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INTRODUCTION

The purpose of this paper is to describe briefly the duck farm industry in the Philippines and to report preliminary findings on the problem posed by pest birds to individual farmers. The concerns of several farmers about the amounts of duck feed being eaten by Europen tree sparrows (*Passer montanus*) prompted this study. Wright (1973) reported that starlings (*Sturnus vulgaris*) caused an annual loss of about 1,000 tons of food pellets at one duck farm in Great Britain. This is one of the few references describing this type of bird pest situation of which we are aware. Although we have not yet resolved this unusual problem, we report here our findings to date and, perhaps, obtain from this forum some ideas for further work.

Duck farming and the processing of eggs for human consumption was introduced to the Philippines by Chinese settlers in 1565 (Zaide, 1964). The popularity of duck eggs in the Philippines is evident at bus stops, restaurants, and street corners. Duck farming occurs throughout the Philippines where lowland fresh-water sources are available. Three main types of eggs are produced commercially: *balut* (an embryo-bearing boiled egg), *penoy* (an unfertilized, hard-boiled egg), and *itlog na pula* (a salted, unfertilized red egg). The business is specialized, as large egg-processing facilities purchase fresh eggs from many small duck farms commonly located along fresh-water shorelines, such as Laguna de Bay in Laguna Province.

Eggs are collected daily on each farm and sold directly to an egg processing firm or to a wholesaler. Eggs are first candled to separate unfertilized eggs, which are sold for home use. Fertilized eggs are warmed by the sun for two hours, bundled in lots of 50 in a thin cloth, placed into baskets, and buried in heated rice hulls for five days. They are then removed and candled a second time. Any remaining unfertilized eggs are boiled and sold as *penoy* for US $0.11 (1 Philippine peso ₱ = US $0.09). Eggs with developing embryos are reburied in the heated rice hull to incubate for about 13 more days to yield an 18-day-old embryo. Some of these eggs are then sold as *balut* for US $0.14 to vendors, who boil them and sell them to the public for about US $0.18. Others that fail normal development are buried in a salt-mud solution for a minimum of 14 days, washed, cleaned, hard-boiled, stained with red food coloring, air-dried, and sold wholesale as *itlog na pula* for US $0.13/egg.

A typical duck farm has between 400 and 1,000 ducks, 85% of which lay eggs daily. However, many families often keep only a few ducks in pens around their homes to provide eggs. Duck feed consists mainly of soaked, unhulled rice (sometimes cooked),

snails, small bivalves, and small fish or shrimp. When this feed is distributed two or more times daily in troughs (tires cut into circle halves), wooden trays, or on the ground, European tree sparrows gather to feed on the rice. Duck farmers in the villages of Malinta and Mayondon on Laguna de Bay, Laguna Province, estimated they were losing between 6 and 10 kg of rice daily to as many as 2,000 birds.

METHODS

During 1982 we selected for study four of the numerous duck farms near the villages of Malinta and Mayondon (Fig. 1). At each farm, we attempted to estimate the sparrow population by making counts several times a day for two to four days each month between May 1982 and June 1983. The number of birds observed within each farm area upon our arrival was counted once each hour for three consecutive hours in the morning and the afternoon.

To determine movements of birds among the four farms, we mist-netted 50 birds in May 1982 at Farm I and marked them with plastic leg streamers attached with string. In February 1983, another 96 birds were similarly marked with leg streamers but attached with metal leg bands (Bruggers, 1981). We then looked for marked birds at each farm and in the villages during our population counts.

We attempted to estimate the amount of food taken by sparrows by exposing 250 g of soaked, unhulled rice in three 3716-cm^2 wire feeding platforms at Farm I and counting the number of sparrows feeding at five-minute intervals over 30-minute periods. Ducks were excluded from the test area by a 60-cm high fishnet. Any remaining rice was weighed and the average consumption/sparrow per 30 minutes was calculated.

Several trap designs* (including Last Perch Trap®), Rid-A-Bird perch®, and commercial bird trappers were evaluated at Farm I as methods to reduce sparrow populations. Other trap designs are still being tested.

