

**Describing habitat and finding colour rings of Black-tailed
Godwits (*Limosa limosa*) in
Morocco, from 25 February-5 March 2019**

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

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Introduction

The Black-tailed Godwit (*Limosa limosa*; BTG) is a meadow bird (Verstrael 1987; Thijse 1904). The current Dutch population is estimated at fewer than 40.000 breeding pairs (Kentie et al. 2016) and 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. 2009; Hooijmeijer et al. 2013).

Demographic research Southwest Friesland

To measure the changes in population numbers and the causes, in 2004 the University of Groningen started a long-term research in the south-western part of Friesland, The Netherlands. In 2007 the research area has expanded up 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.

Migration and wintering sites Black-tailed Godwit

In 1983-1984 the wintering sites of godwits were explored for the first time. At that moment 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 were thought to mainly belong to the eastern European population. Recently, the wintering behaviour has partly changed with an increasing number of godwits deciding to winter in southern Spain at National Park Doñana. In the 1980s during the first counts, only 4% of the NW-European population used this area as a wintering site but recent estimations suggest a big change with up to 23% of the population wintering in Spain. The most important reason for this is probably the creation of new artificial fishponds and rice fields. It is remarkable that this increase was not driven by climatic changes in the Sahel zone of West-Africa (Márquez-Ferrando et al. 2013). For godwits, staying Iberia can be advantageous because they can skip two 3000 kilometre non-stop flights across the Sahara, a potentially dangerous migration episode.

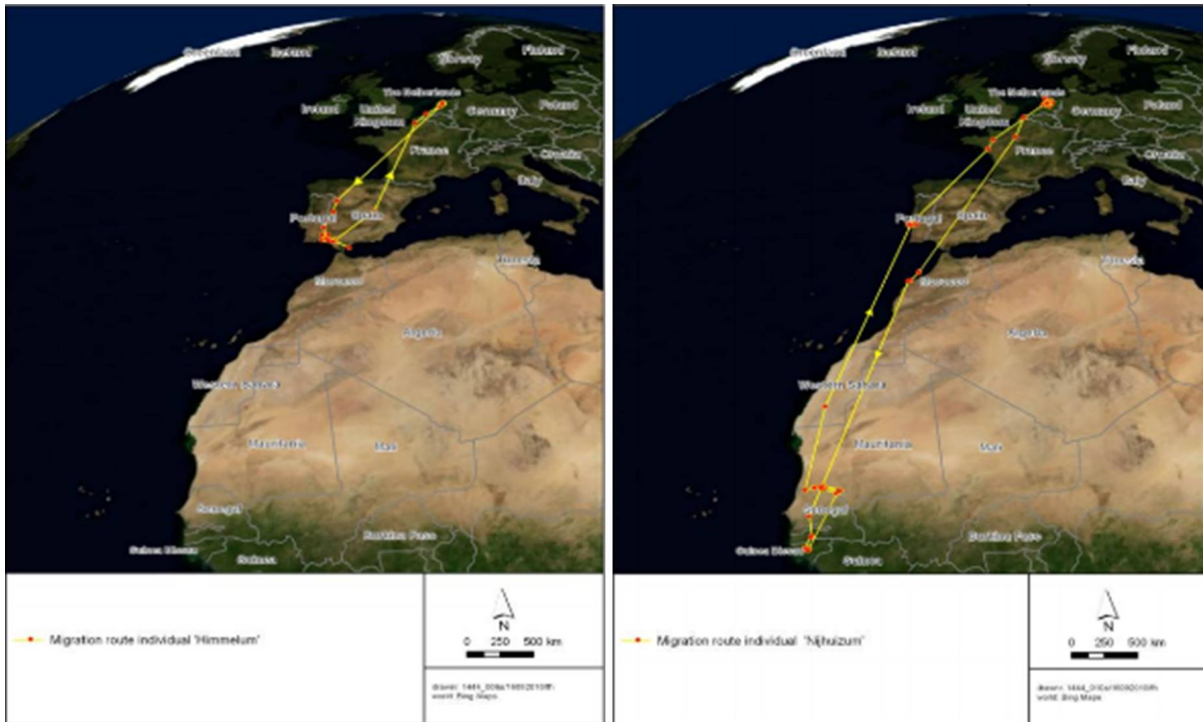


Figure 1. Two migration routes of satellite tagged birds in 2009. The left map shows the route of an Iberian wintering bird. On the right an African wintering bird. Iberian wintering birds save a 6000 km flight and don't need to cross the Sahara twice (Hooijmeijer et al., 2013)..

