# SOCIAL BEHAVIOR AND REPLACEMENT PROBLEMS IN CAGED LAYERS

by

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# INTRODUCTION AND LITERATURE REVIEW

Poultry husbandry has profited by the advances made in the allied fields of nutrition, genetics, management and other associated sciences. Usually there has been a coordinated effort on the part of all these sciences to permit the advances of one to be expressed to its maximum potential. For the major part these sciences have worked with the chicken as a sort of living machine, an entity which grows and reproduces itself automatically. Only in recent years has the recognition of the chicken as an individual animal with habits, mannerisms, instincts, and other traits of behavior come into prominance.

At the turn of the twentieth century, Schjelderup-Ebbe (1924, 1935) reported a hierarchy of dominance he had observed in the domestic chicken, Gallus gallus, and other species of birds. According to these early reports each bird was seen as a definite individual within its flock. Corresponding to this personality was a decided rank or position in the flock.

Since these pioneer reports of Schjelderup-Ebbe's behaviorists have become more familiar with the social organization in flocks of chickens, primarily through observations of small flocks of 25 birds or less. Guhl (1953) observed a flock of 96 hens and substantiated the order in this large flock. Reports on large flocks are few and the indications are that the organization is not as stable in large flocks; reasons for this are discussed in detail later.

Each flock is seen to have a definite social-order among the individuals comprising it. From the most aggressive individual to the most submissive, a definite hierarchy of dominance exists. Sanctuary (1932) presented evidence that dominance-subordinance relationships usually are decided between each two individuals at their first encounter. Fighting, pecking, and threatening are the three major forms of self-assertiveness which are exhibited, although in some cases the relationship is decided merely by one bird submitting to another without a contest (Collias 1943). The individual which causes, by some action or merely by its presence, the submissive behavior on the part of another is the dominant one of the pair.

As observations and reports on social orders in flocks of chickens have accumulated, the effects of position in the social order on egg production, feeding, roosting, mating and other factors have been brought into view. That a domineering hen can decrease the production of a small flock through her constant harassment of the other members of the flock has been shown by Sanctuary (1932) as well as Tindell and Craig, (1958). Birds ranking in the upper portion of the social order have been shown to have precedence at the feeders, waterers, and roosts (Guhl, et al, 1945), sire more chicks (Guhl and Warren 1946), produce more eggs, mature earlier, and consume slightly more feed (Guhl and Allee, 1944). (Tindell and Craig, 1958), than those in the lower portion of the order.

Mating behavior is influenced by social position. Guhl (1950) reported that hens in the upper portion of the social order of a flock crouch less for males and mate at a lower frequency than do the low-ranking hens. Since the dominant males mate at higher frequencies than their subordinates (Guhl, 1951), they sire more chicks (Guhl and Warren, 1946), unless they have low sex drives. In the latter case the fertility of the flock may be severely reduced by the dominant males preventing other males from mating.

Stability and complexity of social orders within flocks is directly related to flock size. As flock size increases, the complexity of the social order also increases and the stability of the order decreases. In the smaller flocks simple straight-line relationships often are found; as flock size increases, the complexity of the social order increases to one containing many triangular pecking relationships. As the complexity of the social order of a flock increases, the possibility for changes in social rankings to occur is increased (Bellah, 1957).

In order for each member of a given flock to distinguish between the birds it may dominate and to which it is subordinant, it is necessary that some form of recognition occur. In the smaller flocks there are fewer individuals to recognize and remember, and encounters between any two members of the flock take place at a much higher frequency than in larger flocks. Recognition is based on memory of individuals, and the memory of the chicken in this respect is poor. Allee, et al, (1939) found the memory of chickens to be lost following two weeks of isolation.

The work of Potter and Allee (1953) indicates that the fewer encounters each bird has with each flock mate, the weaker is the dominance relationship between the pair.

Guhl and Ortman (1953) altered the appearance of birds by changes in the head furnishings, by adding feathers to the tail or body, and by other means. They found that the more profound the changes, the less the degree of recognition by flock mates. Alterations in the head furnishings caused the greatest decreases in recognition; in many cases the altered birds were treated as strangers. Douglas (1948) found that by rotating a hen among several flocks, one hen could hold different social positions in up to five of the flocks of which she was a part time member. Hale (1957) reported that if a bird had decided its dominance relationship with a bird of a different breed it would respond to others of that breed in the same manner. Response to members of other breeds on the basis of individuals rather than breed is found in the observations of Tindell and Craig (1958).