RESULTS AND DISCUSSION

Farmers at the four farms claimed that between 500 and 2,000 sparrows ate between 6 and 10 kg of rice each day. Both estimates exceeded our counts. Over the 14 months of observation, our estimates averaged 124 sparrows per count at Farm I and between 25 and 53 birds at the other three farms. Sparrows were present before 0600 and remained throughout the day. Except for Farm I, the numbers of birds feeding in the morning (0900, 1000, and 1100) and afternoon (1400, 1500, and 1600) were comparable at each farm (Fig. 2).

The number of sparrows feeding at each farm varied. Farms I and II were the most heavily visited by the birds. These two farms were larger and surrounded by greater numbers of trees used for roosting. However, the number of sparrows at Farm I decreased by about 25% when the ducks were fed indoors, which occasionally occurred during heavy rains between June and August. Bird numbers on the farms never approached those reported by the farmers at any time during our study.

Seasonal fluctuations in the number of birds feeding at the farms were evident but did not seem to be associated with any particular event, except during May, June, and July when juveniles join the population (Fig. 3). The number of feeding birds was lowest at all farms during November and December, probably a result of the birds feeding on spillage in the nearby harvested ricefields. During harvest, large flocks of sparrows could be seen regularly gleaning rice in fields and around threshing sites.

It was our impression that the sparrow population in the area of the duck farms was resident. However, based on our marking studies, it seemed that only a small percentage of the birds in the area visited the duck farms and that these birds moved among the farms. Of the 50 birds tagged on 11 and 14 May 1982 at Farm I, one bird was seen at the release site, three at Farm II, and two at Farm III within the first week. No marked birds were seen after one week at any of the farms; the streamers that had

been tied with string most likely dislodged. Of the 96 birds tagged with metal rings between 25 and 28 February, again at Farm I, several were later seen at Farm I, and three at each of the other three farms during the first two weeks after tagging; four marked sparrows were killed by boys with slingshots at other farms in the area within one month.

According to Benigno (undated), *Passer montanus* eat about 30% of their body weight or about 6 g rice/day. The average amount of rice taken (eaten, spilled, and wasted) during the 30-minute exposure periods at Farm I was 3.3 ± 0.8 g/bird (N = 9). Based on about five hours of cumulative daily feeding activity per bird (which we have determined by observation) and a mean of 124 birds at Farm I over the 14-month study period, about 4 kg/day of rice were lost (Fig. 3). Estimated losses at the other three farms averaged between 0.5 and 1.0 kg/day of rice. These estimates are less than the farmers' estimates.

We believe our estimates are reasonable in view of the possibly higher consumption rate reported by Benigno (undated), the high turnover rate of birds indicated from the tagging studies, and the quantity of food available to them after the ducks feed. The ducks never ate all the feed immediately; and when some ducks left the feeding area to drink or sleep, the sparrows moved in. Assuming 1 kg of soaked rice costs US $0.09, a loss of US $0.36/day or US $10.80/month was incurred at Farm I. The other three farms would lose between US $0.05 and US $0.09/day.

Losses to sparrows may be only economically important at some farms in the area during certain months. Daily feed requirements at duck farms varied among the individual farms, apparently depending on an owner's preferences. Total daily feed ration at 2,000- and 1,200-duck farm operations was reported to us as 35 kg and 135 kg of rice, respectively (Table 1). Farm I fed about 100 kg daily, and by our calculation, sparrows took about 4% of this total.

Farmers who watch sparrows eat duck feed each day want a solution to what they consider a problem. According to Wright (1973), two possible solutions to resolving this kind of problem exist: deny the birds access to the food or reduce population numbers to the point where losses become insignificant. However, the constraints imposed by Philippine duck farmers on the use of any control measures — low costs, no materials that are lethal or frightening to the ducks, or no methods that require extensive maintenance — present real difficulties to resolving the problem. Additionally, many control methods apparently disturb the ducks and cause a reduction in egg laying. In a similar but more detailed study of starling damage to feed at an open-air piggery in Scotland, alarm calls, helium balloons, model hawks, and decomposing bird carcasses all were either ineffective, disturbing to the pigs, or economically unacceptable as control methods (Smart, 1982). These control methods cost between US $3.10 and US $54.25 (1 English pound £ = US $1.55) per week, whereas losses to starlings averaged US $5.20 per feeder each week.