Conservation

The change in wintering grounds is remarkable and an important reason why we 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), but not how they develop their individual migration strategy and perhaps thereby change the migration pattern of the species. These changes can also have consequences for the survival rate of both adults and juveniles. Moreover, they may even 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. A better understanding of these processes is therefore also important from a conservation point of view; the Black-tailed Godwit qualifies since 2006 as “Near Threatened” on the IUCN Red List.

Until now, West-Africa is the only area along the migratory flyway from where we don't receive many observations of colour-marked individuals. Only small numbers of colour-ringed birds have been reported, mainly by birdwatchers and, recently, by local scientists. Unfortunately the numbers of sightings are too small to make demographic comparisons between wintering sites.

Expeditions West-Africa and Iberia

In November 2014 the University of Groningen, in cooperation with Global Flyway Network and financially underpinned by Birdlife Netherlands, embarked on the first expedition to the wintering grounds in West-Africa. Since then we have visited the area 2-3 times per year with the aim to set up a demographic research project in this area in close cooperation with local scientists, volunteers and conservation organisations. 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. At this moment comparable research is done in NP Doñana (Spain), Extremadura (Spain) and the Tejo/Sado estuaries near Lisbon (Portugal). The last two are used as staging areas in February. In order to find links between wintering sites,

stop-over sites and breeding sites, we need to continue our research at all these locations. Research questions we want to get into in the future with our work in West-Africa, Spain, Portugal and The Netherlands are:

- What is the overall difference in adult mortality between birds wintering in West-Africa and Iberia? And where along the flyway do these differences occur?
- Can birds change their wintering strategy during their life? And is this age-dependent?
- Does reproductive success determine where birds winter?
- Has the wintering strategy consequences for their migration and breeding phenology? And are there consequences for their reproductive success?

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. The majority of continental black-tailed godwits breed in grassland meadows situated in north-west and Eastern Europe (March – July) after which they migrate southwards for the non-breeding period (mid July – February), finding food resources within wetlands and agricultural rice fields. 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.

Using remote sensing products (Modis EVI 16 day time series) and 5 years of good quality locations of black-tailed godwits (equipped with PTT satellite tags) we generated a spatially and temporally explicit habitat utilization model using Bayesian distribution analysis. We found that during the non-breeding period black-tailed godwits showed 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. *in prep*). However, remote sensing data are by their nature ‘remotely sensed’ and require accurate ground-truthing. Additionally, little is known of the nature of the prey items in the different habitats at the different times of the year. In the present survey we aimed to describe and categorize habitats, measure environmental variables such as water salinity and soil penetration pressure, the feeding efficiency of the godwits and carefully investigate the substrate to establish the identity of godwit prey items.

From 25 February – 5 March 2019 we visited areas in Morocco previously identified as godwit areas as well as new areas that showed up as hotspots from the accumulated transmitter locations. We recorded resightings of individual birds and described godwit habitat. In this report we present a daily overview of our findings with photos, locations we visited, numbers present and the first conclusions and recommendations.

