount of bird life, including numerous waders, but godwits were few and hard to find. We eventually managed to find a few small groups - all unringed birds busily foraging on chironomid larvae. Just before noon we found the largest of the small flocks; a group of 9 birds, for which we made 7 measurements of intake rates. The birds swallowed roughly 1 prey every 2 seconds, ranging from 24 - 38 intakes per minute. Throughout the morning we saw at least 10 Osprey, 3 Black Stork, 1 Red Kite, several Temminck's Stint and some nice flocks of Greenshank among the numerous other migrants.

By noon we proceeded north along the Guadalquivir to the salt pans of Algaida, where we found another 30 birds, including one distant flock of 25 individuals among the Flamingos, and 2 individuals foraging on the muddy banks of the Guadalquivir River. While slowly making our way north towards Brazo del Este we finally managed to find our first colour-ringed bird of the day, which happened to also be a transmitter-bird: Rosalie. She was resting together with 9 other godwits in the Codo de la Esparraguera. Rosalie was tagged at her breeding grounds in the Duemmer area of Germany in 2018, and belongs to the minority of godwits that spend the entire northern winter in Iberia.

First colour-ringed godwit of the expedition was transmitter-bird Rosalie, from Germany, at Codo de la Esparraguera.

A few kilometers further north we passed by an extensive wetland restoration project in the marshes of Trebujena, and shortly after the smaller, already restored Lucio de Coca-Cola/WWF. Here we were pleased to see 21 godwits busily foraging close to the road, and another 5 individuals along the banks of the Guadalquivir River. But yet again - no ringed birds. By this point it was well into the afternoon, and we had managed to find only 80 godwits. From there, it would be a one-hour drive

Most of the foraging godwits had erect back feathers, which probably helps their thermoregulation in the hot weather.

Phenomenal numbers of waterbirds in the meanders of Brazo del Este.

with no more suitable godwit habitat until we reached the Brazo del Este. Along the way we were struck by the vast expanses of scorched land, most of which seemed not to have been cultivated at all this year, with the exception of some cotton fields that appeared to be in very poor condition.

After reaching the Brazo del Este we were immediately greeted by the sight of formidable concentrations of waterbirds. While none of the rice fields were cultivated, and most other wetlands in the Doñana area have fallen dry, the Brazo del Este has become an increasingly important refuge for waterbirds in recent years. And this seems to be true this year more than ever. The area only remains wet because water is pumped into this old river branch to provide a reliable habitat for waterbirds. Thousands of birds were huddled together in the meanders, including many dozens of

Common Snipe, Lapwing and White Stork - birds one would usually expect to see on the rice paddies. The meanders 'El Capitán' and 'La Margazuela' held huge groups of Spoonbills, totaling around 600 individuals, including numerous colour-ringed individuals. Despite having spent three years working in Seville and frequently birding in the Brazo del Este, Wouter had never seen anywhere near such numbers of Spoonbills in the area. Indeed, they are usually much more spread out across the Doñana area.

With so many waterbirds in the area, it couldn't take long before we would find some godwits, and finally, at the northernmost tip of El Capitán, we encountered a group of nearly 1000 birds resting on the shore. Because they were standing close and still, and we expected they might start foraging later in the evening, we decided to make a quick scan of the rest of the Brazo del Este, before coming back to look for color-rings. We found 10 more godwits foraging at the northern end of the meander La Margazuela, and were sad -but not surprised- to see that the rice fields of Finca Casudis that held large groups of godwits in October 2022 were bone dry this year. When we returned to El Capitán the godwits had just started foraging as expected, and they did so in shallow water, at a stone's throw from the road, making for ideal colour-ring reading. This made our day, as we were able to read 13 Dutch colour-ringed birds - including the GPS-tracked bird 'Sietse' - one German individual and an Icelandic godwit. All in all, a very nice reward at the end of a very hot, 12-hour day in the field.

Fabulous views of godwits foraging in shallow water in evening light.

