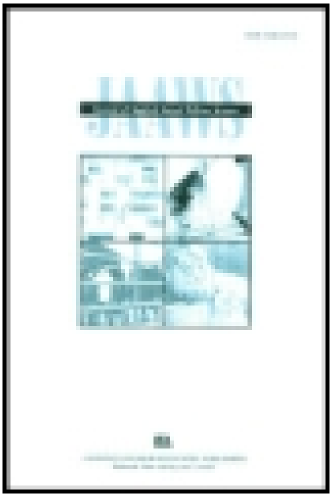

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Animal Welfare Issues in the Poultry Industry: Is There a Lesson to Be Learned?

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Many of the conditions in which poultry live and the procedures to which they are subjected compromise their welfare. This article describes these welfare problems in the hope that they may serve as warnings to the rest of animal agriculture, which then might take steps to avoid the same pitfalls. The article discusses poultry welfare problems under the headings of battery cages for laying hens, forced molting, disposal of spent laying hens, fast growth problems in meat poultry, catching and transportation, food restriction of broiler breeders, hyperaggressiveness in broiler breeder males, elective surgeries, and water-bath stunning.

Poultry are kept more intensively, both for meat and for egg production, than are animals in any other sector of animal agriculture. *Intensively* refers to the numbers of animals per production unit, the degree of crowding to which they are subjected, and the artificiality of the environment in which they are kept. As this article reveals, the poultry industry also has many animal welfare problems. The aim of this article is to describe these poultry welfare problems and how they have arisen and thus erect some warning flags for the rest of animal agriculture.

WELFARE PROBLEMS OF LAYING HENS

Battery Cages

The battery cage system for laying hens was one of the first intensive husbandry systems to come under criticism on animal welfare grounds (Harrison, 1964; Command Paper 2836, 1965). The criticisms have continued unabated (Singer,

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1990; A. J. F. Webster, 1995). In Europe, the movement against traditional cages has been so great that the European Union has approved a directive (Commission of the European Communities, 1999) to ban cages. This directive prohibits traditional battery cages from January 1, 2012. Only furnished or enriched cages will be allowed from 2012. In addition, no battery cages may be installed from January 1, 2003, and standards are set for all "alternative systems."

Despite all the criticisms of traditional cages, it should be remembered that there are some advantages to keeping hens in cages and that certain of these actually are welfare benefits. For example, the increased hygiene achieved through separating the hen from her feces results in a much lower incidence of diseases where the infectious agent is spread via the droppings (Duncan, 2000). In addition, the small group size in cages is much closer to the group size that hens prefer (Dawkins, 1982; Hughes, 1977; Lindberg & Nicol, 1993, 1996).

Nevertheless, there are many welfare problems associated with cages. Possibly, the biggest problem is the lack of a nesting site. Once nesting behavior triggers internal hormonal factors (Wood-Gush & Gilbert, 1975) hens are strongly motivated to find a suitable nesting site (Duncan & Kite, 1989) and will work hard to obtain one (Follensbee, Duncan, & Widowski, 1992). In addition, many hens, particularly those of light hybrid strains who are commonly used in North America, show symptoms of severe frustration in the prelaying period in cages (Mills, Duncan, Slee, & Clark, 1985; Mills, Wood-Gush, & Hughes, 1985; Wood-Gush, 1972).

The lack of space in battery cages reduces welfare by preventing hens from adopting certain postures—such as an erect posture with the head raised—and performing particular behavior, such as wing flapping (Dawkins & Hardie, 1989; Nicol, 1987a, 1987b). Apart from nesting behavior, the behavior systems that have been investigated the most are perching and dust bathing, and there is evidence that their prevention reduces welfare (Duncan, 2000). The lack of movement and exercise also contributes to bone weakness in spent laying hens (Leeson, Diaz, & Summers, 1995). In addition, of course, the lack of space means that hens are crowded together. All of the indications are that welfare is decreased (Hughes, 1975; Mashaly, Webb, Youtz, Roush, & Graves, 1984) at cage densities used in North America (450 cm^2 per bird in Canada and 350 cm^2 per bird in the United States).

The decision already has been made in Europe that the welfare problems of cages more than outweigh the advantages. What will happen in North America? It seems unlikely that there will be a ban on cages in the near future. However, cages may have to be modified to make them more welfare-friendly. There already is some interest in Canada in trying out some of the new European furnished cages (Appleby, 2000). There certainly will be an increasing market for noncage eggs.

The lesson here for other sectors of animal agriculture would seem to be that a look toward Europe is sometimes useful. In the field of animal welfare, North America seems to lag behind Europe by about 8 to 10 years. In the United States, for example, rodents and birds only now are being considered for inclusion in the

Animal Welfare Act, and birds are not included under the Humane Slaughter Act. In contrast, Europe is phasing out battery cages. Dry sow stalls already have been banned in some European countries, and a European Union phaseout is in progress. Wise North American producers should be taking note of these developments and planning their future husbandry systems accordingly.