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Summary

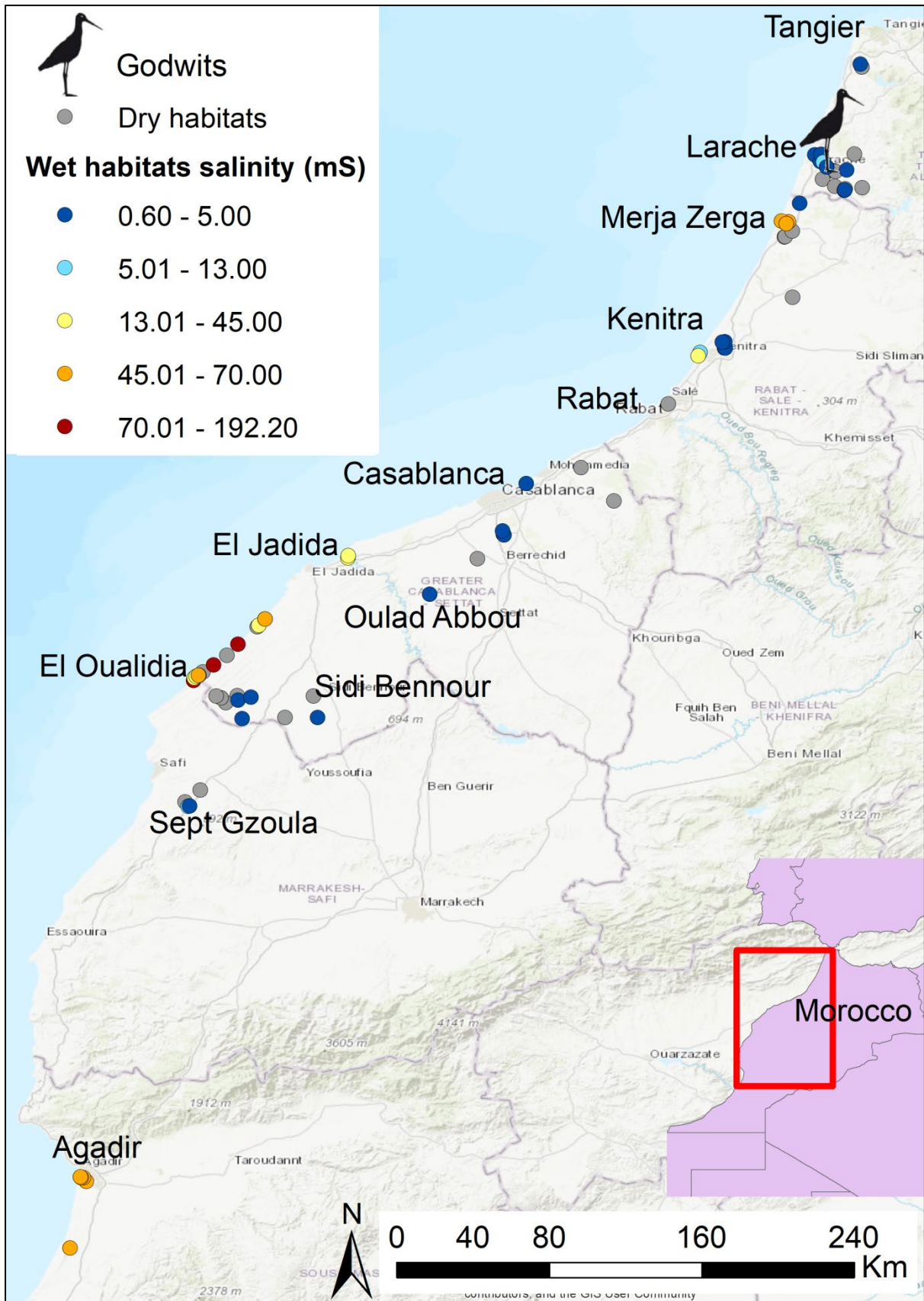
From 25 February to 5 March 2019 we were in Morocco to describe the habitat of Black-tailed Godwits, count them and look for colour-ringed individuals. We started in the south in Agadir and travelled northwards along the coast to Tangier, also visiting some more inland destinations; a total of 84 habitat descriptions with salinity measures were taken. Our itinerary was based on the locations visited by godwits with satellite transmitters and known wader hotspots, and the “Finding Birds in Morocco” - guide written by Dave Gosney. We deliberately planned to make this trip in this week because, according to the satellite locations, this should have been the optimal period to find them in Morocco. It turned out differently because we only managed to find 8 godwits..... This might have had to do with the fact that our arrival was preceded by 2-3 weeks of southern winds that led to a very early arrival of godwits in The Netherlands: they simply might have passed through. However, we also witnessed drought, in combination with omnipresent drainage of wetlands and the use of groundwater for irrigation, everywhere during our trip. It had rained only substantially in November during this winter and most of the intermittent wetlands in the hinterland were (almost) without water. The saltwater habitats like saltpans, lagoons and saltmarshes seemed to be in good condition but we did not find the godwits there either.

What struck us is the fact that large parts of the Moroccan countryside are in use for agriculture, mainly monocultures of peas, wheat, other cereals, cauliflower, cabbage, citrus orchards and strawberries. It is hard to find natural habitats. Even places that are too steep or rocky for crops are used for livestock grazing. Nevertheless, we hardly saw any big machines on the land, most work being carried out by hand, horses or small tractors.