Poultry husbandrymen have begun to take notice of the social order on the performance, fertility, egg production, culling levels, and other economic aspects of their operations. Incorporations of modifications into the managerial practices to alleviate the detrimental effects of social stress on the birds in the lower portion of the social order has met with success in many operations (Wallace, 1955).

Formerly it was the practice to add a few birds to the flock as they were needed to keep the flock at a constant size.

Investigations by Sanctuary (1932) showed that the new birds were soon dominated by the members of the established flock. In many cases the new birds were so suppressed by the members of the resident flock that they retreated to the roosts, refused to feed or drink, and rapidly became culls; this was an economic loss to the poultryman. Sanctuary observed that the effects of bossism caused from 20 to 30 percent of the pullets introduced into a flock to be retarded in maturity. Scott (1948) noted that in some cases the boss hens of a flock will actually patrol the feeders and waterers, driving the more timid hens away.

From the standpoint of the social order, if flocks must be combined or pullets added to them, it is best to add new birds in numbers equal to the size of the flock to which they are added. New individuals should be nearly equal to the established flock in size, weight, health, constitution, and genetic background. According to Collias (1943) these factors aid in the determination of success or failure in initial encounters.

Placing additional feeders and waterers in the pens and on the roosts, to decrease the effectiveness with which boss hens can patrol these facilities and to permit timid hens to feed in their place of exile, has maintained these low-ranking birds very well in many cases (Wallace, 1955).

According to observations by Wallace (1955) and Collias (1944), adding new members to a closed flock may result in a reorganization of the established hierarchy. Members of the flock may revolt and challenge their superiors while the new order is being formed.

Until recently practically all poultry flocks, from the small farm flock to the large commercial enterprises, had been maintained in pens where the birds were free to intermingle. Under these conditions social orders no doubt were present in the majority of the flocks, since the birds were in free communication with each other, utilized the same equipment, and slept on the same roosts. Within the last few years the cage-layer system, a radical departure from these conventional practices, has risen rapidly in popularity.

Caged-layers were first experimented with on the west coast in the middle thirties. These first cage units were little more than batteries of individual hen cages housed in open-sided buildings. Even though these first caged-layer units met with fair success, they gained little popularity. With the end of World War II, interest in the possibility of maintaining commercial flocks in cages boomed. In the span of years between that time and the writing of this paper, caged-layer units have spread in popularity throughout the nation. Many farms now have caged-layer units as substantial portions of their enterprises. Cage units are not confined to farms, as many are located in the heart of metropolitan areas. For a more extensive review of caged-layer systems the book by Hartmen and King (1956) should be consulted.

The majority of caged-layer units in the Kansas area consists of 1,680 production hens, each in its own individual cage. Cage sizes vary according to personal preference, type of bird utilized and other factors. At the present time an 8 to 10-inch wide,

18-inch deep, 16-inch high cage is the most popular. Factors deserving consideration in the selection of cages are detailed in the book by Hartman and King.

In the Kansas area the typical cage operation is housed in a windowless 30 by 80 foot concrete block house, equipped with forced ventiliation, automatically controlled lighting, and in some cases automatic feeders and waterers. Cages are placed in double rows, back to back, in double-decked arrangements, three rows to a house. Dropping boards are placed between the upper and lower levels of cages, the droppings from the upper level of cages falling onto the boards and those from the lower birds falling to the floor. Feeders and waterers run the entire length of the cage rows. Slanted floors on the cages cause the eggs to roll toward the aisle as they are laid, thus facilitating their collection.

In comparison to floor management the advantages and disadvantages of the caged system as seen by Hartung (1958) are as follows:

| Advantages | Disadvantages |
|---|---|
| 1. Cages provide an accurate means of culling. | 1. Cages involve a slightly higher investment than floor equipment. |
| 2. Cages produce fewer dirty eggs. | 2. Labor time per bird capacity is higher than with floor birds. |
| 3. Timid hens have a better chance to produce. | 3. More slightly soiled eggs due to wire marks. |
| 4. Cannibalism and feather picking are reduced in individual bird cages. | 4. Replacement pullets for empty cages are an added problem of management. |

5. Each bird has feeder and waterer space.

6. Diseases and parasites, bacterial and protozoan diseases--greatly reduced.

7. No wet litter problem except in decked cages with dropping boards.

5. Diseases and parasites, respiratory diseases--as much or more than on the floor. Lice and mites--as much danger as on the f floor and much harder to treat.