Forced Molting

After laying eggs for about 1 year, commercial laying hens start to become photorefractory (unresponsive to long days), egg production starts to fall, and eggshell quality decreases. The bird's skeleton has been depleted of calcium through producing many eggshells and is fragile; the hen often is overweight. If hens were then exposed to short days, say of 8 hr, they would gradually go out of reproductive condition and would molt naturally. However, natural molting is a slow process, and there would be a wide range of times within a flock of hens for individual hens to complete the molt. Currently, the poultry industry is not prepared to accept this extended loss of production. At about 74 weeks of age, therefore, hens are sent to slaughter as "spent laying hens" (in Canada) or are "force-molted" (in the United States) to speed up the molting process and get the hens back into reproductive condition for a 2nd and sometimes a 3rd laying year.

Forced molting programs usually involve withholding feed for 10 to 14 days and simultaneously reducing day length (Leeson & Summers, 1991; North & Bell, 1990). Forced molting shortens the period of nonproduction to about 8 weeks but results in a huge increase in stress and suffering. A rather crude indicator of reduced welfare is increased mortality. During forced molting, mortality increases dramatically. Duncan and Mench (2000) cited Bell, who summarized molting results from 353 U.S. flocks during 1997 and 1998 and found that mortality typically doubled during the 1st week of molt, then doubled again during the 2nd week.

Apart from mortality, however, the evidence suggests that hens suffer enormously during forced molting. Hunger is an extremely powerful motivation, and chickens have evolved to forage and consume food throughout the day (Savory, Wood-Gush, & Duncan, 1978). Consequently, deprivation of food acts as a drastic stressor. Food deprivation results in a classical physiological stress response (Mench, 1991). Frustration of feeding leads to signs of extreme distress such as increased aggression (Duncan & Wood-Gush, 1971) and the formation of stereotyped pacing (Duncan & Wood-Gush, 1972). Extremely hungry birds also show stereotypic pecking at objects such as feeders (Hocking, Maxwell, & Mitchell, 1996; Kostal, Savory, & Hughes, 1992; Savory & Maros, 1993). In an experiment in which hens were deprived of food for 3 days, A. B. Webster (1995) found that cage pecking increased by a factor of 3 and feather pecking by a factor of 8. In a later study designed to simulate forced molting, A. B. Webster (2000) deprived hens of feed for 21 days. Hens subjected to this deprivation at first showed increased aggression and nonnutritive pecking suggestive of severe frustration and extreme hunger and, later, inactivity suggestive of debilitation (Duncan & Wood-Gush, 1971, 1972).

The rest of animal agriculture would do well to be wary of extreme procedures. For example, segregated early weaning of piglets at 10 to 14 days of age is an extreme procedure that very likely reduces welfare.

Disposal of Spent Laying Hens

Of all the animal welfare problems faced by the poultry industry today, the disposal of spent laying hens probably is the most serious (Newberry, Webster, Lewis, & Van Arnam, 1999). A spent laying hen is a hen at the end of her productive life. It is usually arranged—by manipulating body weight and day length—for laying hens to start laying eggs at approximately 20 weeks of age. They lay eggs for about 1 year, at which point decreasing egg numbers and eggshell quality mean that it is no longer profitable to continue. When the hens are about 74 weeks old, they either are sent for slaughter as spent laying hens or force-molted and kept for a 2nd laying year. The majority of hens are disposed of after this 2nd laying year; a small number of flocks may be force-molted again and kept for a 3rd laying year. No matter how many years they have been in lay, all laying hens are eventually slaughtered as spent laying hens.

It is difficult to gauge just how serious this welfare problem is. In a British survey, however, 29% of hens from battery cages were found to have freshly broken bones just before they were stunned, and most of this damage occurred as the birds were being removed from the cages (Gregory & Wilkins, 1989). Spent laying hens in North America are handled in the same way, so there is no reason to think that American statistics would be any better.

There appear to be three main reasons for this appalling statistic. First, hens kept in battery cages, even for 1 laying year, have very fragile skeletons (Knowles & Broom, 1990; McLean, Baxter, & Michie, 1986; Norgaard-Nielsen, 1990). There is such a high demand for eggshell calcium in modern laying hens that cortical as well as medullary bone is used as a source of calcium, which results, at the end of 1 laying year, in easily broken bones (Leeson et al., 1995). The bone weakness is exacerbated by lack of exercise in cages (Leeson et al., 1995). Second, traditional battery cages are poorly designed for the removal of hens. Small doors to the cages result in hens getting limbs caught as they are being removed. Modern European cages are designed so that the whole front opens up, resulting in a much lower risk of damage (Tauson, 1980, 1989). Third, spent laying hens are worth very little, and so no effort is made to handle them carefully. The combination of these three factors—fragile skeleton, poorly designed cage, and low value—results in an unacceptably high injury level.

