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RICE FARMING AND BLACK-TAILED GODWITS IN THE CASAMANCE SENEGAL

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Jan van der Kamp (A&W)
David Kleijn (Alterra)
Idrissa Ndiaye (Wetlands International)
Seydina Issa Sylla (Wetlands International)
Leo Zwarts (A&W)

Altenburg & Wymenga ECOLOGISCH ONDERZOEK BV
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ASSSINGNMENT
Ministerie van Landbouw, Natuur en Voedselkwaliteit
Postbus 20401, 2500 GK 's Gravenhage
Telefoon. 0317-474700

FRONT COVER
Godwits in the Casamance, Leo Zwarts

EXECUTED BY
Altenburg & Wymenga ecologisch onderzoek bv
P.O. Box 32, 9269 ZR Veenwouden
Telefoon +31 511 47 47 64, Fax + 31 511 47 27 40
e-mail: info@altwym.nl
web: www.altwym.nl
Alterra BV
Postbus 47, 6700 AA Wageningen
Telefoon. 0317-474700

in co-operation with

Wetlands International
West Africa Programme
PO Box 8060 Cite Djily Mbaye, Yoff Dakar
Telephone : 00 221 33 8206478
Email: post@wetlands.org

INHOUD

Rice fields in the estuarine habitat of the Casamance

SUMMARY

Black-tailed Godwits arrive early July in West Africa. Most birds are concentrated in the coastal rice fields in southern Senegal (Casamance) and Guinea-Bissau. Since they consume sown rice, rice farmers consider the birds as a pest. Farmers attempt to prevent this damage by growing rice in seedbeds near their village or in the forest and replant the rice later in the season and, if the seedbeds are in the rice fields, by chasing the birds away and shooting. Our preliminary estimate is that in the rice areas in the Casamance visited by us in September 2007 (9000 Godwits present on 66 km^2) about 5% is annually shot in July-August. Most farmers were convinced that the number of Godwits present on their rice field in July-August has increased in recent years, - an unexpected result given the steady decrease of the total population with 4% per year. The explanation is that the birds leave their breeding areas a month earlier than 20 years ago; as a consequence Godwits do now more damage in the African rice fields than in the past.

Men use the 'kadiandou' and women the 'ebaraye' to clear the rice fields before planting.

1. INTRODUCTION

The decline of the Dutch breeding population of the Black-tailed Godwit (Teunissen & Soldaat 2006, Teunissen 2007) has so far been largely attributed to developments in breeding areas in the Netherlands (amongst others: Schekkerman *et al.* submitted). Driving factor behind this decline is the low reproduction (Wymenga 1997, Schekkerman & Müskens 2001, Teunissen *et al.* 2006). The quantity and quality of staging sites along the migration routes and in their wintering areas have changed significantly but were nevertheless deemed adequate for Godwits to maintain good body condition (Kuijper *et al.* 2006). This is in agreement with recent estimates of adult survival which are similar or even higher than those reported in the past (80-97%, Both *et al.* 2006, Roodbergen *et al.*, in prep., Zwarts *et al.* 2008). Black-tailed Godwits breeding in Western Europe spend the winter in West Africa south of the Sahara. Most Godwits are concentrated in the coastal rice fields between Gambia and Guinea (Altenburg & van der Kamp 1985, Kuijper *et al.* 2006) where they feed chiefly on rice grains for an important part of the season. The birds arrive here in early July (van der Kamp *et al.* 2006) and depart again in the course of January (van der Kamp *et al.* 2006, Kuijper *et al.* 2006). Kuijper *et al.* (2006) recommended a further study of arriving Godwits in West Africa and the potential conflict with rice farmers.

In the past, the FAO used posters and information sheets on which the Black-tailed Godwit was indicated as a pest species in rice paddies. Earlier studies showed that Godwits feed on rice grains during harvesting time (December-January). However, in this period birds feed only on spilled rice (Ruelle & Bruggers 1979, Altenburg & van der Kamp 1985, Tréca 1984, Tréca 1990, Tréca 1994) which is not harmful to agricultural production in any way. Tréca (1984) pointed out that Godwits may interfere with the sowing and replanting of rice in August-September and, in this period, are considered a pest species by the rice farmers. This was reconfirmed by van der Kamp *et al.* (2006). They estimated that, for this reason, in August and September about 70 birds per day might be intentionally shot by the farmers in the Casamance (southern Senegal). This would imply that possibly some 2000 birds are annually shot in this region alone. This number could be even higher if Black-tailed Godwits were killed in other rice-growing areas along the West African coast for similar reasons. The shooting of birds in the wintering area could be an additional cause for the decline in the Black-tailed Godwit in Western Europe. On the other hand, it is difficult to match these observations to the high adult survival recently estimated for some Dutch Godwit populations (Both *et al.* 2006, Roodbergen *et al.*, in prep., Zwarts *et al.* 2008). Clearly more information is needed about the potential conflict between rice farming and habitat use of Black-tailed Godwits and the possible persecution of these birds in West Africa.

This report presents the results of a survey done in the second half of September 2007 in the Casamance (Senegal, West Africa). The aim of the study was to examine the conflict between rice farmers and Godwits in more detail, with special emphasis on the problems caused by the Godwits as they experienced by the farmers. Also, this study may provide insight in the way potential conflicts can be solved in a community-based approach.

Rice parcel cleaned from weed with bare ridges on which the rice will be planted.

Seedbed in a forest to prevent sown rice from being eaten by Godwits.

2. METHODS

2.1. RICE FARMING IN THE CASAMANCE

Like elsewhere in Gambia, Guinea-Bissau and Guinea, it is not easy to grow rice in the Casamance. The raining season is short in Southern Senegal and the annual rainfall variable. Moreover the soils may turn saline if the fresh water supply is insufficient to wash away the salts (entering from the estuary or by capillary rising from deeper soil layers). When drained, soils may also turn acid due to the presence of dissolved iron and aluminium which can make farming impossible. Given these main limitations (well described by Bos *et al.* 2006), it is impressive that local farmers are able to grow rice at all. However, the annual production amounts to only 1-2 ton per ha.[i] To keep salt water out of the agricultural areas many, usually small, dams have been built in the main rivers and streams (Fig. 1), but this has not always led to a higher rice production and, locally, even to a decline due to acidification as a consequence of the change in the hydrology.

Despite the construction of these so-called *anti-sel barrages*, many rice fields in the Casamance have been abandoned the last decades. This was due to salinisation and acidification but most importantly due to lack of manpower. As everywhere in Africa, people are moving out of the countryside into cities. In the Casamance, the urbanization has been further reinforced due to the political instability in the region since 1982. Since the traditional subsistence rice-growing systems are time-consuming, a reduction in rice farmers results in a reduction in the rice-growing area. The market in Senegal is increasingly dominated by imported rice (source: annual food balance sheets of FAOSTAT, produced by the FAO).

In 1960-61 the total surface of rice fields in the Casamance was estimated to be 555 km^2 (*Direction Général de la Production Agricole*, D.G.P.A./D.S.A, 1960-61) with the largest areas of rice paddies located near Bignona, Oussouye and Sédhiou (Table 1). In the whole of Senegal the area grown with rice increased from 750 km^2 in 1990-1995 to 860 km^2 in 2000-2005, mainly because of expansion of the irrigated rice culture in the Senegal Delta (FAOSTAT data, 2007). FAO statistics (2002) indicate that approximately half of Senegalese rice growing area is found in southern Senegal. This would amount to 350-400 km^2, which is substantially less than the estimated 555 km^2 in 1960 suggesting that a considerable decline in the Casamance has indeed occurred. However, the recent FAO-surface refers to harvested area and it is not clear whether the 1960 estimate refers to total rice growing area or harvested rice growing area.

Table 1 *Surface of the rice paddies in 7 departments within the Casamance in 1960-61 (source: D.G.P.A./D.S.A. 1960-1) and the total surface of the departments.*

Département	Rice, km^2	Total, km^2
Bignona	214	5295
Oussouye	107	891
Ziguinchor	46	1153
Sédhiou	120	7293
Kolda	57	8284
Sélingara	11	5434
TOTAL	555	28350

Seedbeds and rice fields

Rice fields are covered by rice between August and January, but natural succession results in the development of a dense vegetation of grasses and rushes between the cropping seasons. Prior to planting, women clear the vegetation from the fields with a grub hook that looks like a light pickaxe (locally known as 'ebaraye'). Men use a large spade (locally known as 'kadiandou'). Long vegetation is cut and laid down on the small dams surrounding the parcels. Also a part of the sod is brought to the dams, but mostly turned around on the spot. The ditches are deepened and the mud is laid down on the ridges. As a result the ground is fully bare before the rice is planted. Subsequently ditches may need to be deepened and ridges need to be (re)constructed. Rice farmers in the Casamance use small seedbeds of 10-30 m^2 ("pépinière") to germinate the rice seed. This has evident advantages compared to sowing directly in the field, but it takes more time. By sowing rice at high density in seedbeds, plant growth is retarded so that seedlings remain available for planting over a longer period of time giving farmers some flexibility with regard to field preparation or the onset of the raining season. In 2007, the raining season started late, so that less rice than usual had been planted in August. During our visit in the second half of September, throughout the area farmers were still preparing the rice fields and planting rice. At this time, approximately half of the rice plants from the seedbeds had been transplanted in the fields. The planting season lasts till the end of the raining season, usually mid October, so the farmers still had some weeks left.