7 October
Day started clear and relatively cool. Temperatures built to maximum 36C in the late afternoon, dropping to temperature in the high twenties in the evening.
Total number of godwits: ~1700 (Hato Blanco, Veta la Palma)

We started the day by exploring the finca of Hato Blanco near Villamanrique de la Condesa; this is the main area where rice is still cultivated in the Doñana area, and several of our transmitter birds that rest in the lucio besides the Antonio Valverde visitor center come to forage here at night. Unsure whether this area is publicly accessible we first asked for directions at the farmhouse, and were promptly sent on the right way. The rice harvest was in full swing, and hundreds of Glossy Ibis,

The massive but nearly empty water basin of Veta la Palma held 13 Black-tailed Godwits, besides 150 Spoonbills, 25 Black Storks, 170 Grey Herons, and 20 Great Egrets alongside a variety of other waterbirds.

Bone dry rice fields and irrigation canals dominated the landscape for miles.

and dozens of herons, egrets and storks were foraging on the fields. We arrived just in time to see a flock of roughly 250-300 fly southeast at roughly 150m altitude, and quickly concluded that these birds were heading to Veta la Palma to rest during the day, and so we headed there.

First stop in Veta la Palma was the vast water basin, which had very low water levels, but nevertheless large numbers of herons, Spoonbills and a small flock of godwits. There was one colour-ringed bird among them, but despite our best efforts it was impossible to read the code. Before heading to the fish ponds, we had a look around the rice growing areas and lucios at the northern end of Veta la Palma, all of which were bone dry, with the exception of a few puddles that were being used by a handful of Green and Common Sandpipers.

Next on our route were the small ponds at the eastern side of Veta la Palma that are used for intensive fish farming. Although these held much water, there were relatively few waders to be found here and no godwits. We did see a Red Kite carrying a GPS-tracker, and several Marsh Harriers hunting in the area, and shortly after we were surprised to see large numbers of Griffon Vultures soaring over a large salt marsh meadow. The explanation for this unusually high number of vultures soon followed, as we saw a dozen of cows had recently died due to the drought in this area. Eventually we saw no less than 200 Griffon Vultures on the ground.

After so much dust, death and despair it was high time to head for the main fish ponds, where we were sure to find at least some godwits. And find godwits, we did!

The first flock we found was also the biggest flock, with over 1100 birds in pond A5. However, this was around 13:30, so the heat haze was strong, and birds were mostly inactive, standing closely together. So we decided to first have lunch in the shade before exploring the remainder of the fish ponds, and returning to the big flock to read colour-rings in the afternoon. In the remaining fish ponds (C2, C7, gaveta 2) we found around 300 more godwits across multiple flocks running from single individuals to 130 individuals in size. Among them we managed to read a few colour-ringed birds, ánd we found German transmitter bird Tinadja at the southernmost end of Veta la Palma.

During lunch we had a very interesting conversation with Juan Antonio, who has been working in Veta la Palma for 33 years, and who is responsible for managing the water circulation system. He confirmed that the ponds this year had unusually high salinity levels, as we previously heard from EBD researcher Andy Green. Veta la Palma draws water from the Guadalquivir River, and the extremely high salinity is due to the lack of fresh water flowing down the river, which means that sea water now reaches far deeper into the estuary. According to Juan Antonio, the ponds have now become too saline for some of Veta la Palma's characteristic species, such as Red-crested Pochards, while species that are more adapted to saline environments, such as Slender-billed Gulls, have been doing unusually well. We further discussed the big impact of the drought on the Doñana region, the closure of intensive fish farming operations in Veta la Palma, and the upcoming purchase of nearly 8000 ha of Veta la Palma by the Andalusian government. As a result, Veta la Palma's ponds and lucios are intended to become part of the Doñana National Park. But while the sale is set to be finalized in December, it is still entirely unclear how the area will be managed in the future. One thing, however, is clear. In order to maintain, let alone improve, the value of Veta la Palma's wetlands for (migrant) waterbirds, it will be essential to make good use of the knowledge of experts like Juan Antonio.

Finally, we finished the day reading colour-rings in the big flock we had found around noon. In the end, we were able to read no less than 19 Dutch colour-ringed individuals, and 5 colour-ringed individuals from other schemes. Among those transmitter bird Haukesleat that recently moved from the Rio Tinto to Doñana. A few more birds we were unable to read for certain, among them at least one head-started individual from the UK. All in all, a long but rewarding day during which we got a very good impression of the current state of Veta la Palma, being torn between hope and despair, and on which we were able to collect some highly valuable resightings.

Small part of the 1100 strong flock of godwits in one of Veta la Palma main fish ponds.