In general, the biodiversity was disappointing with relatively few herb-rich fields, just a very limited number of bird species like Kalander lark, Common quail and Corn bunting and the complete absence of other wildlife; not even as road-kills. We learned that the attitude of most people to wildlife is indifferent and that (illegal) hunting is definitely an issue in some areas we visited like Merja Zerga and the Larache marshes – the discarded shotgun cartridges being the evidence. Many of the remaining wetlands have signs of developing infrastructure to drain the wetlands and convert the land to other land uses. In general, the good options for migrating waders like black-tailed godwits are very limited and only in very wet winters they might be tempted to spend more time in Morocco instead of just passing through.

Acknowledgements

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Map of the areas visited during the expedition, showing the range in salinity of the wet habitats

Daily reports

25 February 2019

Today we travelled to Agadir where we arrived only at 01:00 after our connecting flight had been cancelled in Casablanca. We slept in Motel Rifik in Ait Melloul.

26 February 2019

A cloud free day, starting fresh at around 10 °C with at midday reaching around 25 °C. After some shopping we went for the two estuaries south of Agadir: the Oued Sous and Oued Massa Reserves. Of those two, Oued Sous is the most suitable for waders. Along the river are nice mudflats and further towards the sea there is a series of small pools on the north shore. We saw about 200 redshanks, 75 greenshanks and a variety of other wader species (spoonbills, ruffs, herons) but unfortunately no godwits. We know that this is a stopover site because of the satellite locations that we have received from birds with transmitters. We have reason to believe that they also use the golf course of the King of Morocco just north of the reserve, but that site was unfortunately off limits. Water in the estuary was saline at 55 mS and in the shallow pools it was even higher: 61 mS. The Oued Massa riverbanks are not suitable for godwits. The shoreline is mostly covered with reeds and bushes and the adjacent agricultural fields are probably too dry and dangerous for them to use. Water again was hypersaline in 54 mS, intriguing is that these highly saline conditions don't seem to deter the barn swallows from drinking. In the afternoon we drove north all the way to Sebti Gzoulah to find out that there was no hotel in that city. So we drove to coast and slept in Safi.



Shallow saline pools in the salt marsh vegetation outside the Kings palace at Oued Sous



An incredible amount of plastic rubbish collects along the high tide mark in the marshes of Oued Sous

27 February 2019

A few small clouds, but almost completely sunny day with around 22 °C at midday. The theme of today would be: drainage. We started at the first clump of satellite points just north of Sebt Gzoula. It turned out to be a depression in the vast agricultural fields of wheat, grass, peas and some kind of beet that dominated the landscape. According to local farmers, there is water in this place in wet winters, but this year the winter was dry and these fields unsuitable for godwits. The next stop turned out to be the rubbish tip of Sebt Gzoula. Apparently, the sewer of the city ends in two pools on the northside of the city and mixes there with the garbage piled up on the shore, creating an extremely smelly soup. This soup was a bit saline, 4 mS in both pools. However, there were more than a 100 waders, ducks, storks and coots foraging between litter but no godwits. Amazing that these waders are capable of using such polluted water.

We continued north and made a brief stop at a hill top in the fields where apparently one of the godwits had lost its transmitter or died, based on the satellite locations. The next stop was at a small lake just east of Ouled Azzouz. Half of it was covered with reedbeds but in the open part we found some waders (mainly stilts) and ducks. No fewer than eight marsh harriers were continuously

hunting over the reedbeds and some were displaying. The lake was still well filled with water but on several sides water was pumped out to water the crops.

Our next destination was the Zemamra lakes, advertised by Dave Gosney in his booklet *Finding Birds in Morocco* as a terrific spot for waders and ducks in winter and during passage periods. But that was in 2011..... The first lake from Trine Gharbia was almost dry except for some small pools. Perhaps it did not rain enough, but we heard a pump running that brought water to the surrounding agricultural fields. The second pool was even worse: it had been fully converted into arable land and no sign of a lake left. The third called Khemis de Zemamra was still the best with several dozens of waders, mainly stilts and redshanks. But it will not take long before this lake will be history as well: in every corner there were pumps that took out water for irrigation purposes. Water was very fresh here measuring ~1300 uS.