6. Fly control in warm months is a major problem with cages.

McBride (1958) found that the direct relationship between aggressiveness and egg production observed in floor pen birds is not present in individually caged hens. The question arises, What is the effect of these conditions of controlled physical factors and semi-isolation on the social order.

Consequently, investigation was begun on the determinatinn of the effect of the caged-layer system on social behavior and the evaluation of any effects that might be found. Three systems of introducing pullets into cages were employed to determine the effect of treatment during caging on adaptation to cage environment.

According to Hess (1958) "that the early experience of animals has a profound effect on adult behavior has been demonstrated by psychologists and behaviorists for some animals." Four rearing treatments for replacement pullets, to develop differences in flightiness and aggressiveness were used to investigate the effect of early experience on adaptation to cages.

Each of the four rearing treatments was tested for cage adaptation in the two major systems of pullet replacement used in cage operations, the pullet block system and the pullet-between-hens system.

## MATERIALS AND METHODS

One hundred forty-four ready-to-lay pullets were randomly selected from those reared on the college poultry range, by selecting every other bird from a list of wing band numbers. One third each were Ghostly White Leghorns, Babcock White Leghorns, and Parmenter Rhode Island Reds. These three strains were selected from those available on the basis of their differences in aggressiveness as determined by Tindell and Craig (1958) and Grosse (1958). Each bird was assigned a numbered plastic wing badge for identification purposes. Six groups of eight birds each were selected for each strain, a total of 18 groups being thus assembled.

For these studies the new mating house of the college poultry farm was utilized. Although this building was not intended for caged-layer usage, it had been modified considerably to simulate the conditions of a cage operation. The cages utilized in this experiment formed two double-decked, back-to-back rows running the length of the house between two rows of breeding pens. Time clocks turned the lights on at 7 a.m. and off at 9 p.m., giving the birds in the house 14 hours of light. All 18 groups were placed into these commercial type laying cages. Four birds of each group were placed opposite the other four; in this way each group formed a small block of individuals isolated from the adjacent group by a vacant cage.

The first treatment consisted of handling the birds in a gentle manner to sooth them, then carefully placing them into their assigned cages. For the second treatment, the first treatment was

repeated during the evening hours of semi-darkness. Treatment three consisted of merely removing the birds from the carrying crates during daylight hours and placing them immediately into the cages with no attempt at special handling or soothing of the birds. Of the six groups formed for each strain, two were used in each of these handling treatments; one group was placed in the upper level of cages and the other in the lower level, each group being assigned to level and position by simple randomizing of the locations.

Observations of all the interactions among the four central birds of each group were made following caging to determine any strain or handling treatment differences in the birds' adaptation to the cages. Only the four central birds of each group were observed. The four end birds bordered on vacant cages and were not under the usual condition, having only three neighbors with which to interact. For a 10-minute period daily, following caging, observations were made recording all interactions between each of the four central birds of each group with left and right neighbors, opposites, and diagonals. Observations were continued until interactions diminished to a stable minimum.

In order to obtain stock of the same strains for replacement among the originally caged birds, these caged and other available birds were artificially inseminated. At hatching the chicks were randomly divided into four groups, each of which contained 18 Ghostleys, 18 Babcocks, and 28 Parmenters. These four groups were reared under the usual conditions of management used for all chicks

at the farm until two weeks of age. At two weeks all the chicks were dubbed and the rearing treatments were inaugurated.

Treatment of rearing for each of the four groups was as follows: Group A, Unlimited Feeding; Group B, Limited Feeding Time; Group C, Limited Feeding Time and Dewinged; Group D, Unlimited Feeding and Dewinged. Limited feeding time consisted of placing the feeders into the pens for two four-hour periods, eight hours apart, daily. Dewinging was done at hatching by removing one wing-tip at the first joint. It has been reported[1] that limited the feeding time may reduce aggressiveness during feeding. It has also been reported[2] that dewinging may reduce flightiness.