8 October
Day started clear and relatively cool. Temperatures built to maximum 35-36C in the late afternoon, dropping to temperature in the high twenties in the evening.
Total number of godwits: ~700 (Odiel) and comparable numbers at Veta la Palma as yesterday

On today's program was the last major godwit site which we had not yet visited on this expedition: the marismas and salinas in the Odiel estuary, in Huelva. Today was a perfect day to visit Odiel, since the tide would be rising during the morning, and so we could expect godwits to leave their foraging grounds on the intertidal flats to rest in the salt pans, giving us ample opportunity to read colour rings in the morning hours, before the heat haze would complicate our mission.

We arrived at the visitor center of the National Park at 8.30 sharp, where the local raptor and wader expert Jose Manuel Sayago was already awaiting us. By 8.50 we already found a first group of 70 godwits, but they were standing in deep water and against the light, and so we decided to move along to places where reading rings would be easier. Jose Manuel had seen around 750 birds in the park two weeks before, but we'd have to look for the right places as water levels change every couple of days depending on the operations in the salt pans.

While driving over the narrow trails between the lagoons and salt pans we enjoyed nice views of Black-necked Grebe (about 10.000 of these smart looking birds come to the National Park as a moulting site) and large numbers of waders of all kinds.

The salt pan Isla de la Liebre in Odiel NP where we saw most godwits.

Jos and Jose Manuel reading rings in the salt pans of Odiel.

About an hour later, we found the biggest flock of godwits of the day, which initially held close to 300 birds but would grow to 430 birds as more and more godwits arrived from the mudflats due to the incoming tide. We found at least 8 different colour-ringed birds in this group. From experience

we know to expect about 1 colour-ringed godwit for every 50 birds we see, and this was true also in Odiel.

The morning continued with more flocks ranging from 25-130 godwits, and we ended up seeing slightly over 700 birds in total -very similar to the amount seen by Jose Manuel two weeks earlier. With some perseverance we managed to read 7 colour-ringed birds from the Dutch scheme, a few more from other schemes. We ended our trip around the National Park reading one Spoonbill with a Danish code ring, and three others with Spanish code rings. Afterwards, Jose Manuel kindly showed us some good locations along the estuary where we can try to read godwits during low tide, while they are foraging on the intertidal flats.

When looking at godwits in southern Spain, you'll often see Flamingos in the background.

By 14:00 we returned to our headquarters in Villamanrique for a short lunch and to process some data during the hottest part of the day. At 17:00 we got back on the road for an evening session of ring-reading at the big roost we found yesterday in the fish ponds of Veta la Palma. The drive to Veta la Palma seemed to take longer than usual in the late afternoon heat, and as both of us were fighting fatigue after a couple of long days in the field. The bone-dry landscape, completely devoid of any bird life, didn't help much either.

While driving along the ponds we saw the usual Ospreys perched here and there, but also an adult female Peregrine at pond A4. Upon arriving at the main godwit roosting site in pond A5, we were a bit disappointed to see that the birds were standing further afield than the day before. A strong breeze brought some relief from the heat and kept the flies at bay, but also made for shaky scope views and thus complicated ring-reading. To make matters worse, a Marsh Harrier spooked the flock several times over, so that we lost many birds out of sight before we could read the complete colour-ring code. Nevertheless, between us we were able to read 9 colour-ring combinations, including a few birds we had not yet seen the day before. Most of the birds eventually moved even further afield, with no possibility of reading any more rings. And with that we were able to return home a little earlier than usual, allowing us to enjoy some nice tapas and a refreshing beer in the local bar before getting some much-needed shut-eye.

The centre pivot irrigation systems on the barren fields of Veta la Palma would not be out of place in a post-apocalyptic Hollywood movie.

9 October

Day started clear and relatively cool. Temperatures built to 30+ temperatures, though less extreme heat than we suffered over the past few days, before dropping to mid twenties in late afternoon. Total number of godwits: comparable numbers in Brazo del Este as two days ago, and 300 in Hato Blanco in the late afternoon/evening.