We had high hopes of our next stop: a rather big lake just west of Sidi Bennour where one of the satellite godwits had spent some time a few years ago. But we found out that the lake was completely dry and people were ploughing the lake bottom. Again the combination of not enough rain and drainage? Fortunately, a big lake some kilometres south of Sidi Bennour was still there. Very fresh conditions ~300 uS comparable to tap water. There were hundreds of waders, mainly ringed plover, little stint, Kentish plover, greenshank, stilts but also 26 spoonbills, gull-billed tern, 100s of large gulls and ducks, including casarca and marbled teal. But no godwits. Again we noticed drainage pipes taking the remaining water in the lake towards the agricultural croplands. Our final check for today was west of Lahlate. We could still see the remains of previously waterfilled depressions, but all potential sites had been turned into arable land.

The borders and up to 1-2 m surrounding the borders of the small remaining wetlands were natural vegetation. Other than that, every square meter of this landscape had been converted to croplands. Rocks have been removed from the top soil followed by ploughing. Interestingly we couldn't see any really big machinery which could plough up such a vast agricultural landscape; we encountered small tractors and horse/donkey pulled ploughs. Rare in the landscape were fields that contained some herb diversity dispersed in the crop (poppies, buttercups, thistles and *Rumex*). However, most were monocultures of uniform height of wheat, legumes or root crops. The only variation in could be found between dry meadows or meadows that were irrigated. Godwit-wise it was not the best possible day, but we learned that potential stopover sites are rapidly disappearing from the Moroccan countryside.



Drained wetlands cultivated for cereals north of Sebt Gzoula



Wetland created through drainage of waste water from the neighbouring city (Sebt Gzoula) with incredibly high levels of pollution but still used by waders and barn swallows



Small wetland near Ouled Azzouz with eight marsh harriers soaring above

28 February 2019

Another sunny day, 21 °C with a mild sea breeze. Today we headed for the coast again and started south of Oualidia. From here all the way to Sidi Abed the coastline consists of a ridge of dunes or rocky hills with behind it a series of lagoons, saltmarshes, saltpans and places that have been converted into arable land (mostly vegetables, strawberries and wheat). We visited almost all of the places where waders could be expected at Oualidia, Sidi Brahim and Sidi Moussa and checked several places where godwits with transmitters had been located in the past. We found hundreds of stilts, redshanks, greenshanks, grey plover, ringed plover, curlew, Kentish plover, pied avocet, dunlin, sanderling etc. and a variety of waterfowl including ~100 marbled ducks and one pair of eed-

knobbed coot.....but not a single godwit. We ended the day at Azemour where a transmitter-godwit had been using the banks of a rather polluted river. We saw a handful of waders but no godwits. In the salt pans we measured record high (for the flyway) salt levels of 198 mS, the Atlantic Ocean was only 27 mS and the estuaries ranged from 33 – 54 mS. We didn't encounter any fresh water pools today. We slept at El Jadida.



View from the cliffs between Oualidia and Sidi Abed, looking down on the lagoons, salt marshes and salt pans



Dunes cultivated for vegetable production



Salt pans with incredibly high salinity levels (198 mS)



We found very few areas with herb-rich natural vegetation (Sidi Moussa)

1 March 2019

No change in the weather. Today we followed the track of satellite locations up north that brought us to the most remarkable places that godwits visit. Our first stop was at Oulad Abbou. It turned out to be an idyllic freshwater lake on the premises of a communal farm. No godwits but many little grebes, 20 stilts and a spotted redshank. We continued towards Berrechid through an agricultural area that you might call the Lake District. Unfortunately, almost all the lakes were completely dry, some apparently already for years. A farmer confirmed that it was a dry winter. Normally it rains from November to January and thereafter spring starts.

We continued our quest towards Bouskoura, a suburb of Casablanca. The satellite location was exactly on a graveyard! But perhaps the bird had been foraging in the surrounding fields or flew over it? Next to the graveyard was a very beautiful herb rich meadow with many colourful flowers and insects zooming around. With the help of the aerial photos of google earth we saw there was a small lake, close to the graveyard but behind a dump, again with some waders, ducks and glossy ibises. An uptight guy came speeding up to us and demanded to know what we were doing. When he heard our accents and found out we were only interested in birds he relaxed and allowed us to stay.