At intervals of two weeks the birds were weighed and these weights as well as the weights of feed consumed during the period recorded. In connection with the collection of these data the chicks were observed as groups to record the frequency of pecking as a measure of the postulated effects.

At six weeks of age the chicks were moved from the batteries to a brooder house. Each group was moved into a 10 by 10-foot pen, the pens containing the same equipment in as near the same arrangement as possible. Both the rearing treatments and the observations were continued at the new locations. At 10 weeks of age the cockerels were removed from each of the groups, since only the pullets

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[1] Wade Smith, D. V. M., personal correspondence.

[2] J. O. Coombs, personal correspondence.

were to be used in these studies. Both the cockerels and the pullets had been kept because there was no sexer available at the time of hatch. When the pullets were 20 weeks of age they were moved once more to give them more space; treatments were continued until the pullets were placed into the laying cages.

In the investigation of the effects of rearing treatments on the adaptation during replacement, three schemes of introduction to the cages were used: (1) Pullets were placed between and across from mature established cage hens; (2) Pullets were placed into cages as groups of pullets out of direct contact with established cage hens; and (3) Hens which were removed from cages to provide vacancies for the pullets were caged in new locations in new combinations of individuals. In this way all possible situations to which a replacement pullet might be exposed were tested for each strain within each treatment. Effects on the older hens as a result of being shifted and put into contact with new neighbors of the same strains also were tested. Observations were made on each replacement pullet and each shifted hen to record pecking, fighting, and withdrawal behavior as well as any other forms of social interaction that might occur.

## RESULTS

### Initial Introduction of Pullets to Cages

As the pullets were moved in from the range it was very apparent that those moved during the evening hours of semi-darkness were much less active, a factor which facilitated greatly the placing

of this group into cages. During the first day of observation the types of activity the study concerned were at a minimum, the birds seeming absorbed in adjusting to the new environment. Location of the feeders and waterers was readily learned; the birds encountering difficulty mainly with the footing the wire offered them.

Since each of the four central birds of each group was observed directly, it was necessary for the observer to place himself in front of the cages. The narrow aisle between the two rows of cages caused the observer to be very close to the birds. For the first few moments of each initial observation period the observer drew the full attention of the birds. This tendency to be distracted diminished within a few days.

Five rounds were made observing each of the four central birds of each group once per round, covering a time span of 15 days following caging. At no time was there sufficient interaction between any two individuals to cause one to be declared dominant over another (Table 1). Individual cages severely limited the possibility for the occurrence of interactions since the birds were exposed to pecking only when they were feeding or drinking.

Of all the interactions which took place during these observations, feather picking had the highest frequency at 2.0 per hour. If a feather protruded into the adjacent cage it was picked or pulled upon by the occupant of that cage. Pecks and threats delivered at the feeders and waterers placed second in occurrence with a frequency of .729 per hour. If a threat was delivered or received

Table 1. Rates of aggressive and submissive interactions following initial introduction of pullets into cages, by strains and treatments.

| Treatment | Ghostley 1/ | | Babcock | | Parmenter | | Total of all interactions | Hourly Frequency of all interactions 2/ |
|---|---|---|---|---|---|---|---|---|
| | P&T | A&S | P&T | A&S | P&T | A&S | | |
| 1. Careful handling Daylight | 0 | 0 | 0 | 0 | 15 | 10 | 25 | 1.56 |
| 2. Careful handling Night | 6 | 4 | 3 | 1 | 5 | 0 | 19 | 1.18 |
| 3. Usual handling Daylight | 2 | 2 | 0 | 0 | 4 | 2 | 10 | 0.63 |
| Total | 8 | 6 | 3 | 1 | 24 | 12 | 54 | 1.12 |

1/ The following abbreviations will be used in all tables unless otherwise specified.

P & T = Pecks and Threats delivered.
A & S = Avoidances and Submissions exhibited.

2/ Based on 16 hours of observation per group.

the recipient had only to retract its head into its own cage to avoid it; a received threat or peck followed by a retraction constituted an avoidance or submission (A&S). Avoidances and submissions placed third in frequency, occurring at the rate of .395 per hour. All such interactions diminished rapidly in frequency, and by the end of the second week interactions were at a rate of less than one per hour. Interactions were of such small magnitude that it was impossible to determine any behavior differences for strains or treatments.