When the rice plants are 30-60 cm long they are transplanted into the rice fields. The plants are carefully extracted from the seedbed and bundled. Only a small proportion of the seedbeds are found in the rice fields. Most are situated near the villages, often among trees. Since the rice fields may be located at a distance up to 2-3 km from the villages, the women walk this distance to the fields with many bundles of seedlings on their head. The main reason to have seedbeds so far away is to prevent that the seeds are eaten (see below). To prevent desiccation, the leaves of tall plants are topped and, after transport and prior to transplanting, plants are covered against the sun or put in shallow water. Even so, plants are usually transplanted within hours after arrival in the fields.

The plants in the seedbeds grow with one or more plants per square cm, but in the fields the plants are spaced at a distance of 10-13 cm. Usually, rice is planted on 35-40 cm wide ridges, with 3, sometimes 4, plants next to each other. The small ditches between the ridges are usually also 35-45 cm wide. However, in 30-50 cm deep water no ridges are made and the rice is planted in a regular grid over the entire parcel. The fields (5-30 m wide and 10-40 m long) are surrounded by low, 30-50 cm wide dams. The estimated overall planting density should therefore be in the range of 20-40 plants/m^2.

Planting is time-consuming. The average planting rate appeared to vary between 7 and 38 plants/min (average 27.4/min; n=10). Planting rice above the water table takes 50% more time, since the soil is firm and a stick has to be used to make holes directly before the planting. Planting a single ha may altogether take about 200 hrs, an estimation based on all information given above. Planting is only a fraction of total amount of work to be done by the women each year to obtain a harvest of 1-2 ton/ha. De Jonge *et al.* (1978) arrive at 500-700 h/year/ha. Obviously, rice farmers have to work hard for their living.

On 29 September, we saw a fast, but probably less productive way to plant a rice field. Rice was pulled from a seedbed by 30 men. The rice plants, which had formed already an extensive root system, were torn into clods of 3-7 rice plants. These clods were thrown nearby the seedbed into 30 cm deep water, taking care that each clod was about 20-30 cm

apart from each other. The women possibly decided to rent the men to do this (and pay them 150 CFA/day or 0.23€) since they were running out of time. Herbicides, pesticides or mineral fertilizers are not, or hardly, used in the seedbeds nor in the rice fields.

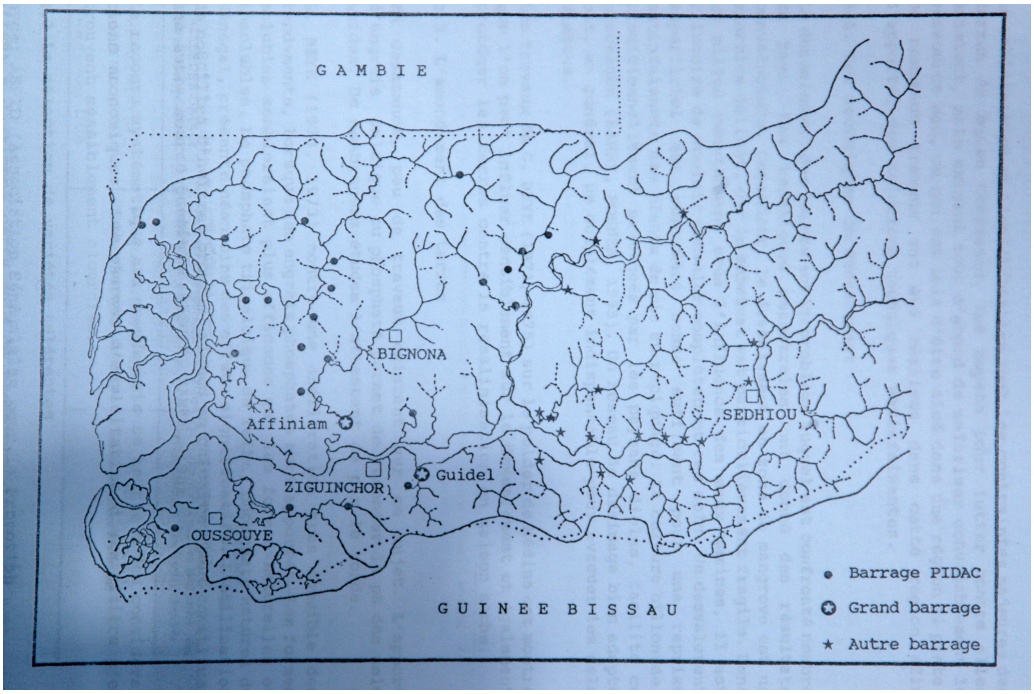

Fig. 1*. The anti-salt dams built in the different branches of the Casamance River before 1990. Source: Montoroi (1990).*

2.2. SURVEYING BLACK-TAILED GODWITS IN RICE FIELDS

Between 18 September and 3 October 2007, we visited 36 rice-growing areas in the Casamance (Fig. 2, 3) measuring in total 66 km^2. We continuously marked our position with a GPS. Additionally, we used 200 recent, detailed colour maps covering all rice fields in the Casamance (scale: 1/22 000; source Google Earth). The rice fields were clearly visible on these high resolution true colour images, due to the presence of the many small dikes and ditches. Apart from the rice-growing areas visited by us, we observed several dozens of small rice fields from the road. These were examined from the car but no Godwits were observed. Altogether, we may have seen about 20% of the entire rice-growing area of the Casamance.
We classified rice fields in two separate ways. First, fields were classified according to their state of agricultural preparation:
1) fields being not, or not yet, in cultivation,
2) fields cleaned from weed and ready to be planted and
3) fields that had already been planted.

The category "fields not (yet) cultivated" combines fields being abandoned in the last few years (the still existing structures of ditches and dams betraying that there had been paddies before) as well as fields that were in agricultural use but that had not yet been cleared of weeds. Between both extremes, there were paddies where the farmer had decided not to cultivate them this year because the environmental conditions were unsuitable. Moreover, farmers told us that they intentionally let lie fallow a part of their land.

Second, we classified fields according to the type of landscape:

1) "mangrove rice" (usually adjacent to mangrove or tanne (tanne = bare or sparsely vegetated, hyper-saline, open areas within or near the mangrove zone),
2) "rain-fed rice fields" (estuarine impact less pronounced, usually bordering the higher-situated woodland),
3) "Upper valley rice", as 2, but surrounded by forests (usually small valleys; enclosed landscape).

In all surveyed areas we estimated the relative area occupied by the three types of rice fields in each of the two classes.