Over the past days we have been able to visit all the main sites we intended to visit on our trip, and so we decided to start the day revisiting the Brazo del Este in hopes of reading some new colour-rings among the 1000+ birds residing there. After a quick cafe con leche in the town of Pinzon, we reached the meanders of the Brazo del Este at 9.00, where we quickly found half of the godwits standing far away, and belly-deep in the water of El Capitán. This made it impossible to read any rings. The other half of the birds were foraging in the meander La Margazuela, also in deep water, and with no possibility of reading rings. With no alternative sites in the area, and having driven 1.5h to get to the Brazo, we wanted to make good use of our time in the Brazo and decided to direct our attention to the Spoonbills that were frantically feeding close to the road.

Small part of a flock of hundreds of Spoonbills foraging in El Capitán in the morning light.

Reading the Spoonbills was child's play in the glorious morning light and from a very short distance. Within half an hour we had read at least 25 individuals, and by noon we had managed to read at least 50 different colour-rings and code rings. While reading the Spoonbills, we were treated to a moment of great hilarity as an elderly Spanish birder drove past with a pigeon on the roof of his car. Assuming the man was unaware of his feathered passenger, we alerted him to the pigeon's presence, to which the man calmly exclaimed "*eso es mi GPS!*". Turned out the pigeon was his trusted birding companion. A most unexpected meeting…

Not so unexpected were the ecotourist guides showing their clients around the Brazo del Este ("la nueva Doñana" - as Wouter calls it). After introducing ourselves we learned that one of the guides had read several color-rings only recently, but was unsure where to send the data. So we pointed him in the right direction, making sure his records will end up in the right place, and that he would get a nice reward for his effort in the form of some beautiful godwit life-histories!

Finally, a few godwits decided to forage in some shallow water, after they were disturbed by a low-flying small aircraft that sprayed pesticides on the adjacent farmland. We were happy to read two colour-ring combinations at Brazo del Este. But of course, we were hungry for more, and we decided to drive back north a bit earlier than expected, and explore some new terrain in the farm of Hato Blanco Nuevo, to the north of Doñana, where we saw the rice harvest was in full swing a few days earlier.

The Hato Blanco rice fields could still deliver some godwits we haven't seen before, since we know from GPS data that at least two transmitter birds have been foraging on the Hato Blanco Nuevo rice fields for the past few weeks. And while we also know that these same birds are roosting in the lucio next to the Antonio Valverde visitor centre of Doñana NP, they are sleeping too far from the road, hidden from view. So we decided the rice fields of Hato Blanco are our best bet to see these birds, ánd just 20 minutes driving from our headquarters in Villamanrique.

Commuting flights of Haukesleat (pink) and Boerenstreek (purple) between the lucio at the Antonio Valverde visitor center and the rice fields of Hato Blanco Nuevo between Sept 25-Oct 9.

The roads of Hato Blanco Nuevo are not public, and so after returning from the Brazo del Este we first made sure to get permission from the farm managers. A few helpful workers made a call to the

Harvested rice paddies in Hato Blanco Nuevo. A world of brown and blue. And godwits too!

main responsible manager - Juan Carlos - and we were welcome to visit the area so long as we would keep the road clear for the combines that are harvesting the rice paddies.

When we entered the rice field complex in the evening there were birds all over the place. A little under 10.000 Glossy Ibis, thousands of Storks and Gulls, hundreds of Flamingos, and dozens of Green Sandpipers and Greenshanks. As we made our way through the rice fields, we were intercepted by the manager Juan Carlos who shared a very interesting anecdote, stating that the 'Arciruelo', as godwits are called colloquially in the Guadalquivir delta, is more typically a spring bird in Doñana, that it loves to eat rice grains, and that some decades ago the farmers would have to plant the rice seedlings manually instead of sowing the grain because of the godwits. Back then, the godwits arrived in March (rather than in December - January as they do today), and would stay well into April-May when the rice was traditionally planted (now sown). What a remarkable parallel with what we know from the Casamance in Senegal, where rice farmers had to switch to planting seedlings for the exact same reason, as godwits advanced their arrival dates to Senegal to coincide with the traditional timing of sowing (now planting)!

Part of the godwit flock in the rice fields, along with Flamingos, Black-winged Stilts and a black fog of Glossy Ibis whooshing by in the background.