## Rearing Treatments

Following hatching four groups were formed, each comprising of 18 Ghostleys, 18 Babcocks, and 28 Parmenters. Two of these groups were dewinged and all four groups reared similarly for the first two weeks. At two weeks of age the rearing treatments were started. By the end of the first week on the treatments it seemed that the birds on a limited feeding schedule were pecking at a slightly lower frequency (13.4/hour) than those on unlimited feeding (14.5/hour).

As feeding time approached in the limited feeding groups, pecking frequency increased, reaching its highest point just prior to feeding. When the feeders were placed in the pens all interactions ceased. Within the first hour following feeding the frequency of interactions gradually rose to a point equal to that of the full-fed groups.

When the young birds were moved to the brooder house at six weeks of age both the feeding treatments and the observations were continued. As the birds developed, the differences in aggressiveness between groups undergoing the two feeding treatments became less apparent. Since a sexer was not available at the time the chicks were hatched, it was necessary to rear all the chicks until the sexes could be separated on the basis of visual differences. With the removal of the males at the tenth week after hatching, the frequency of social interactions fell to an all-time low and remained at that point for the balance of the experiment. At no

time was there sufficient interaction in any of the groups to apply statistical treatment to the data collected (Table 2).

### Placing Established Cage Hens in New Combinations at New Locations

In preparation for the introduction of pullets from the rearing treatments to cages as replacements, every other hen was removed from the established cage groups. These hens were formed into new combinations of individuals at new locations. This procedure permitted the observation of hens in active egg production in revised combinations of individuals, and at the same time provided the necessary vacancies for the replacements.

In these new combinations of older hens, individual hen fights were relatively frequent during the first day. It was noted that when a fight began at the feeder or waterer, the hen under attack might retract into her cage and continue the fight through the screen (1 by 2 inch welded wire screen). A breed difference was apparent in these observations, as the Leghorns engaged in 2.4 to 5.9 times as many fights as did the Rhode Island Red strain (Table 3).

As in the initial pullet introductions, none of the fights appeared to establish the dominance of one individual over another. By the fifth day, interactions had all but ceased and observations were discontinued.

Table 2. Observed overall interaction frequencies for rearing treatments, by two week periods, from two weeks of age to caging.

| Rearing treatments | Observed Overall Interactions P&T + A&S | Interaction frequencies by weeks | | | | | | Hourly frequencies 1/ |
|---|---|---|---|---|---|---|---|---|
| | | 2-4 | 4-6 | 6-8 | 8-10* | 10-12 | 12-14** | |
| A. Full fed Normal | 35 | 12 | 9 | 11 | 3 | 0 | 0 | 4.38 |
| B. Restricted feeding Normal | 48 | 29 | 5 | 12 | 11 | 0 | 0 | 6.0 |
| C. Restricted feeding Dewinged | 30 | 10 | 8 | 9 | 3 | 0 | 0 | 3.86 |
| D. Full fed Dewinged | 49 | 17 | 13 | 16 | 3 | 0 | 0 | 6.13 |

* Males removed at the end of the tenth week.

** Observations were discontinued after the 14th week since interactions were at such low levels.

1/ Based on 8 hours (32 observations) per treatment.

Table 5. Rates of aggressive and submissive interaction observed when established hens of each strain were formed into new combinations of individuals of that strain.

| | Ghostley | | Babcock | | Parmenter | |
|---|---|---|---|---|---|---|
| | P&T | A&S | P&T | A&S | P&T | A&S |
| Totals | 11 | 5 | 31 | 11 | 5 | 2 |
| Hourly frequency 1/ | 2.0 | | 5.0 | | .85 | |

1/ Based on 32 observations per strain.

## Placement of Pullets Between Established Cage Hens

At 24 weeks of age four pullets of each strain were selected randomly from each of the rearing treatments and placed into the vacancies created in the groups of established hens of their respective strains. Each pullet was placed into a randomly assigned cage by routine handling.

When all the replacements were in their proper locations the lights were turned off. The following morning observations were begun as soon as the lights came on. Each pullet was observed daily for a 10-minute period, until the activity of all the pullets decreased to a stable minimum.