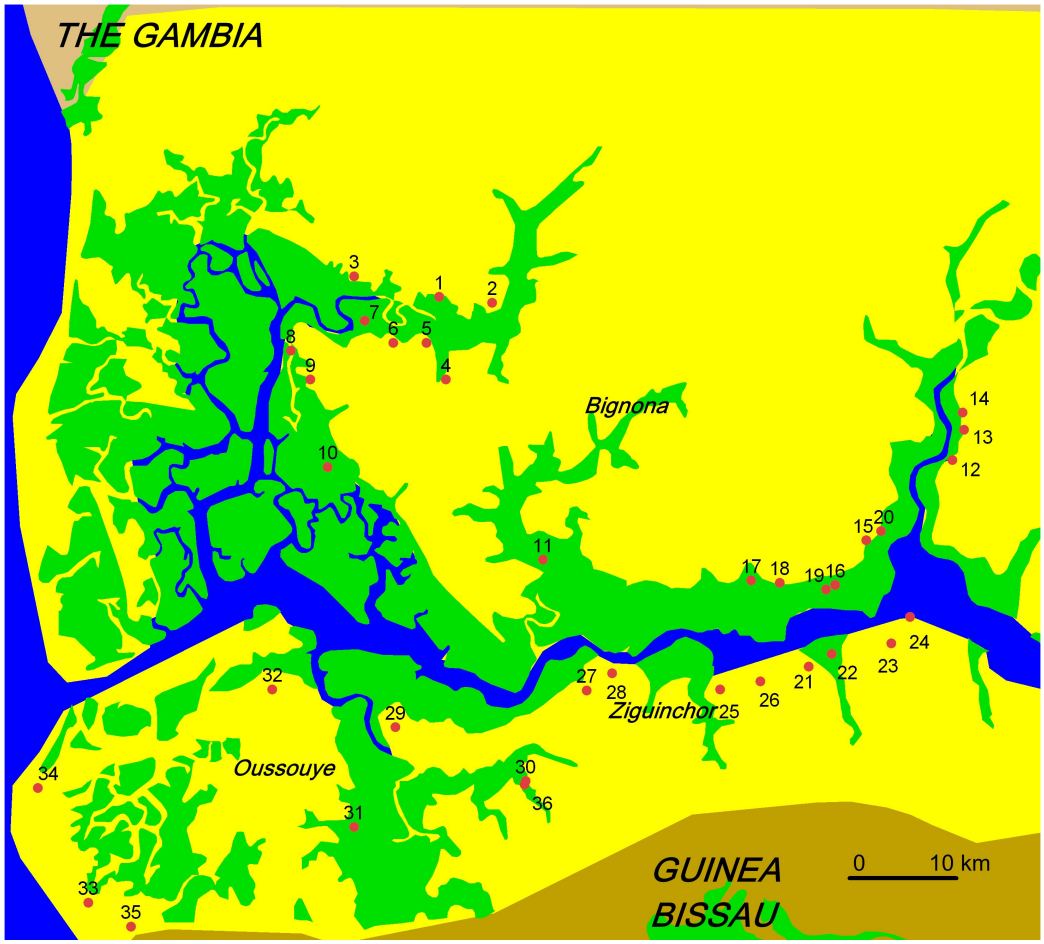

***Fig. 2**. The 36 rice fields visited in the Casamance in September 2006 and/or 2007. The mangrove and rice zone is indicated in green.*

In each site, the number of observed Godwits was counted, split up in feeding and non-feeding birds. The geographical position of each group of Godwits and the type of rice field in which they were present was noted. If the birds could be observed from a short distance the type of prey taken by them was occasionally noted.

2.3. INTERVIEWING FARMERS

In total 104 farmers were selected at random and interviewed about crop damage and how to prevent it. They were asked whether they know Godwits and, if so, whether the birds cause damage and, if so, what kind of damage. We made the choice to have open interviews, but took care that all main questions we had in mind were answered by all interviewees.

The interviewed farmers gave us detailed information on the shooting of Godwits. Twenty-one percent said they had shot Godwits or had asked a hunter to come and shoot the birds. The initiative to shoot Godwits is generally taken by the women, after they ascertain damage on their seedbeds. They pay the hunter 300 CFA (0.46€) per lead shot. The birds shot are for the hunter.

This information did, however, not enable us to estimate how many birds are shot annually. Therefore we spent two additional days to interview hunters and hunting farmers, and ask them how many Godwits they had shot during the last three years. Because of political troubles, the government had forbidden the people in the Casamance to possess firearms since 1991. To avoid people taking us mistakenly for government officials, we decided to look for hunters in an area we had already visited twice: the rice-growing areas between Fintiok and Ouonk (Fig. 4). In these areas the people knew us to be scientists interested in crop damage and Godwits. We assumed this would make the exchange of information easier.

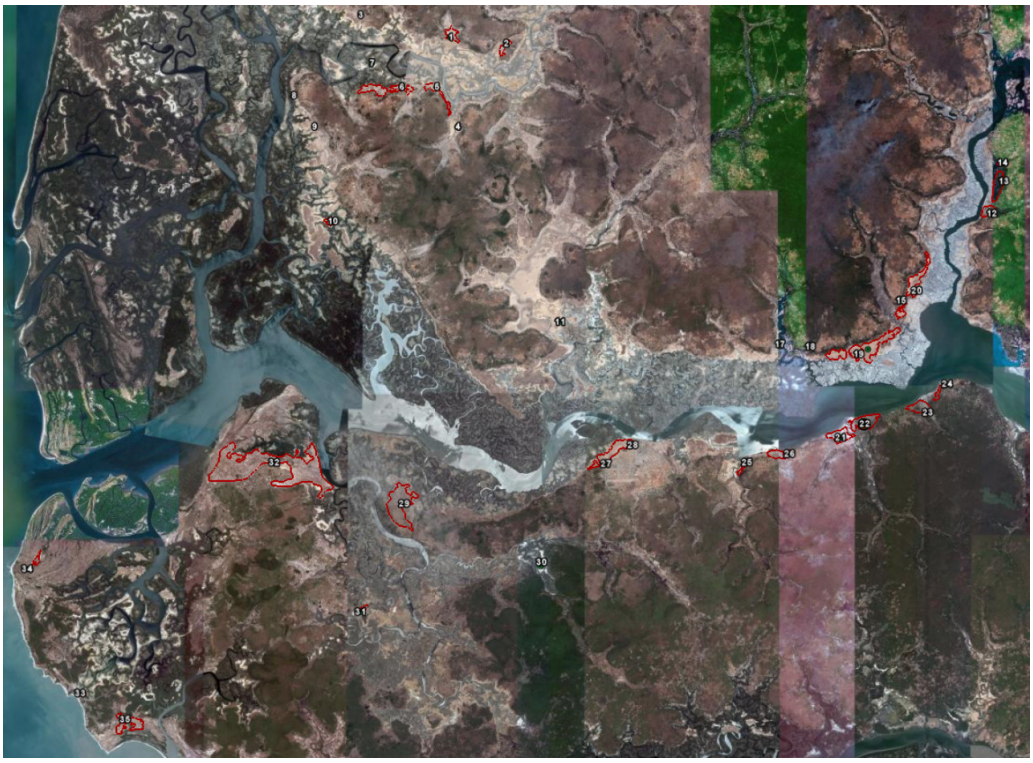

Fig. 3 *The rice fields (borders indicated in red) visited in the Casamance in September 2007. Map taken from Google Earth.*

Fig. 4. *The four villages where hunting people have been interviewed. The rice fields are indicated (red outer line); Inset figure gives the position of the area in the NE part of the Lower Casamance. Map taken from Google Earth.*

3. RESULTS

3.1. GENERAL OBSERVATIONS

Godwits on seedbeds

According to the local people, Godwits are able to find newly sown rice seed within a day. In Djibabouya (area 13 in table 4, visited on 20/9), we found two seedbeds in the middle of a large rice-growing area where people had attempted to prevent bird predation. They had placed cassette tape over the fields stretched between sticks put on the field edges. This kind of protection which, according to local people was applied widely in this region, was not seen by us elsewhere in the Casamance, however.

Farmers in the Casamance have learned to prevent rice consumption by Godwits by locating seedbeds at places where Godwits do not dare to come. For instance, one of the women interviewed by us had her seedbeds destroyed by Godwits three times in a row. After the third time she decided to relocate the seedbeds from the rice fields to her village. Nearly all observed seedbeds were situated at the edge of or even in villages and sometimes in the forest. Only a small minority of the seedbeds were found in the rice growing areas. This generally prevents Godwits from consuming rice grains sown into the seedbeds. In Guinea-Bissau the seedbeds are similarly located at the village's edge in order to (as the farmers said explicitly) prevent Godwit exploitation (van der Kamp *et al.* 2006). Although this in generally true, especially in smaller rice paddies, a part of the rice in the larger rice complexes grows up in seedbeds in the middle of these paddies. It struck us that, if isolated trees were present, seedbeds were usually found very nearby, probably to lower the risk of Godwit predation. As people told us, Godwits are intentionally shot on these seedbeds directly after the rice has been sown (see 2.3).

Godwits on areas before and after rice is planted

Local people mention Godwits interfering with the replanting of the rice in two ways. First, birds often feed on the ridges in the fields before the rice is planted and by doing so, compress the soft soil. This may seem rather far-stretched, but Godwits feed in dense flocks (3-4 birds/m^2) and may stay hours at the same place. The soil surface is thoroughly trampled (as we could observe ourselves from footprints completely covering the area where the birds had foraged). Considering the laborious nature of rice planting it is easy to understand that rice plants can be planted faster in a soft clay soil than in a more firm soil.

Second, Godwits walk between the freshly planted seedlings and may trample plants. We carefully inspected freshly planted rice fields both where Godwits had been present and where they had been absent. In both cases we observed a small part of the plants being out of position (oblique or even laying flat on the surface). In other words, a small proportion of seedlings is displaced regardless of whether Godwits have visited or not.

Interestingly, all flocks of Godwits were observed in the direct vicinity of people working on the land. Nevertheless, we never saw people attempting to chase birds away. Furthermore, during or after the transplanting of the rice Godwits are not longer shot according to the local people.

Women walk up to 3 km to transport the young rice plants from seedbed to rice field.

Rice field with just planted rice surrounded by small ridges.