Under the constraints imposed upon us, our preliminary attempts to reduce sparrow numbers at Farm I were not successful. It is unlikely that the farms and feeding areas can be made less attractive to the sparrows. Excluding sparrows from the duck pens with netting might possibly be effective on the smaller farms but might also be economically impractical. Rid-A-Bird perches, mounted at Farm I in the manner described by Jackson (1978) but without a toxicant, did not attract birds. Birds avoided them, preferring to land on adjacent trees, roof ledges, and bamboo poles which extended from the farm buildings.

Traps did not give any better success. The Last Perch Trap was not visited, despite being moved to several locations, baited, and supplied with live decoy birds. Hav-A-Hart and funnel traps are now being evaluated. Perhaps modified Australian Crow Traps would perform better; but feed may be sufficiently abundant on the farms so that birds might not be attracted to any type of trap. The use of the local *korag* or clap traps and mist-nets by local bird trappers and the farm owners were the only methods that caught birds.

Korag traps are manually operated traps composed of two rectangular nets, each measuring 1.5-2 m wide, framed by light poles, and positioned flat on the ground 3 m apart. The nets are flipped over passing or feeding birds by a jerk on a pull cord by a hidden trapper (Benigno, undated). Two local trappers caught 364 total birds at Farm I using a *korag* trap on 22 May and 9 August 1982; the birds were sold locally. The owner of Farm I also caught 258 sparrows on five different days between 29 May and 13 August 1982 using mist nets. If intensive trapping at farms could be shown to reduce feed consumption, and not simply result in immediate reinvasion by other sparrows in the area, the use of clap traps would seem to meet the farmers' needs. They are particularly appealing because the problem would be alleviated at no cost to the farm owner, while providing an income to the trapper.

Other methods that might be useful are bird limes (Fitzwater, 1982) and 4-Aminopyridine (Avitrol®) baits. A bird lime prepared from *Artocarpus* spp. trees has shown promise in preliminary trials to protect ripening rice from birds (*Lonchura* spp.) in the Philippines (Reidinger and Libay, 1979). Bait formulations with 4-Aminopyridine are registered for a variety of situations on house sparrows (*Passer domesticus*) in the United States (Matheny, 1980). Two-percent 4-Aminopyridine diluted at 1:10 treated:untreated bait is an optional rate for reducing or dispersing house sparrows from feeding and roosting sites (Miano, 1982).

Sparrow damage at duck farms in the Philippines is an unusual pest problem in its nature and location. Our study and Smart's (1982) evaluation of starling damage and control at piggeries in Scotland are good examples of the common "perceived" pest problem. In both pest situations, control seemed needed and desirable until their constraints, logistics, and economics were evaluated. Farmers in developed countries have the luxury to initiate relatively expensive control programs against noxious pests, often when control may not be warranted. The major complicating factor to these duck farm owners, and to farmers in general in developing countries, in using the many methods available to solve bird pest problems at feed lots is the very limited capital available.

Protection methods should emphasize manpower-intensive approaches because they involve little cash outlay. Based on our sparrow counts and food consumption data, it is our opinion that the losses caused by sparrows are not economically important at most farms in the Laguna de Bay area during most of the year and that the costs of protective measures would exceed the costs of the feed losses. However, at certain times, the larger farm owners may find it profitable to have trappers remove some of the pest birds. The fact that many duck farmers feed ducks small amounts of rice several times daily may keep losses to a minimum. If large amounts of feed were available for longer periods, the sparrows probably would cause much more damage.

ACKNOWLEDGEMENTS

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* Reference to trade names does not imply U.S. Government endorsement.

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TABLE 1. Reported daily cost (US $)* of food items at 1,200- and 2,000-duck farms in Laguna de Bay, Philippines.