On the first day two rounds were made, observing each bird once per round. All the pullets were having difficulty with footing on the wire floors. The tendency for the established resident hens to threaten and peck the new introduced pullets was strong,

with nearly all the aggressive activity being directed by hens at pullets. In only one of the 182 interactions observed did a pullet antagonize a resident hen. In all other cases the pullet exhibited submissive behavior. Submissiveness was displayed primarily by the retraction of the pullet into her cage.

On the second day the quantity and severity of the attacks upon the pullets had decreased markedly, since the pullets had made the adjustment to the cages and now were adjusting to the hens in the neighboring cages. There was a strong tendency for the pullets to be cautious; they fed very little and appeared wary of any movement by neighboring birds.

No observations were made on the third day, due to power interruption at the farm which caused erratic lighting conditions in the building.

By the fourth day the pullets had adjusted to the cages, the neighboring hens, and other conditions of the house. They appeared much less cautious and wary, pecked resident hens occasionally, fed frequently, and were threatened and pecked by the resident hens no longer. It was decided at this point to discontinue observations.

Interactions for these pullets from the rearing treatments, when placed into cages, are shown in Table 4. The frequency of interactions was too small to permit the application of any statistical analysis.

### Introduction of Pullets to Cages as Strain Groups

Twelve pullets per strain were selected at random from the

Table 4. Rates of aggressive and submissive interactions following caging for replacement pullets, placed between resident hens, according to rearing treatment and strain.

| Rearing treatment | Ghostley P&T | Ghostley A&S | Babcock P&T | Babcock A&S | Parmenter P&T | Parmenter A&S | Total | Hourly frequency |
|---|---|---|---|---|---|---|---|---|
| A. Full fed Normal | 0 | 0 | 0 | 0 | 0 | 5 | 5 | .5 |
| B. Restricted feeding Normal | 3 | 0 | 4 | 1 | 3 | 3 | 14 | 1.4 |
| C. Restricted feeding Dewinged | 0 | 0 | 24 | 0 | 1 | 0 | 25 | 2.4 |
| D. Full fed Dewinged | 0 | 0 | 0 | 0 | 0 | 1 | 1 | .1 |
| Total | 3 | 0 | 28 | 1 | 4 | 9 | 45 | $\bar{x}$=1.1 |

remaining pullets, each of these groups of 12 containing birds from each of the rearing treatments. These groups were placed into blocks of cages, each cage in the block randomly assigned a number, and the pullets randomly assigned to the cages in the block. A 10-minute daily observation per bird failed to determine any interactions whatsoever in these groupings. When the same type of groupings was made at the start of this experiment with pullets from the range, there were some interactions observed. The small differences in the amounts of interactions observed in sections of the experiment might be attributed to the smaller groups and confined conditions under which the second group was raised.

## DISCUSSION

With the growing popularity of the caged-layer system numerous articles have been published discussing the relative merits of the caged system as compared to the more conventional floor-pen methods of keeping poultry. Some of these reports indicate that in some operations the slightly higher egg production shown by caged layers fails to offset the higher costs involved in the operation of a caged-layer plant (Adolph, 1956).

Cage systems which have one hen per cage automatically allow trapnesting all of the hens in the unit. Because of this, records may be kept on a per-cage basis rather than on the combined production of the flock as a unit. When a caged hen falls below a predetermined level of production, she is declared a cull and is removed from her cage to be replaced by a ready-to-lay pullet. Guides for culling are based on three basic patterns, i.e. egg records, physical appearance of the birds, and the combination of the two (Abplanalp et al, 1956) and (Rosenblatt, 1957). Each operator must decide for his own unit and conditions to which schemes of culling and to what level of production his operation will be geared.

This study is in strong agreement with the belief that one of the main advantages of the cage system is that new pullets can be added with very little difficulty due to social stress. Thus, the unit may be kept at full capacity and at a high level of production. With pen management this would not be practical, since

an extensive culling program, which would involve more labor, would be necessary to determine the low-producing birds of the flock. If new birds are added to an established flock they are attacked by the members of the resident flock. The reactions and behavior of established flocks to new birds has been investigated and reviewed adequately by several observers (Sanctuary, 1932; Scott, 1948; Bellah, 1957; Tindell and Craig, 1958).

A yearly turnover of from 70 to 80 percent of the birds in a cage operation is not unusual, and in some cases may exceed 100 percent (Adolph, 1953, 1954, 1956). The purchase of so many ready-to-lay replacement pullets represents a large investment on the part of the operator. Replacements form one of the keystones of a cage layer operation. Methods of management under which the replacement pullets are raised and introduced into the cages may have some effect on the adaptation of pullets to the cage environment.