3.2. THE DISTRIBUTION OF GODWITS IN DIFFERENT TYPES OF RICE FIELDS

The proportion of not (yet) cultivated fields varied a lot between areas. Some fields were completely abandoned, while others appeared to be (almost) completely cultivated. Part of this was due to differences in the timing of the agricultural activities. For instance, 95% of the large rice-growing area west of Seleky (600 ha; area 29 in table 4), was not (yet) cultivated during our visit on 26-9 but according to the women this was caused by the men having prepared only such a small proportion. In contrast, near the wide zone along the northern side of the Casamance river near Koubanao (where the women not only planted the rice but also prepared the fields) already 70% of the area (1500 ha) was in cultivation during our visit on 19 September and 90% on 29 September (area 16-20 in Table 4; see also Fig. 4). On average, half of the rice fields in the visited areas were estimated to be not yet cultivated in the second half of September, of which the greater majority seemed to be actually abandoned. In the same period 40% of the cultivated area was still bare and 60% already planted by mid September. A fortnight later, no more than 20% was bare and 80% planted.

All flocks of resting Godwits were observed in fields with bare soil, usually in open water. Altogether we spotted 41 flocks in the rice fields containing a total of 4644 individuals. Moreover 4 flocks were observed outside the rice fields, in a "tanne". The birds in the tanne were all inactive. Only 29% of the birds observed in the rice fields were actively feeding. However, nearly all observations were restricted to the period 9.00 – 17.00 h, and most between 10.00 – 16.00 h which coincides with the midday resting period of the Godwits. People in the field confirmed earlier observations on Godwits in the Senegal Delta (Tréca 1984) and Bissau (Zwarts, unpubl. data), that birds of this species are mainly active in the first and last hours of the day. Unfortunately, this was the time we used to drive to and from the observation areas.

Foraging Godwits have a strong preference for bare fields (Table 2). More Godwits were present in bare fields than would be expected based on the availability of this field type (Chi-square test, X^2 = 321, 1 df, P<0.001). Not (yet) cultivated fields and, to a lesser extent, planted rice fields were used less than proportional for foraging (resp. X^2 = 100, 1 df, P<0.001, X^2 = 8.61, 1 df, P<0.005). A possible reason for the attractiveness of bare fields may be that the recent disturbance of the soil on these fields provides the birds with easily accessible prey items.

Occasional observations by telescope revealed that prey items were small and transported to the gape within a second in 2-3 fast swallowing movements. The prey items were too small to be identified with certainty, but may have been midge larvae with a length of several mm. We did not measure the feeding rate but estimated it to vary between 20-35 per minute. This would be a rate comparable to measured feeding rates of Godwits on midge larvae in the Senegal Delta (December 1982; Zwarts unpubl.) and Oostvaardersplassen (The Netherlands, July-August 1991-94) (Blomert *et al.*, unpubl. data). In a few cases we saw a bird swallowing a larger round item with a diameter of some 3-5 mm. Subsequent inspection of the location used by the foraging birds produced seeds of that size and structure. It might also have been snails, although we only found specimen larger than 2 cm. However, no seeds or snails were detected in an analysis of the seven Godwit droppings collected from the same spots. Hence we conclude that the Godwits preyed most likely on small midge larvae.

***Table 2**. The occurrence of feeding Godwits in not (yet) cultivated, bare and planted rice fields compared to the estimated surface of this type of rice habitat. In total, 1221 feeding Godwits were observed (=100%). Data refer to the visited rice fields (Figs. 1 & 2) in the second half of September 2007.*

	Estimated surface area (%)	Feeding Godwits (%)
Not (yet) cultivated	50	0
Bare (ready for planting)	15	79
Planted	35	21

We visited 49 rice-growing areas characterized as mangrove rice, 10 rain-fed rice-growing areas and 10 upper valley rice-growing areas. The visited areas with mangrove rice were relatively large. We estimate that 80% of the visited area belonged to the mangrove rice. Nearly all Godwits (97%) were observed in mangrove rice (Table 3). Even though mangrove rice occupied by far the largest area, Godwits were still disproportionally abundant in this type of habitat (X^2 = 18.0, 1 df, P<0.001). Rain-fed and upper valley rice were used less than could be expected from the surface area of both habitats (X^2 = 11.3, 1 df, P<0.001;X^2 = 5.3, 1 df, P<0.025). The percentages were exactly the same when considering foraging birds only. Not surprisingly no Godwits were observed in the upper valleys where *Acacia albida* and other trees are scattered in between the rice fields and the landscape is too closed to expect a bird of the open landscape as the Godwit.

***Table 3**. The occurrence of Godwits in mangrove rice, rain-fed rice and upper valley rice (100%=4181 birds), compared to the estimated total surface of the areas visited by us.*

	Estimated surface area (%)	Counted Godwits (%)
Mangrove rice	80	97
Rain-fed rice	15	3
Upper valley rice	5	0

3.3. DISTRIBUTION OF THE GODWITS IN THE CASAMANCE

We counted in total 6568 Godwits (Table 4).Because we covered only about 20% of cultivated rice fields (66 / 350 km2) the total population present in the Casamance in this period might be five times as high. The main concentrations were observed between Bassir and Kartiak in the NW, between Baabat and Ouonk in the NE and in two regions in the SW: directly west of Ziguinchor and the region north of Oussouye near Niambalang.
A comparison between the counts done in September 2006 (Van der Kamp *et al.* 2006) and September 2007 (Table 4) shows that the larger bird concentrations were found in the same areas. No Godwits have been observed in 2006 nor 2007 in 8 of the 18 areas visited in these two years. Godwits had been seen in 10 areas in 2006 and in 7 of these areas they were observed again in 2007. In 2 of the remaining 3 areas where no Godwits have been seen in 2007, farmers told us that the birds had been feeding in the rice fields in the early morning, but had left for a near-by tanne prior to our visit.

The numbers counted in 2007 were lower than in 2006. Altogether we may have missed some 500-1000 birds in 2007, because birds were on day-time roosts, being counted in 2006 but not in 2007 (e.g. in Baabat, area 15 in Table 4). However, even after correcting for this the numbers in 2007 were about twice as low as in 2006. The most likely explanation for this is that numbers of Godwits in the rice fields decline in the course of the planting season. In 2006 the counts were done between 2 and 13 September, but in 2007 between 19 September and 3 October.

Three types of rice fields were distinguished: mangrove rice, rain-fed rice (both on page 13) and above upper valley (above).

***Table 4**. The presence of Black-tailed Godwits in rice fields surveyed in September 2006 (van der Kamp et al. 2006: table 4) and September-October 2007. Surveyed areas are lumped into four zones according to bearings taken from Ziguinchor. 'Total same areas' refers to the total number of Godwits observed in areas visited in 2006 as well as in 2007. Only a part of area 31 could be covered during the first visit; the second count refers to a much larger area.*

		2006		2007		Coordinates	
	Region	**date**	**count**	**date**	**Count**	**W**	**N**
	NW						
1	Badiana	2-9	0	21-9	0	-16.429	12.912
2	Belaye	2-9	33	21-9	53	-16.383	12.907
3	Ebinkine	4-9	12			-16.503	12.930
4	Kagnobon	5-9	6			-16.423	12.840
5	Bassir	5-9	1504	21-9	54	-16.440	12.872
6	Dianki	6-9	1270	21-9	1392	-16.469	12.872
7	Kartiak	7-9	298	22-9	142	-16.486	12.989
8	Tiobon	7-9	6			-16.558	12.865
9	Thionk-Essyl	8-9	101			-16.541	12.840
10	Diegoune	9-9	23	28-9	0	-16.526	12.764
11	Affiniam	9-9	0	28-9	0	-16.339	12.683
	NE						
12	Diafar	10-9	0	20-9	0	-15.983	12.770
13	Djibabouya	10-9	0	20-9	0	-15.973	12.796
14	Manguire	10-9	0	20-9	0	-15.974	12.811
15	Baabat	11-9	665	29-9	0	-16.058	12.700
16	Koubanao	11-9	2841	19-9	747	-16.085	12.661
17	Pont de Koubalan	12-9	0	19-9	0	-16.158	12.665
18	*no name*	12-9	0	19-9	0	-16.133	12.663
19	Fintiok	12-9	1160	29-9	619	-16.093	12.657
20	Ouonk			29-9	102	-16.045	12.708
	SE						
21	Agnak	13-9	862	24-9	126	-16.108	12.590
22	Sindone	13-9	187	24-9	0	-16.088	12.601
23	Banghagha	13-9	0	24-9	0	-16.036	12.610
24	Adeane			24-9	0	-16.020	12.633
25	Niagiss			24-9	100	-16.185	12.570
26	Gourafe-Djibok			24-9	60	-16.150	12.577
	SW						
27	Ziguinchor-West			18-9	1334	-16.301	12.569
28	Ziguinchor-Boudodi			25-9	60	-16.279	12.584
29	Seleky			26-9	124	-16.467	12.537
30	Dar Salam			27-9	37	-16.354	12.490
31a	Niambalang			27-9	414	-16.461	12.448
31b	Niambalang			3-10	1442	-16.503	12.450
32	Mlomp			27-9	1	-16.574	12.570
33	Cap Skiring			2-10	52	-16.734	12.384
34	Diembering			2-10	6	-16.778	12.484
35	Kabrousse			2-10	4	-16.697	12.363
36	Etome			3-10	113	-16.355	12.487
	total same areas		8843		3133		
	total		8968		6568		

104 rice farmers were interviewed.