The next stop turned out to be a real challenge. It was a small pond on an industrial area in the outskirts of Casablanca, surrounded by “townships”. We could not convince the guard to allow us to enter a road behind some warehouses, but he showed us a path that would go to the pool and promised to look after our car. Immediately after we took that path on the edge of the townships, we were warned by some guys not to proceed because the area was unsafe without a local joining you. One of them offered his help and so we finally could get close to a stinky pool with some egrets and a spoonbill. Essentially the pool is created through the runoff of waste water from the informal township, and it was very polluted.

After this “adventure” we headed inland again towards a lake south of Ben Slimane, but again it turned out to be a dry lake although it was much greener than most of the dry lakes we have seen today; perhaps there was some water in early winter? Our last stop was at the banks of the Oued Bou Regreg in downtown Rabat. This proved to be too difficult to reach behind the well-guarded Necropolis of Abu Al-Hassan, but we could get some good views from a nearby hill. By that time it was getting dark and we found a place to sleep at Sidi Yahya.



Fresh water lake at Oulad Abbou



The dry lakes of Berrechid



Small wetland next to a rubbish/rubble tip near the graveyard in Bouskoura



Small wetland situated in the industrial site within Casablanca, the wetland is created by waste water runoff from a shanti village

2 March 2019

The day started sunny, but in the afternoon it became more clouded; still a nice 21 °C with a slight breeze. We started the day at the main road entering Kenitra that crosses a lake. On the north side it was dry enough for waders, mainly Stilts. On the south side the water was too deep for waders; the numbers of nesting cattle egrets were impressive. The water was slightly saline at 2.4 mS and pollution levels were quite high, there were many homeless people sleeping in the area, but the area was under development, therefore it may improve in the future.

The next stop was at the scenic Lac de Sidi Bourhaba. It was too deep for good numbers of waders but it was full of ducks like red-crested pochard, white-headed duck and many red-knobbed coots. Here the water was coloured brown by humic acid and was surprisingly salty with 13 mS, despite the prolific *Juncus* and Eucalyptus trees growing at the edges of the lake.

We moved on to the next satellite location just north of Kenitra. It turned out to be a low-lying piece of arable land that was connected to a freshwater wetland with some open water. No waders were seen here despite a marsh harrier that flew over the marsh continuously.

We followed the N1 up north to take a turn off at Allal Tazi to arrive at a village called Lamlaguit. From the images on Google Earth we expected to find rice here: big parcels, irrigation channels and close to the river Sebou. However, we found no rice but just grasslands and arable fields. A local guy who thought he knew where to find rice in the end could not help us either so we left the area without having found either rice or godwits. It is remarkable to see how much land has been cultivated for agriculture, meadows with more than two herb species were exceptionally rare, and fields were cultivated right up to the edges for maximum production. We noticed both legume cropping being used to improve the soils as well as many many bags of artificial fertilizers being used to intensify crops yields.

We slept at the coast at Moullay Bouselham. Let's see if tomorrow brings us godwits when we will explore Merja Zerga.