	1,200 ducks			2,000 ducks		
		Cost (US $)			Cost (US $)	
Food items	Amount (kg)	Unit	Total	Amount (kg)	Unit	Total
Unhulled rice	135	0.11	14.85	35	0.13	4.55
Snails and bivalves	720	0.03	21.60	38	0.72	27.36
Fish and shrimp	50	0.27	13.50	30**	0.72	21.60
Corn	—	—	—	15	0.12	1.80
Total cost/day			49.95			55.31

*One Philippine peso ₱ = US $0.09.
**Shrimp only.

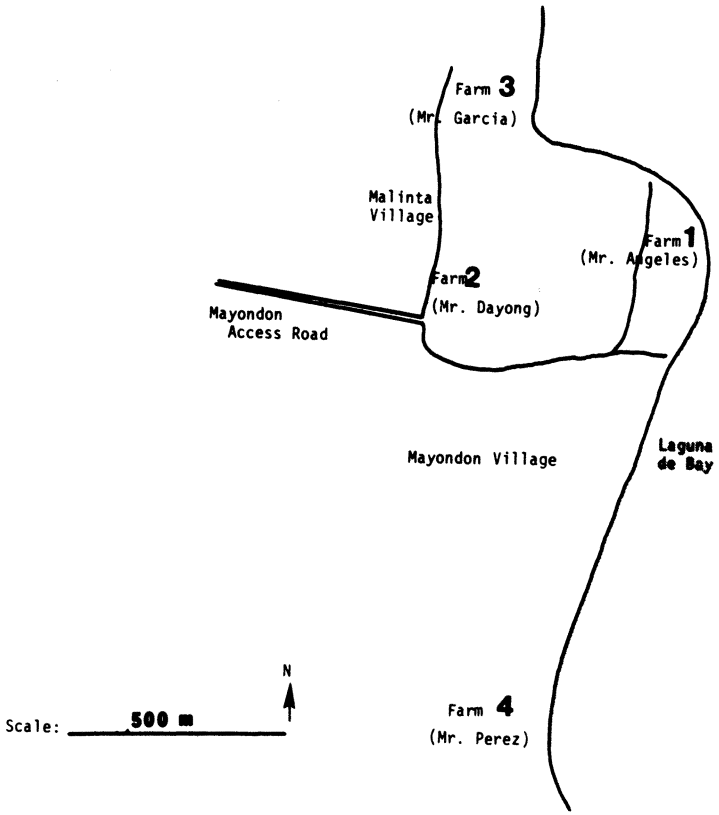

FIGURE 1. Relative location of four duck farms in Laguna Province, Philippines at which the problem of tree sparrow losses to duck feed was studied.