3.4. THE CROP DAMAGE ACCORDING TO THE FARMERS

General

The 104 interviewees came from across the entire Lower Casamance. Their origins may be split up in four quadrants, relative to Ziguinchor: north of the Casamance River in NE (n=41) and in NW (n=17), and south of the Casamance River in SE (n=14) and in SW (n=32). The age of the interviewees varied between 17 and 65 year. Most were females (62%). Our first question was to mention all species doing damage in the rice fields.

According to the farmers, crop damage is done by a wide variety of actors during the entire crop cycle. The interviewees mentioned altogether 20 animal species (groups). It is of interest to note that nobody mentions destruction of newly transplanted rice seedlings by crabs. This was mentioned as a severe problem in the mangrove swamp rice fields of West Africa where nine crab species occur (Agyen-sampong 1988, Guei *et al.* 1997). Apparently, this is a problem restricted to the southern part of the coastal rice zone.

According to the interviewed farmers, each species (group) has its own specific period during which damage is caused. Weavers and the like (Ploceus, Quelea spec.), for instance, potentially cause huge damage by the end of the growth period (November-December) when the rice becomes harvestable. There is an almost unanimous notion that these birds are the actors to be most concerned about as they operate in flocks comprising hundreds or even thousands of birds. Black-tailed Godwits, together with mice, complete the top three of most frequently mentioned species causing damage (Fig. 5). Seventeen other actors are

mentioned by the interviewees, all affecting rice (and other) crops in various growth stages, but often on a more local scale and less frequently.

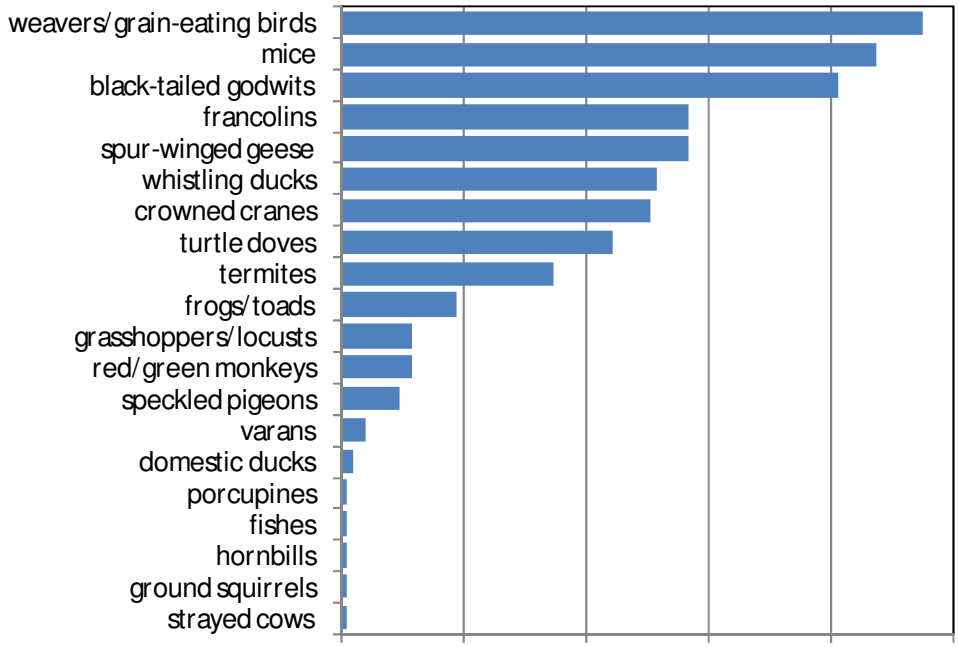

Fig. 5. *The frequency (%) with which species causing damage in the rice fields are mentioned by 104 farmers. Farmers were asked to mention all damage species they know.*

Black-tailed Godwit phenology according to farmers

In total, 92 of the 104 people knew the Black-tailed Godwit and could give us the local name of the species. All interviewees from the NE, NW and SE knew the species well, but 12 of the 32 farmers in the SW did not know the species. Eighty-seven people could tell us when Godwits arrive in their rice fields: one farmer said June/July, four farmers were more specific and indicated late June/early July or early July as arrival date. Thirty-nine farmers mentioned July as arrival date, 40 July-August and three August. A part of this variation is due to the question being not specific enough. Some people may have indicated the arrival date of the first birds, while others mentioned the arrival date of the majority of the birds. From the discussion it was clear, however, that the people agreed that the Godwits start to arrive around the first of July and that some weeks later most birds have arrived.

In total 72 farmers knew when the Godwits leave their rice fields. According to most people they leave in October (n=16) or November (n=25), or during the course of both months (n=9). In total, 19 farmers said they stay longer, until December-January (n=6) or until January (n=13). Also this question was possibly not unequivocal, since saying that the birds left in October or November does not exclude the possibility that the birds returned in December/January after the harvest. Probably most birds leave the rice fields after the planting season and (some?) return locally after the harvest. Some people indicated that the Godwits do not leave the area after the planting season and can still be found in the surroundings, e.g. on the tannes.

Godwits feeding close to a woman planting rice.

Damage done by Black-tailed Godwits according to farmers

We had four questions about the damage done by Godwit: What kind of damage? In which period? How to prevent this? Is the crop damage by Godwits less, equal, more than in the past? Only two people said that the Godwits do no damage. Most people said that the birds do damage in more than one way. Most people (85%) mentioned the damage caused by Godwits eating rice seed, 58% mentioned the trampling of newly planted rice and 57% mentioned Godwit-related soil compacting just before planting. Not a single farmer said that Godwits do harm during the harvest and only one farmer said that Godwits eat the ripening rice grain from the plants. Not surprisingly, Godwits were therefore said to do damage in the early season: July (21%), July-August (46%), August (1%), July-September (26%). Only 6% of the farmers mention damage being done over a longer period: July-November (1%) or July-December (5%).

Godwits operate in flocks, which are mainly seen at the start of the rice cycle (July-September) when rice land is being prepared and seedbeds are made. In the first few days after sowing farmers look after their seedbeds from early morning until dawn to prevent Godwits from removing the sown grains from the beds. The question how to prevent crop damage elicited many stories. The type of prevention depends on the situation. To keep birds away from the seedbeds, farmers use a scarecrow (79%), sticks (40%) or cassette tape (9%). They also actively chase the birds away by shouting (49%), gesturing (15%), throwing mud (27%) or shooting (21%). Among the less common or even exceptional prevention-related initiatives we noted prayers and the use of poison. This highlights that people do all they can to keep the birds off their land.

Given the decline of the Godwit population, we expected most people to say that they noticed more Godwits in their fields in the past. 20% of the farmers had no opinion about that. According to 53% there were now more Godwits than in the past, 25% said there were less and 3% that the numbers had not changed.

3.5. SHOOTING OF GODWITS

The 19 interviewed hunters indicated that most birds were shot in July, early in the planting season (Table 5). Furthermore, the number of shot birds decreased over these three years. According to the farmers, the estimated total number of shot birds in the period 2005-2007 amounts to 645. We have no reason to believe that people give too low estimates, but since we were not able to speak with all hunting people, we estimate that the actual number of birds shot in this region during these three years must have been 700-800 Godwits. The lower number of shot birds in 2007 may have been the result of the recent difficulties for the local hunters to purchase lead shot, since this has to be imported illegally from The Gambia.
The rice-growing areas indicated on the Google Earth map (Fig. 4) measure about 1500 ha. Mid September 2006, some 4000 Godwits were counted here (counting area 16-19 ; area 20 not counted ; Table 4). Late September 2007 we saw only 1350 birds in area 16-19 and another 100 birds in Ouonk (area 20). Local people told us on 19 September that larger numbers than observed by us had been present in the early morning and that the Godwits had been decreasing during the weeks preceding our visit. Hence we assume that some 4000-5000 birds use the area indicated in Fig. 4 as their foraging site in July-September. The last three years an estimated number of 700-800 Godwits have been shot in July-August, which means that per year about 5% (250 / 4500) of the present population is shot.