The rearing treatments and systems of replacement used in this investigation failed to disclose any effect on the pullets' adaptation to cage conditions. Some interaction does occur in most cases, but it is not sufficient to warrant any concern. A certain amount of "bossism" does occur in cages, but it does not appear to have the latent detrimental effects that some of the more popular articles to recent years have attributed it with.

Some poultrymen are very reluctant to place a new pullet between two layers that have been in cages for some time. Hartman and King (1956), p. 182, state, "Even though the hens cannot peck

at the newcomer, their threatening attitude and sounds may worry the pullet so much that she has an inferiority complex. It affects her appetite. She doesn't eat as much as she should. It doesn't take long for her to become a cull." Both the results of this study and interviews conducted with successful commercial cage operators indicate that the threatening situation does exist, but only for the first few days following caging of the replacement.

When a pullet is first placed into a cage, she is under a handicap in that she is not familiar with her surroundings. If the adjacent birds are established cage hens the handicap is increased by virtue of the age difference and the superior numbers of the resident hens. Collias (1943) showed in pen flocks that either of these differences placed the new bird at a disadvantage in initial pair encounters. Both the results of this study and the interviews conducted indicate that this situation is present, but to a very small extent and for only a few days in the caged-layer system.

A new pullet first adapts to the physical characteristics of the cage, the difference in footing offered by the wire floor, and the limited movement possible in the cage. Location of the feed and water is readily learned. When the adjustment to the cage has been made, the bird begins to adjust to the neighboring individuals. If the adjacent birds are pullets undergoing the same initial adaptation, the adjustment takes a short time. Should the adjacent birds be established cage hens, the new pullets may be intimidated when they expose themselves at the feeders or waterers. In the latter

case the adjustment takes a few days longer; the pullets retract into the cages when antagonized, and because of this they feed less for the first few days. Observations from this experiment indicate that in a few days the pullets become adjusted to the situation and feed with little or no interference. Sanctuary (1932) observed that in pen flocks submissive birds may be pursued and the intimidation continued. Cage birds cannot be pursued once they have retracted into their cages, and as a result dominance-subordinance relationships are not as well established.

In the attempt to determine which, if any, management methods facilitated the adaptation of the pullets to the cages, the method of handling the pullet at the time of initial introduction to the cage was investigated. Carefully handling the birds and placing them gently into the cages did not alter their adjustment in comparison to those placed into cages in the conventional manner.

Placing pullets into the cages at night, as compared to placing them into the cages during the daytime, had no influence on the adaptation.

When replacements are to be added to a caged-layer operation one method the operator may use is to place his replacements into the cages as blocks or groups of pullets. This system seems to cause the least amount of interaction since all these pullets are making the same adjustment simultaneously. The pullet group system is discussed in detail by Abplanalp, et al. (1956).

When pullet block replacements were made in this investigation the levels of interaction were extremely low in birds that had been

reared on the range, and completely absent in pullets that had been reared in small pen flocks.

Another method is filling the vacancies created by the removal of culled hens. The pullet-between-hens system is in dispute; it sometimes causes considerable antagonism of the pullets, and the pullets' adaptation is slower than in the pullet block system. It was found that more antagonism of the replacements does exist in this system than in the pullet block method, but the antagonism decreases to nil in a few days with no adverse effect on the pullets or the neighboring hens.

Tenhulzen[1] found that by moving a few additional old hens so that the vacancies are in pairs, then placing the pullets into these paired vacancies, the pullets receive less interference than if they had hens pecking at them from both sides. If the pullet-between-hens system is to be used, conditioning the pullets to cages before placing them where they are needed may remove the disadvantage of unfamiliarity with the cage conditions (Hartman and King, 1956). This situation would be similar to that of reorganizing established cage hens, which is discussed below.

If the block or colony system is to be used it will be necessary to consolidate the remaining established hens. Moving hens into new combinations at new locations results in some individual hen fighting through the wire sides for the first day or two.