Juan Carlos was also able to point us in the right direction to find the 'Arciruelos', as he had just seen a flock arriving in a field that we had passed before. It didn't take us long to find them, and while we stood there, we saw several groups arriving from the direction of the Antonio Valverde research center, consistent with the tracking data of Haukesleat and Boerestreek. What a joy to see the day-night patterns we observe in the GPS data in the field! Unfortunately, the furrows were too deep for the godwits to forage in, and standing among the rice stubble it was impossible to read their ring. Still, we had a very beautiful evening with a lot of exciting observations.

10 October
Another warm day, around 34 at mid day but cooling down in the evening to 23. Almost no wind during the day but a nice breeze in the evening.
Total number of godwits: lower numbers in Odiel compared to Sunday (around 400) but 240 at a roadside pool in Huelva and 200 at Estero Domingo Rúbio.

In the morning we left at 7:30 to be at Huelva at low tide to check the Rio Odiel riverbanks. Unfortunately, it was a relatively high tide and small parts of the mudflats were available for foraging waders. We only saw about 20 godwits without rings at the Huelva boulevard and at the Punta Umbria bridge. We continued ahead of schedule to the Odiel NP office where we met Jose Manuel Sayago again. We did a quick tour around Isla de la Liebre before it would get too hot but the godwits were not very cooperative. Most of them were standing in deep water and we got just a few rings. Numbers were also lower; godwits were probably foraging more up north as it still was a few hours before high tide and numbers usually drop in October when godwits leave for the rice harvest in Doñana. In the field we met José Manuel Mendez who joined us last year and he advised us on 2 other spots (see below). Back at the office we had a brief meeting with the director Mr. Enrique Martínez Montes.


At low tide godwits forage on the river banks of the Rio Odiel promenade.

Around 14:00 we had to split up with Wouter having a small holiday break and Jos continuing the expedition. He checked a place called Salinas de Bacuta, a small estuary in the outskirts of Huelva, closed in by the major H5-road and houses. Jose Manuel Mendez Garcia, technician at Odiel NP had pointed out that this place might be worth checking. A brief stop in the morning had only brought us a handful of birds but at 14:00 there were 240, including 2 Dutch birds and a code flag UK5, a chick ringed at the nest in 2019 in SW Friesland and never reported before.

Roadside pool at Salinas de Bacuta with Huelva in the background.

Jose Manuel had another good advice: the freshwater lagoons of Estera Domingo Rúbio. There I found another 200 godwits in a scenic lake surrounded by woodlands and palms. Not the first place you would think of to check for godwits. Most of them were foraging in deeper water for Chironomids but after a short panic flight most of them landed on the shore. Unfortunately, only 1 German ringed godwit could be identified and 1 code flagged bird was too far away.

From there I went onwards to spend the late afternoon and evening at Veta la Palma. The situation was comparable to earlier this trip. Again, the water was just too deep, the Marsh Harriers a bit annoying and the birds too far away for a very good score but there was no reason to complain with 9 ring combinations read at the end of this day and amongst those many individuals seen on our previous October expeditions, suggesting these birds habitually winter in the Doñana area.

Great scenery and 200 godwits at Sentero Domingo Rúbio Reserve near Palos de la Frontera.

11 October

Finally it is cooling down a bit: 32C in the afternoon. More humid in the morning and an increasing slight breeze during the day.

Total number of godwits: lower numbers at Brazo del Este (around 675) and around 1000 birds at Veta la Palma.

The last trip to Brazo del Este was not very rewarding, godwit-wise. This morning I had more luck as 550 birds were standing close to the road in low water and a helpful Marsh Harrier shook them up every now and then without causing too much panic. This resulted in a nice morning session with 17

godwit-combinations read, mostly Dutch birds including 2 code flags. Later they started foraging on Chironomids in deeper water nearby. The number of Spoonbills was still impressive but I did not have time to check those.

In the afternoon Veta la Palma was on the program again. On the way there I saw farmers ploughing the weeds in the ricefields: are they expecting to seed their fields again this winter? About 120 birds were standing in C3 including a R4 with very stained rings, like the ones I had seen in the Casamance some years ago. This gave me the idea that there might have been an influx already of trans Sahara migrants, an impression that was backed up with a Spanish bird with similar staining in A5. Here the numbers were just under 1000 birds and as they were standing in quite low water and at close range, the total score for today ran up to a comfortable 32 different godwit combinations seen. At dusk most of them flew up when a Marsh Harrier did a final tour before dark and those headed in a northern direction; to Hato Blanco?