Table 5*. Number of Godwits shot by 19 hunters in Fintiok, Koubanao, Hatioun and Ouonk (see Fig. 4) in 2005, 2006 and 2007, split up for two months.*

	July	Aug	Total
2005	300	0	300
2006	180	65	245
2007	80	20	100
Total	560	85	645

3.6. EURING ANALYSIS

This section is based on a recently performed analysis of the recoveries of the Black-tailed Godwits in Africa (Zwarts *et al.* 2008). The data were re-analysed to check whether the shooting data obtained in the field were corroborated by the ringing data. Altogether 2168 ringed Godwits were recovered, 213 of them from West Africa south of the Sahara. Of these birds, 91% was reported as shot. Fig. 6 shows that most birds were shot in the Senegal Delta (n=46) and the coastal rice fields (n=131). The same information is given on an enlarged map of the Casamance (Fig. 7), which includes 10 rings being reported to us during our field mission.

***Fig. 6**. The recoveries of Godwits shot or found in the Senegal Delta (n=46) and in and near the costal rice fields (n=131; Saloum, Gambia, Casamance, Guinea-Bissau and Guinea). Source: EURING.*

During the course of the years, the number of recoveries in the Senegal Delta has declined (Fig. 8). It is unlikely that this is due to a decline in hunting pressure, since the number of Ruff and Garganey shot in the Senegal Delta did not show the same large decline (Zwarts *et al.* 2008). Moreover, bird counts since 1972 show a large decline of the number of Godwits too. This decline was probably caused by extensive damming and creation of embankments in the lower Senegal which significantly reduced the area of floodplains (Zwarts *et al.* 2008).

Remarkable is the lack of overlap in the distribution of the EURING recoveries in 1965 - 1995 and the recent recoveries in the Casamance (Fig. 7). Recoveries tell us something about the distribution of the birds, but also about the distribution of the hunters. The shot bird has, however, also to be reported. For rural people in Africa it is out of question, that they will ever do effort, and spend money, to send a letter to Europe to report a ring. In practice, an intermediate person (a teacher, a missionary, a development-aid worker, a research worker) has to be present to report the ring to the ringing station in Europe. The ten people who told us about the ring on a shot bird, did not show any interest in the ring. Everybody had thrown away the ring immediately. Only one woman could tell us that the word "HOLLAND" could be read on the ring. This lack of interest was also for us a surprise because, for instance, the people in the Inner Niger Delta (Mali) kept their ring on a rope around their neck or in a pot at home and were keen to know more about it.

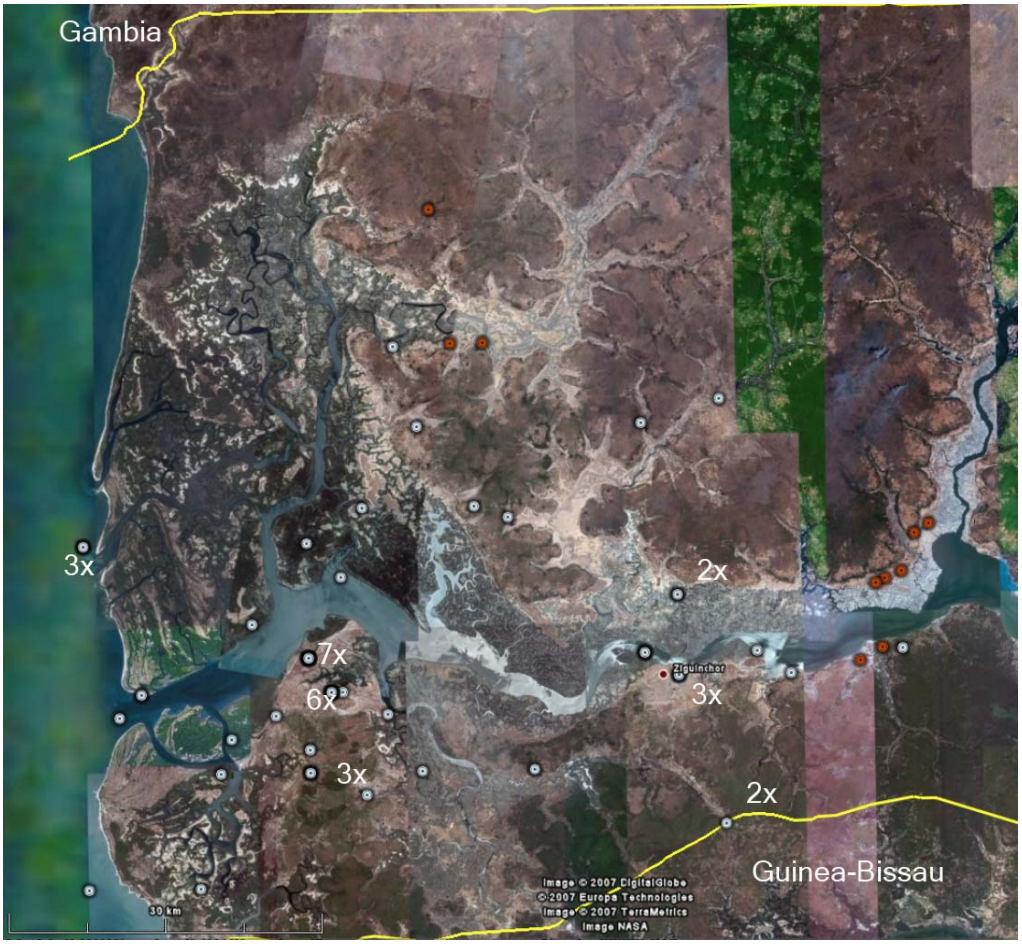

Fig. 7*. The recoveries of 53 Godwits shot in the Lower Casamance (white dots). Source: EURING; backrground: Google Earth. Ten recoveries collected by us during our mission are separately indicated with red dots.*

The many EURING recoveries (in total 22) north of Oussouye may be attributed to the relative high reporting rate due to the presence of several catholic mission stations. In contrast, the ten recoveries collected by us are from areas without mission stations or other Europeans. Although we cannot exclude the possibility that the Godwits in the Casamance have changed their distribution over the last decades, it is more likely that Fig. 6 shows an extreme example of the bias due to an unequal reporting rate within the area.

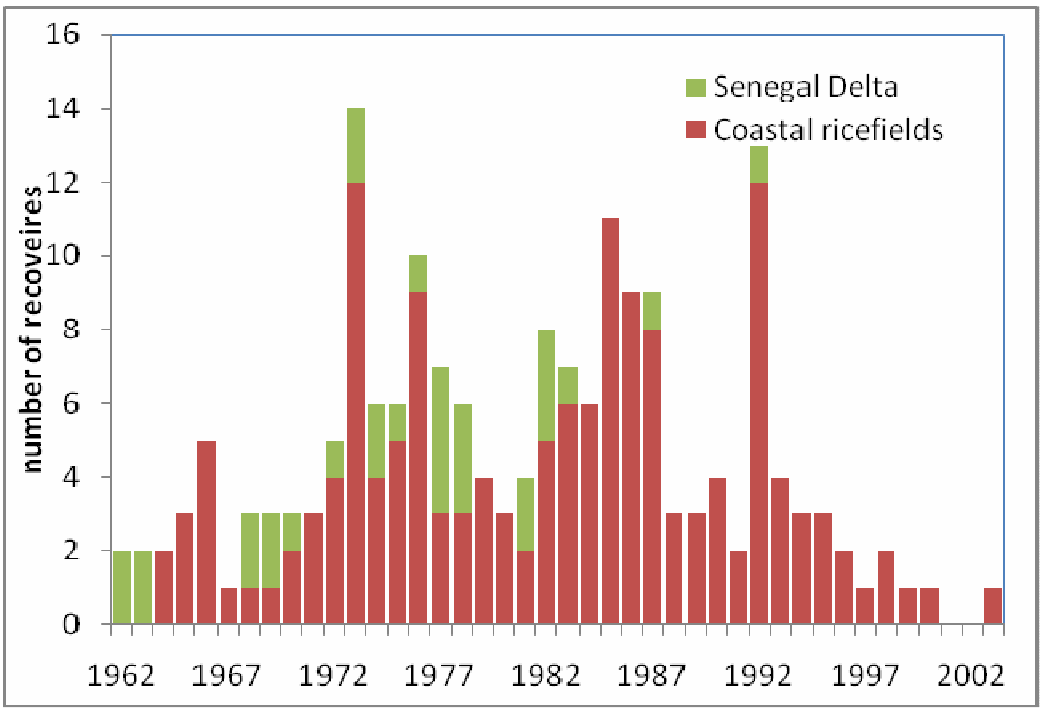

***Fig. 8**. Total number of recoveries per year from the Senegal Delta and from the coastal rice fields, to show the gradual relative decline in the Senegal Delta. Source: Zwarts et al. 2008*