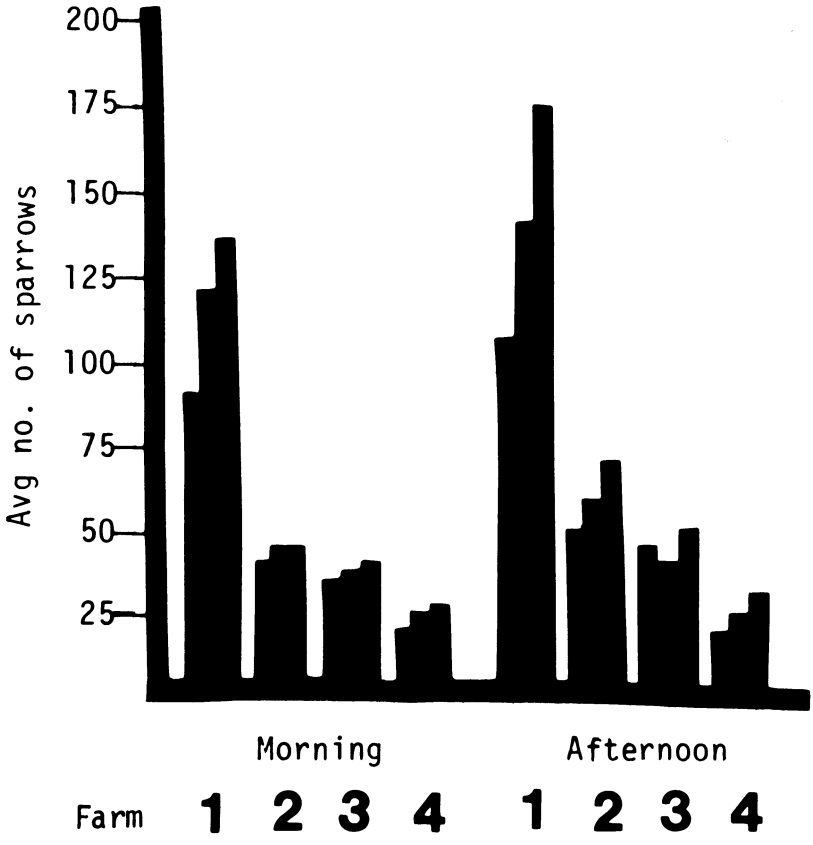

FIGURE 2. Comparison of the average numbers of sparrows feeding during the morning (0900, 1000, and 1100) and afternoon (1400, 1500, and 1600) at one-hour intervals between 21 May and 15 December 1982. Data are based on 25 observation days and six counts/day at each farm during that time period.

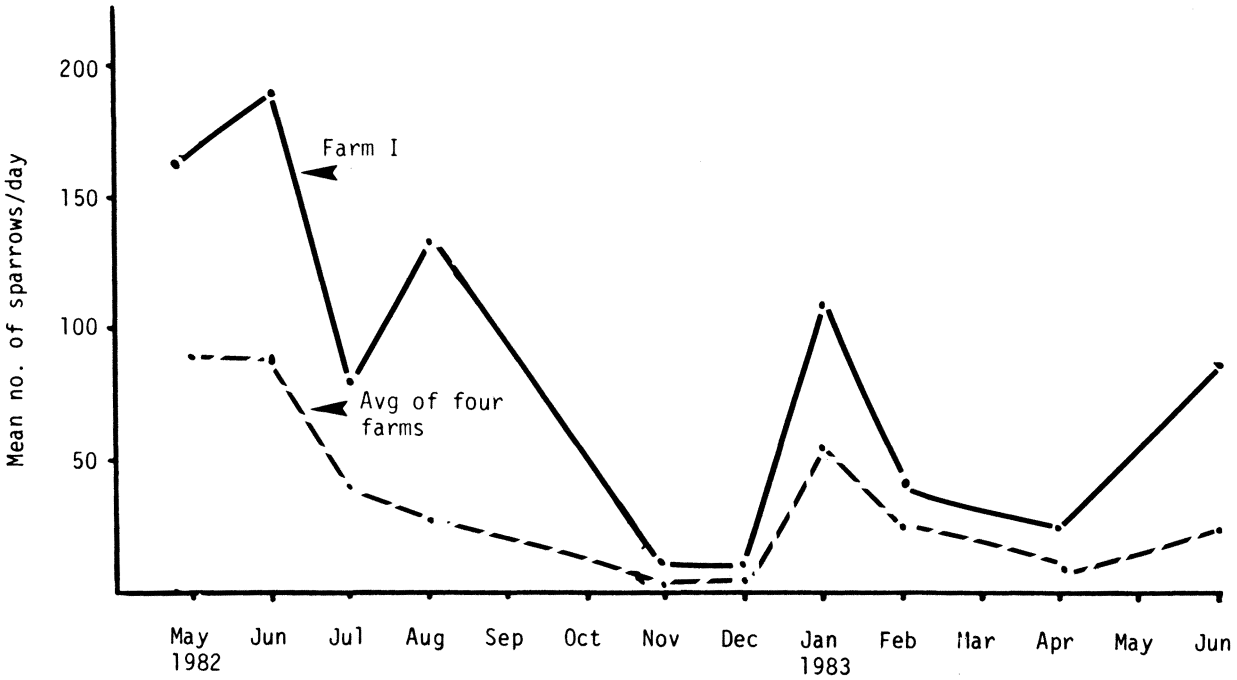

FIGURE 3. Mean number of European tree sparrows counted per day at Farm I and the average number for the four duck farms near Laguna de Bay, Laguna Province, Philippines.