Nice godwit flock at Brazo del Este that brought us many ring combinations today

12 October
A fresh start but still running up to 33C with a breeze in the afternoon; sunny all day long.
Total number of godwits: 3000 birds at Veta la Palma.

On the last day of this trip, I decided to do a full tour of Veta la Palma again. On the way there I drove through many rice fields that were overgrown with weeds after lying fallow for several years now. The biggest group was again at pond A5 but it had grown to at least 2500 birds. When I arrived just after dawn, they were almost all firmly asleep in the SW corner. Looking at the group from different angles resulted in a handful of sightings and a ring density sample: 7 birds of the Dutch scheme out of 400 birds checked. Halfway the morning, they flew up for some reason and landed further away in the pond and continued their daytime sleep. After a final resighting I moved on to pond C2; the number of birds here had increased as well to 240, most of them asleep but some of them foraging, providing 3 more resightings and some intake rates of Chironomids (22 per minute; n=3). Searching the rest of the eastern part of Veta la Palma only brought some 50 birds in pond C7. The large numbers of Spoonbills seemed to have moved on, so unfortunately no extra resightings of ringed birds of this species. Later in the afternoon it was time to leave Veta la Palma, clean the car and pack for the return.

After not being cultivated for several years, the rice fields start to become covered with weeds.

13 October

The first clouds of this trip predict a change of weather; with heavy rainfall expected next week. The air was already much more humid and temperatures didn't go above 28C with a slight breeze.
Total number of godwits: 115 godwits at Brazo del Este and 370 at Marismas de Cetina.

Before the closure of this expedition there was still time to check Brazo del Este once more. The numbers of godwits had dropped to 115 birds but as they stood in low water, 3 ringed birds could easily be read. It seems likely that the increase in Veta la Palma is at least partly due to an influx of birds from the Brazo. This idea is corroborated by the behaviour of transmitter-bird Sietse that stopped using the Brazo del Este and started using Veta la Palma and Hato Blanco on October 13! Moreover, it seems that all transmitter-birds staying in the Doñana area adopted this same space use pattern around this time, including Rosalie and Tinadja that left the salinas of Bonanza and Algaida where they stayed through the first half of October, and Boerenstreek that stopped roosting at the Antonio Valverde center and started roosting in Veta la Palma instead.

Space use of godwits in the Doñana area between Oct 1-10 (left) vs Oct 10-24 (right). Coloured circles = main/last location of each bird in each period. White dashed squares = areas used by godwits in each period, with white arrows indicating connectivity between areas through frequent commuting flights.

Throughout this expedition it has been remarkable to see how well the distribution of our transmitter-birds reflects the distribution of godwit numbers across different sites in the greater Doñana area. The way in which the transmitter-birds' movements paralleled the sudden and fast changes in site-specific numbers at the end of our expedition underlines just how precisely godwits track environmental changes. And this tracking behaviour in turn leads to some formidable questions. For example, how did birds like Rosalie, Tinadja and Sietse learn that the time was ripe to leave the meanders of the Brazo and the salinas of Bonanza and Algaida, and to start using Veta la Palma and Hato Blanco instead? Did other godwits come to tell them?

Our last stop of the trip was at Marismas de Cetina near Puerto Real in the Cádiz region. We had seen that transmitter godwit Bruindeer had been around there for several weeks. Thanks to local bird expert Francisco Hortas we could also check the restricted part of these huge saltworks. I saw a flock of 370 birds resting in the middle of the saltpans but they were too far away to be checked for rings and going there on foot for sure would have disturbed many waterbirds with no guarantee that the godwits would have stayed. With a nearby ringed Spoonbill we finished this trip in style.

Godwits at Marismas de Cetina were too far out to be checked for rings.

Appendix A: Godwit locations visited

Appendix B: links to open letter and perspective articles concerning the dire situation in Doñana

Open letter of international bird migration scientists: *maintaining Doñana's Natural World Heritage Values will require radical cross-sectoral changes in water use in the Guadalquivir basin. May, 2023*

- *Available in five languages (English, Spanish, French, Dutch, German) via: https://www.waderstudygroup.org/news/openletterdonana/*

Perspective article *- Wader Study:*

- *Freely available to download at: https://www.waderstudygroup.org/article/17447/*