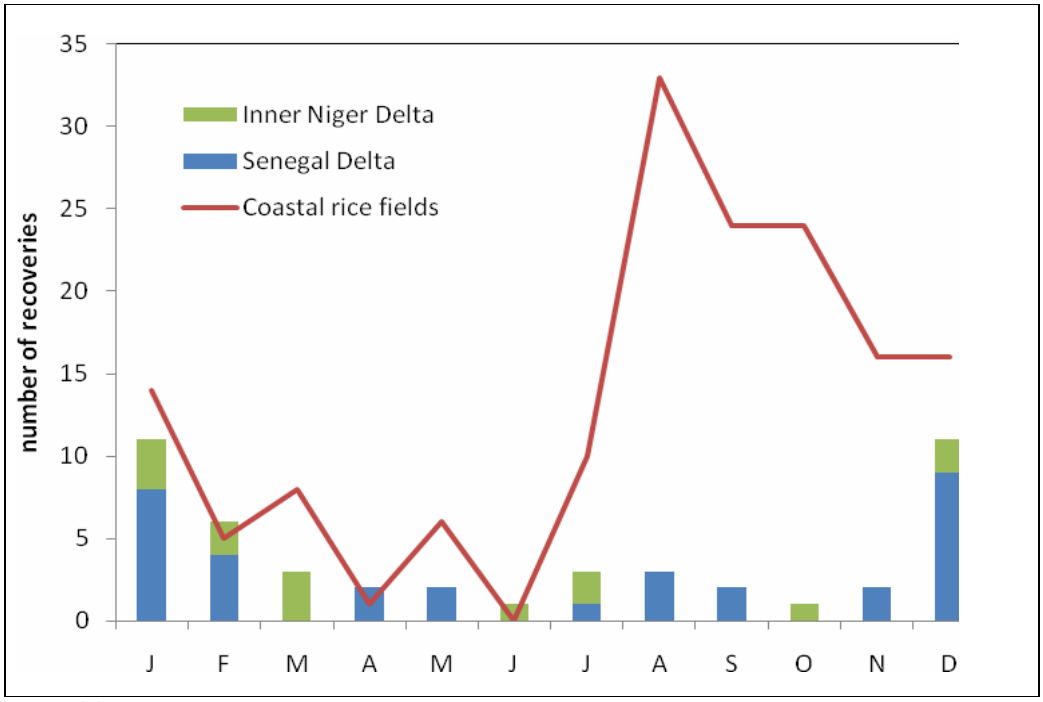

***Fig. 9.** Total number of recoveries per month from the coastal rice fields, compared to those of the Senegal Delta and Inner Niger Delta. It shows that most recoveries from the floodplains are from December-February (when the birds are concentrated in the last remaining wetlands), while most birds in the rice fields are from August-October. Source: Zwarts et al. 2008.*

If we assume that the chance of a ringed Godwit being reported back after it was shot is equal throughout the year, the high number of recoveries of Black-tailed Godwits (mostly shot birds) in August-September in the coastal rice fields (Fig. 9) confirms the finding of this study that most Godwits are shot early in the rice-growing season. Further analysis revealed no effects of latitude or the starting time of the raining season (using data from 15 weather stations in the region with complete series from the last 40 years) on the number of Godwits shot per year. The amount of rainfall had a considerable impact however: the drier the year, the more birds were shot (Fig. 10).

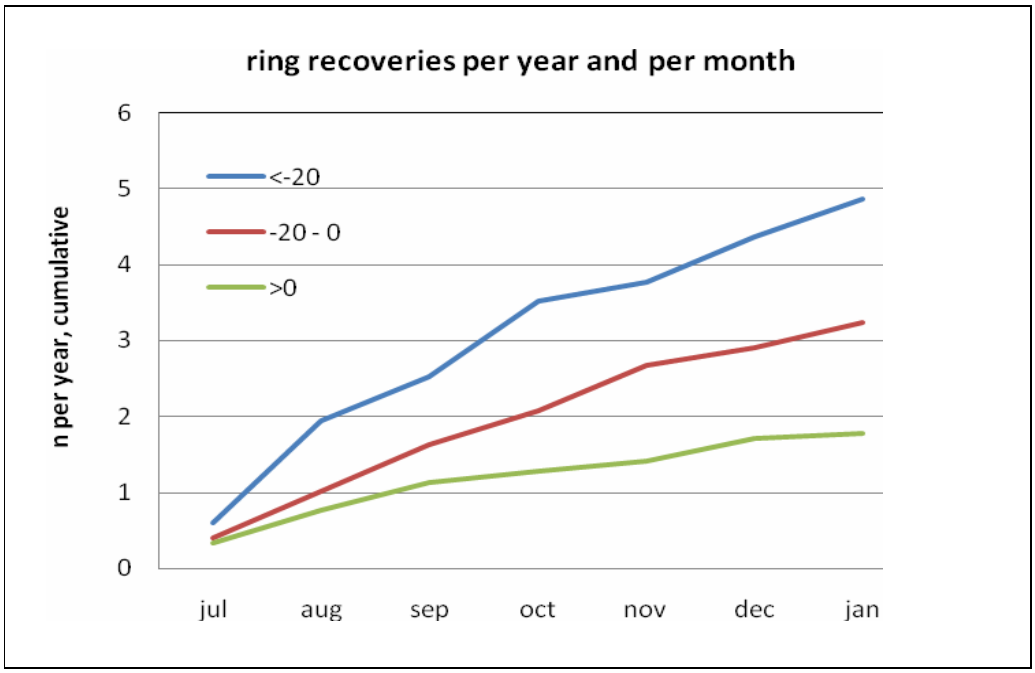

***Fig. 10**. The cumulative number of recoveries from the coastal rice fields, split up for years with a rain anomaly above the 20th century average, 0–20% below this average, or more than 20% below, to show that more birds are shot in dry years. Source: Zwarts et al. 2008.*

Godwits may trample young rice plants.

4. DISCUSSION

4.1. PREY CHOICE

Godwits are opportunistic in their food choice and are reported to feed on a wide variety of food sources: seeds (sun flower, *Cyperus esculentus*, rice, maize), tubers (*Cyperus*), insects (midge larvae *Chironomus plumosus*, beetles, *Tipula* larvae), snails (*Cleopatra bulinoides*), bivalves (*Scrobicularia plana*, *Corbicula fluminalis*, *Caelatura aegyptiaca*), ostracods and earthworms (Tréca 1984, 1994, Altenburg & van der Kamp 1985, Zwarts 1993, van der Kamp *et al.* 2006). According to the farmers in the Casamance, in July-August Godwits take every opportunity to feed on rice seed. After the rice has germinated, they apparently switch to small invertebrates found in the soft mud of the newly cultivated rice fields. This swith is still a gap of knowledge. Later in the season ripening rice may be taken. It was mentioned by only one farmer in the Casamance, but observed in Guinea-Bissau in December 1982 by Zwarts (unpubl.) and Altenburg & van der Kamp (1985), who saw that Godwits slowly walked between badly developed rice plants and pulled the grains from the stalk with a raised bill. Rahmani & Shobrak (1992) even saw hovering Godwits in an inundated sugar sorghum field in Saudi Arabia. These birds plucked the ripe grains from the plant. This kind of feeding behaviour seems to be rare, however.

In Guinea-Bissau Godwits appear in the rice fields during harvest and may remain there for a longer time to feed on spilled rice grains. When the rice plants are harvested in the paddies, the plants are temporarily laid in piles on the small dikes, to be transported later on to the villages. Godwits were seen feeding on these piles in January and November 1983 in Guinea-Bissau by L. Zwarts (pers. obs.) and Altenburg & van der Kamp (1985) respectively. The interviewees in the Casamance did not mention this type of crop damage, however.

4.2. OCCURRENCE

Most interviewed farmers had very pronounced opinions about the Godwits, since they know the species very well. That is not surprising, since Godwits are conspicuous, not shy and often feeding close to the people. One does not need a telescope, or even binoculars, to discover Godwits in the rice fields. That is why the farmers being everyday in the field know exactly when the birds arrive and when they leave. When most people indicate that there are now more Godwits, there is no reason to throw doubt upon it. Their observations bring forth two questions: 1. where do the birds go in October when they leave the rice fields? 2. Why are there now more Godwits than in the past?

Godwits feeding in the rice fields in July-September eat in the beginning newly sown rice seed (if possible), but probably mainly small invertebrates from bare soil. Our survey showed that in the planting season Godwits had a very pronounced preference for recently bared fields. That is why they feed so often near people during the planting season. When most of the rice is planted, the Godwits leave the rice fields. We counted in late September 2007 65% fewer birds than in early September 2006. Also Pirotte (2007) saw a decline of the Godwits in the rice fields near Ziguinchor frequently visited by him between July and November. It is still unknown where the birds remain later in the season. Rice is harvested 3 months after planting. The first rice is already harvested in November, most in December,

and the very last rice in early January. Godwits reappear in the rice fields from November onwards to feed on spilled rice (Tréca 1984, Altenburg & van der Kamp 1985), but where most birds feed in October-November is still puzzling.