White-faced duck in the lake Sidi Bourhaba



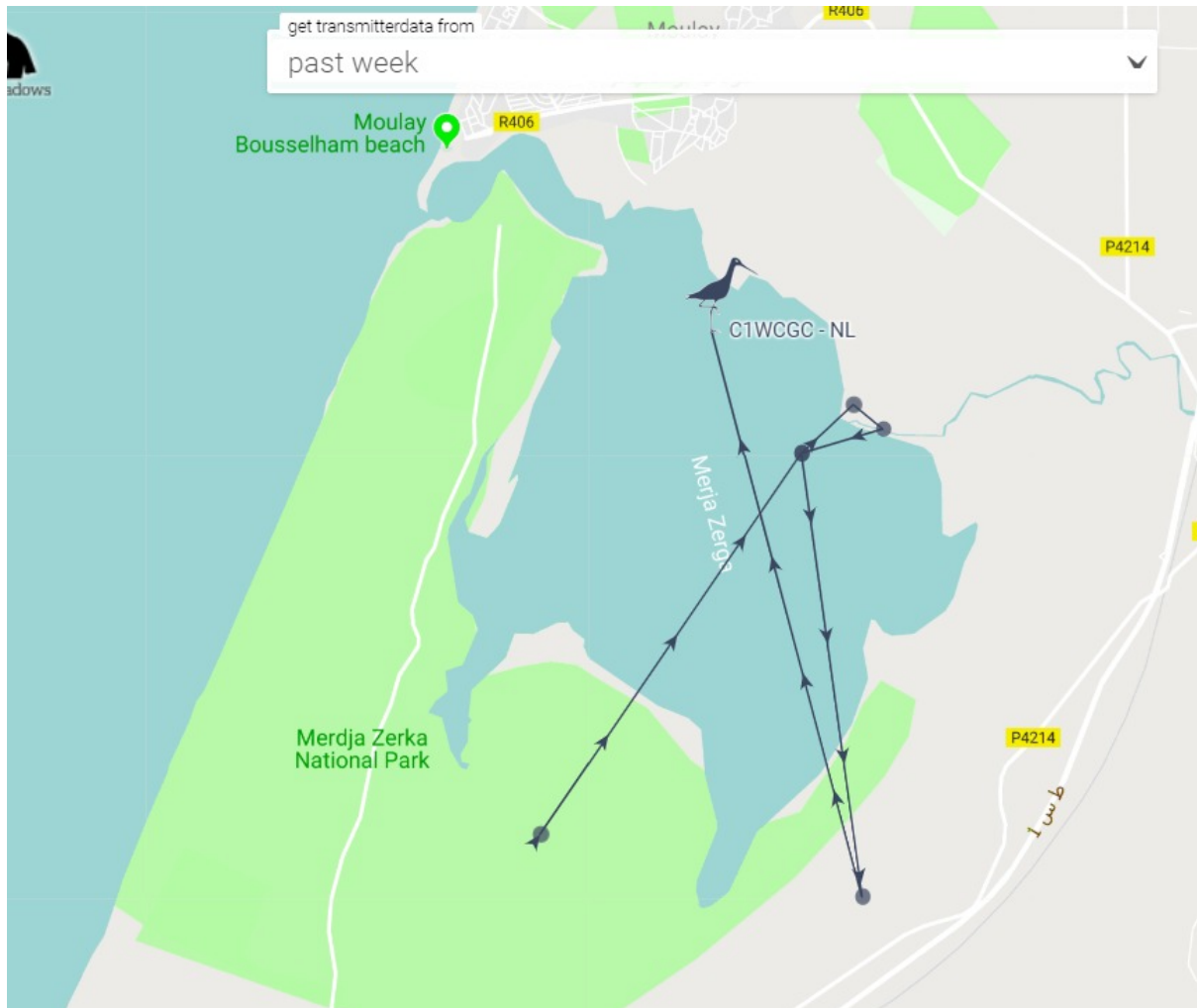
Small elongated fresh water wetland in the centre of arable fields north of Kentira

3 March 2019

We met with Hassan Dalil, the local guide who was recommended in the book of Dave Gosney at 08h30 outside our hotel, and headed to the shores of lake Merja Zerga. It was a misty start to the day and it took until 11h00 for the mist to lift. We were searching for what we hoped would be the group of godwits accompanying the satellite tagged godwit with the last location sent yesterday at 12h15 on the northern shore and a smaller lake called Merja Kala. We were not successful in finding godwits but mainly saw redshanks, greenshanks and grey plovers. So we drove around to the mouth of the lake that connects to the Atlantic Ocean. It was still low tide and it was remarkable to see the large number of people on the mudflats and in the low water harvesting cockles and fishing for eel. Still no godwits.... The lake is large and there are few opportunities to get to the shoreline. We did see large flocks of small waders, presumably dunlin and a great number of gulls in the distance but light conditions were poor from the west side of the lake in the morning. Hassan thought our best chances to find the godwits would be to return to the north shore and walk the saltmarshes along a dry spit of land between the Merja Kala and the main lake. We eventually found waders, in the main lake of Merja Zerga far off and had to cross a 1m deep creek to reach it. Indeed, there were some waders to be seen; a large flock of 130 curlews, 35 grey plovers, even an osprey sitting on a pole in the lake - but no godwits. But our luck turned when a small flock came flying in and in this flock there was one single godwit. It might well have been our satellite bird, but it was too far off to see if it had rings and there were no options to get closer.