According to Hess (1958), the early experience of some animals

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[1] L. Tenhulzen, personal correspondence.

may have a profound influence on adult behavior. It was suggested by Coombs[1] that dewinging the chicks might reduce flightiness, and by Smith[2] that reducing the feeding time might reduce aggressiveness during feeding. Restricting the feeding time in the experiment did tend to reduce slightly the amount of interaction during feeding time but did not alter appreciably the overall frequency of interactions. Dewinging had no effect on flightiness, though there was a hint of a slightly lower pecking frequency in the pen that was both restricted and dewinged.

When the pullets from these rearing treatments were placed into cages, both by blocks and between hens, no differences in adaptation due to rearing treatments were evident. In none of these replacement systems investigated or discussed with cage operators was there any evidence for a decrease in egg production due to the introduction of replacement pullets.

Observations in this experiment are that the conditions of close confinement and semi-isolation found in the caged-layer system place the birds in a non-competitive situation and tend to eliminate the formation of a peck-order. These results are in agreement with the findings of McBride (1958) who reported that egg production of caged birds does not have the direct relationship to social status that Collias (1944) and Guhl (1953) found for floor-pen birds. Social interactions apparently are of very little importance in individually caged hens.

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[1] J. O. Coombs, personal correspondence.

[2] Wade Smith, D. V. M., personal correspondence.

## CONCLUSIONS

Three different methods of handling pullets during their initial introduction to laying cages apparently had no effect on the pullets' adaptation to the cages.

Following introduction to cages, pullets readily learned the location of the feeders and waterers. The major difficulty encountered by the new pullets was the difference in footing offered by the wire floors.

Pullets adapted to the cages first, then to the neighboring individuals. If the adjacent birds were other pullets, this adjustment took about two days; if they were established cage hens, the adaptation took about four days.

Restricting the feeding time of growing chicks appeared to reduce slightly the social interaction frequency during feeding but not the overall diurnal frequency.

Dewinging chicks had no apparent effect on the degree of flightiness during growth or following introduction to cages.

The four rearing treatments employed apparently had no effect on the adaptation of pullets to cages.

Reorganizing established cage hens into new combinations of individuals at new locations caused some fighting between hens for the first day or two.

When pullets, irrespective of rearing treatment or strain, were placed between established cage hens they were usually antagonized by the hens for the first four to five days of cage life.

In none of the interactions observed could the sustained dominance of one individual over another be considered established.

The conditions of semi-isolation in the caged-layer system apparently eliminate dominance-subordinance situations, since no free contact with other birds is permitted. Social behavior is present to a limited extent but is influenced by the cage environment reducing the intensity of agonistic behavior.

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# SOCIAL BEHAVIOR AND REPLACEMENT PROBLEMS IN CAGED LAYERS

by

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Social behavior and the effects it has on flocks of chickens has been investigated by numerous workers. The rising popularity of the caged-layer system has stimulated interest in the social behavior of these individually caged production birds. This investigation attempted to determine the effect of the caged-layer system on social behavior and to evaluate any effects that might express themselves.

Since replacement pullets are the foundation upon which the continuous operation of a cage unit depends this study concentrated on them. The factors concerned in the adaptation of the replacement pullets to the cage environment under several replacement systems; the influence of certain treatments during rearing on cage adaptation, and the effects of different methods of handling during initial introduction to cages were investigated.

Pullets adapt first to the physical factors of the cage itself and then to the individuals in the neighboring cages. If the adjacent birds are pullets making the same adjustment, then adaptation is relatively rapid. When pullets are placed between established cage hens there is a tendency for the pullets to be antagonized by the hens for the first few days of cage life. When pullets are placed into cages as groups there are very few interactions and the adaptation is more rapid than in the pullet-between-hens method of replacement.

Neither removal of one wing-tip at hatching or restricting the feeding time to two four-hour periods daily, during the growth period had any effect on the overall level of social activity during

rearing or following introduction to cages.

Extra care in handling pullets at the time of caging, both during daylight and evening hours, had no effect on adaptation to cages when compared to usual method of handling.

Reorganizing established cage hens into new combinations of individuals at new locations, as is done in the pullet block replacement system, causes some individual hen fighting at the screen for the first day or two following caging.

The conditions of semi-isolation found in the caged-layer system apparently eliminate the social order since no free contact between birds is permitted. Social behavior is present but the intensity of agonistic behavior is reduced by the cage environment. It is this condition which reduces certain management problems that arise from social interactions in floor pens of laying flocks.