There are two possible explanations for the (according to most farmers recent) increase of the Godwits in the Casamance in July-August. First, the Godwits lost a significant feeding area further north (the Senegal Delta), after which the birds learned to fly further south after arrival in Africa. However, the Senegal Delta has gone lost for the Godwits a long time ago, thus this does not help us to explain why there was in recent years an increase.

The second explanation has to do with a shift in the timing of departure from the Netherlands. After the breeding season Godwits start to roost communally. These roosts have been counted since already several decades. Until the early 1990s, peak numbers were present in mid or late July, but there has been a shift forward to June in recent years. This shift is partly due to an earlier breeding season (Beintema *et al.* 1985), but more recently also with a decline of birds producing young, by which more Godwits leave NW Europe earlier in the season, and thus also arrive earlier in the rice fields. This seems to us a likely explanation why many farmers are convinced that there are now more, and not less, Godwits during the planting season.

4.3. CROP DAMAGE

It is of interest to compare the damage as experienced by the farmers in the Casamance to those of their colleagues in the Senegal Delta (Fig. 10). All 25 farmers in the Senegal Delta ranked the weaverbird as the species causing the largest damage. 64% agreed that the whistling-duck was second worse and 48% that weavers (including related bird species), whistling-duck and rat+mice belong to the three species groups causing the largest damage. There was much less consensus regarding the other five species. The farmers in the Senegal Delta and Casamance agreed that weaver birds cause most damage, but the farmers in the Casamance see the Godwit as more harmful than the farmers in the Senegal Delta.

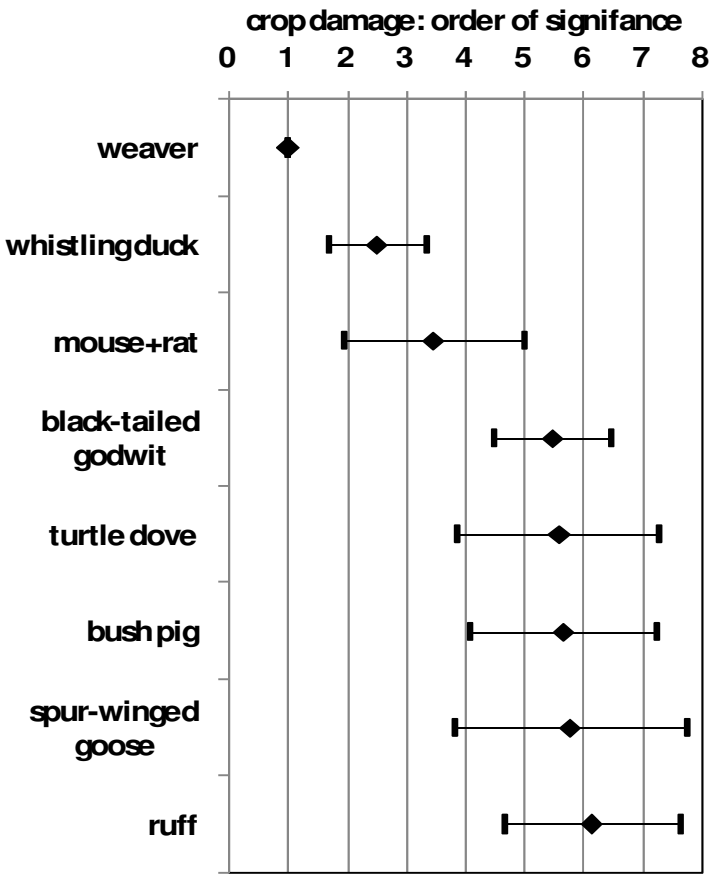

***Fig. 10**. The significance of crop damage by eight different animal species in the Senegal Delta, according to 25 local rice farmers who were asked to rank the eight according to the presumed crop damage. The lines indicate one standard deviation. Source: Idrissa Ndiaye & Jan van der Kamp (unpublished; July-August 2006). "Weaver" includes beside Black-headed and Village Weaver also Red-billed Quelea, Golden Sparrow and bishops*

It should be noted that the Godwit damage is restricted in time (July-September) and place (small seedbeds within the rice fields). Consequently, it must be possible to find a solution and search, together with the farmers, for small- or large-scale, community-based opportunities to prevent the damage (use of ropes, nets, etc. bought for them by us; create alternative feeding grounds using abandoned rice area). We may assume that the women are willing to cooperate since shooting is illegal and it is getting more difficult to purchase illegal cartridges from Gambia in recent years.

4.4. SHOOTING

The main question for us was: how many birds are shot in the Casamance? Obtained information shows that hunters (professionals and skilled locals) are provided with cartridges

by associations of women involved in rice sowing and planting. There are two indications that there was, and still is, much shooting.

First, for the Koubanao region we arrive at an estimated 5% of the birds being annually shot the last three years, viz. 250 birds shot on a population of about 4500 birds.
Second, just by asking hunters whether they had shot birds with rings during the last years, we recovered a total of ten aluminium rings (but no colour rings) from the last 5 years. The hunters in the surroundings of Koubanao had annually shot in total 250 birds during the last three years. They shot between 2002 and 2006 five ringed Godwits, thus one per year and 1 ring on 250 birds. Given a ringing density of 1 ring on 250 birds, the interviewed hunters shot the last five years in the Casamance 10 ringed birds, or an extrapolated number of some 2500 birds or about 500 birds per year. Since we interviewed hunting farmers only in that part of the Casamance where we counted the Godwits, these 500 birds may be compared to the 9000 Godwits present in these areas. Hence 5.5% of the birds might be killed annually.
So, both estimates, although very preliminary, arrive at the same 5% of the wintering population present in that area.

4.5. RESEARCH PRIORITIES

1. It is necessary to check our first estimate that about 5% of the Godwits present in the Casamance are annually shot in July-August, by interviewing systematically more hunters. We also have to check whether there has been a shift forward in the arrival date.
2. The same data have to be collected in Guinea-Bissau where the majority of the Godwits are concentrated in July-August.
3. We need to find out what areas and habitats Black-tailed Godwits use in the period after rice-planting to assess and anticipate potential threats to these unknown staging areas.
4. Bird counts in August in the Casamance as well as in Guinea-Bissau are needed, to know more about the total number present and the distribution of the birds. The ground survey has to be combined with an aerial count.
5. Godwits are not shot to get meat, but since they do damage. Damage in the seedbeds may simply be prevented, by using ropes or nets. We need to consult the farmers to search for possibilities to guard the seedbeds as well as the Godwits.
6. Feasibility study as to community-based creation of alternative feeding grounds in abandoned rice paddy area, in order to protect Godwits from hunting and avoid or mitigate crop-damage.

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[i] The different sources give varying production data. According to an internal report of the "Direction des Services agricoles", without year of publishing or author, titled "Possibilités de développement de la producton rizicole en Casamance continentale jusqu'en 1977" the average rice production amounted to 2.5 ton/ha between 1972 and 1977 (with 1.5 and 2 ton/ha for 'riz de plateau' (300-4000 ha), 2.5ton/ha for 'riz en sols gris' (1200-14000 ha) and also 2.5 ton/ha for 'riz aquatique' (300-11000 ha) between 1972 and 1977, and 1.5-2 ton/ha for 'riz de plateau' (300-4000 ha). De Jonge *et al*. (1978) arrive at a similar production of 1.4-1.6 ton/ha, measured in the same years. A higher production is given in "Bilan de 12 années de recherches rizicoles en Basse Casamance: 1967-1979", published by the "Institut sénégalais de recheches agricoles": 3 ton/ha for sandy soils in the Lower Casamance, 3.5 ton/ha for the upper valleys, but only 1.1 ton/ha for Kamobeul (mixed substrate). Guei *et al*. (1997) comparing the productivity of different improved varieties, mention for the Casamance a yield of 1.7-2 ton/ha for three improved varieties and 1.5 ton/ha for the still widely used 'non-improved' variety. The FAO (2003) arrives at only 0.6-2 ton/ha for three different years (1988, 1990 and 1994) and different zones within the Casamance. A low production for the rice paddies in the Casamance is also given by Montoroi (1990): 1.09 ±0.25 ton/ha. The latter estimate refers, however, to a longer period - 1970-1985 -, and thus also includes the dry years in the 1980s when the rice production was low due to lack of rain. The larger part in the apparent variation in the yield is most

likely, however, due to a different definition of rice field for which the production is given. The yield is of course higher if restricted to fields being planted and harvested than for all rice fields, including areas in fallow or even abandoned.