According to Hassan, Black-tailed Godwits still frequent Merja Zerga, sometimes in flocks up to 5000, but that is generally in winter between November and January. Nevertheless, numbers had definitely gone down in line with the decrease in the breeding population. Godwits were chased off the agricultural fields in the past (unclear damage to the crops). The main problem in the area now is hunting; it is apparently easy to get a license from the hunting association. Except ibises and herons, most species are shot for consumption, even flamingo's because there is lack of control and most local people rather look the other way instead of reporting it to the authorities. The same goes for illegal land reclamation on the borders of the lake. Due to the increased use of groundwater for irrigation and decrease in rainfall, many wetlands in the surroundings of the lake have dried out and are now being used for grazing or crops. This winter only in November there was a lot of rain, not sufficient for groundwater level to reach the surface. Agriculture exerts its influence on the Merja Zerga also in another way. In summer, previous to the harvest, the water is released from the

ricefields north of Kenitra and ends up in Merja Zerga through the Nador channel. According to Hassan, fish die when the water reaches the lake because it is polluted with many pesticides from the ricefields. Perhaps, anoxic conditions also play a role. To finish the day, Hassan treated us with fantastic views of marsh owls that are highly endangered in Morocco. We slept again at Moullay Bouselham.



We hoped to catch sight of the satellite godwit and its flock located in Merja Zerga



Exploring Merja Zerga, with local guide Hassan Dalil, we found only one godwit in the Merja Zerga, it could have been our satellite transmitter bird, but it was impossible to see due to the heat haze



A special treat!

4 March 2019

In the morning mainly overcast skies, but in the afternoon more sunny; 19 °C. On our final full day we started at Merja Barga, a small lake surrounded by agriculture just north of Merja Zerga. Half of the lake was fully covered with some duckweed species (*Lemna sp.*). There were ducks, coots, stilts, spoonbills and even a flamingo but no godwits. So we did not stay long but went straight to our main destination for today: the Larache marshes on the borders of the Oued Loukos river.

As soon as we left the N1, we followed the Loukos river and found a number of flooded meadows with the usual species. But the main attraction were the marshes a bit further down at the southside of the road. There were 100's of glossy ibises and stilts, some spoonbills, two spotted redshanks, 50 ruff and finally.... 7 black-tailed godwits! We could get close enough to check them for rings and one of them was born as a chick in our study area in southwest Friesland, The Netherlands. The birds were actively foraging in the shallow water with an intake rate averaging 24 items.min⁻¹ (n=5), very likely on Chironomids. They were in fine condition (average abdominal profile score of 3.7; n=7).

We continued the road that eventually brought us to the rice fields, the water in the river adjacent to the rice fields was fresh (0.7 mS). Rice is produced in Morocco only here and north of Kenitra. However, the fields were all dry and unploughed. Most of the irrigation channels were without water, so apparently the preparation for the sowing here is later than in Iberia where this is normally already in full swing in February. Like there, the massive use of glyphosate was also evident here; all of the road verges were the recognizable yellow colour after spraying.

To finish the day, we visited a satellite point location some kilometres west of Oulad Ouchih on the westbank of the Loukos. It turned out to be a field that had not been used last year but it was suitable for artificial flooding, interesting is that the points from the satellite bird exactly matched the extend of the flooded fields, there were no satellite locations in the bordering fields of maize and sugar cane. At this time it was dry and no godwits were there. We moved up north and slept in Asilah on the coast.



Merja Barga covered in duckweed (*Lemna* sp.)



Larache marshes on the borders of the Oued Loukos river



At long last we found a small group of 7 godwits, with one code flag!!



Dry unploughed rice fields near Oulad Ouchih on the banks of the Loukos river

5 March 2019

Our last day in Morocco, we navigated to the delta of the Oued Mharhar river, where a satellite transmitter bird had been located. We encountered a dry valley bottom which looked like it could be flooded in wet years, which would form shallow lakes and good habitat for godwits. As we turned to travel to Tangier airport, we stopped at a river crossing within the delta we stopped to test the water salinity. I was relatively fresh at 1 mS, the area in general was heavily grazed by many sheep, a few cows and donkeys.

We returned to Tangier to wash and fill the car with fuel. We checked in at the airport without any problems and took off to Amsterdam on schedule.



View from above the delta of the Oued Mharhar, heavily grazed by livestock