Because only a few processing plants are prepared to accept spent hens, the problem is made worse by the often long journeys to slaughter. This means that injured hens may be in pain for long periods. When they reach the processing plant, their problems continue. The tetany and muscular spasms that accompany electrical stunning lead to further bone breakage in spent hens with their fragile skeletons (Gregory & Wilkins, 1989). To reduce this in countries where electrical stunning is practiced, there is a tendency on the killing line to reduce the intensity of the electrical stun. This increases the risk that some hens will not be stunned properly before slaughter. If they are not stunned properly, they do not assume the characteristic posture during tetany and face a bigger risk of missing the automatic cutting machine. Thus, they run a higher risk of entering the scalding tank alive and conscious (Duncan, 1997).

The disposal of spent laying hens is proving to be an intractable problem. It has been suggested that perhaps the hens should be killed in the barn and composted, but this gives a very wasteful image. The most humane way would be to kill the birds while still in the cages, say by gassing. However, the problem then is a mechanical one of removing bodies stiffened by rigor mortis from the cages. Because there also might be safety issues for humans associated with using a poisonous gas, there is some interest in developing a portable carbon dioxide gas-stunning and killing cabinet (A. B. Webster, Fletcher, & Savage, 1996) into which hens could be placed on removal from the cages.

The problem in North America could be eased by switching from light body-weight hybrid strains of laying hen to medium body-weight hybrid strains that are more robust and have more value as spent hens. However, these medium hybrid strains have been bred to produce brown eggs, and there is little current demand for brown eggs in North America.

The lesson here for other sectors of the livestock industry is that the welfare of "low-value" animals is at great risk and that safeguards need to be established for their protection. Probably, the animals most at risk are cull dairy cows, cull boars, cull sows, and any animals with reduced value due to some market quirk. The cost of humanely disposing of low-value animals must be factored into the costs of production for that commodity. For example, the only way found to protect the environment from the dumping of worthless used automobile tires is to add a charge for their disposal when they are bought as new tires. Similarly, the cost of humanely disposing of spent laying hens should be added to the price of eggs. Even if the cost were as high as $1 per hen, this only would amount to an additional cost of about .33 cents per egg.

WELFARE PROBLEMS OF MEAT POULTRY

Fast Growth Problems in Meat Poultry

There are reports of an increasing incidence of conditions such as skeletal deformities and ascites that accompany fast growth in meat strains of poultry (Julian, 1998; Leeson et al., 1995). *Ascites* is the condition that occurs when a rapidly growing bird has insufficient heart–lung capacity to supply all of the soft tissues with oxygenated blood. This leads to an increase in blood pressure, dilation and hypertrophy of the right ventricle, and leakage of serous fluid into the body cavity (Julian, 1998). Because these conditions cause the birds to suffer, they are both welfare and production problems. For example, there is evidence that these skeletal deformities are painful. When given a choice between two feeds—one of which contained an analgesic—broilers with gait abnormalities consumed more of the drugged feed than did broilers with no lameness. Moreover, the walking ability of lame birds was improved by this self-administered treatment (Danbury, Weeks, Chambers, Waterman-Pearson, & Kestin, 2000). In another experiment, the amount of spontaneous movement shown by male turkeys was increased greatly by the administration of a drug that reduces pain and inflammation in arthritic joints. These turkeys were later shown to have degenerative lesions of the hip joints (Duncan, Beatty, Hocking, & Duff, 1991).

The increasing incidence of fast growth problems such as these in meat strains of poultry indicate that we are reaching the biological limit of growth and that it is a mistake to think we can go on and on selecting for increased growth rate without costs to the bird. It also is a mistake to think that we somehow can find an environmental or nutritional solution to these problems. The long-term solution will be a genetic one. McMillan (2000) developed a computer simulation in which the effects of four different genetic selection procedures for growth rate and against incidence of ascites were compared. All of these procedures resulted in increased growth rate, but they also resulted in an increase in the level of ascites.

The primary breeding companies should heed this warning, stop selecting for increased growth, and try to add value to their strains of bird by some other means. Because the breeding companies assume that this would put them at a competitive disadvantage with their rivals, they, of course, are reluctant to stop selecting for fast growth.

The other sectors of the livestock industry should be wary of intense selection for fast growth. The swine industry, which is following the same pattern of genetic selection as the meat chicken industry, already is running into these problems (Grandin & Deesing, 1998). There also may be problems of selecting intensively for leanness in both swine and cattle (Grandin & Deesing, 1998).

Food Restriction of Broiler Breeders

Broiler breeders—the parent stock who produce broilers—have the same huge appetites as their progeny and have to be maintained on very severe food restriction so that they are able to reproduce. If allowed free access to food, they soon become obese and suffer from all of the problems of obesity, including low fertility and reduced life expectancy (Leeson & Summers, 2000; Renema & Robinson, 2000). Food restriction is carried out for a very good reason: to keep the birds in good reproductive condition and prevent them becoming obese, a condition that itself reduces welfare (Renema & Robinson, 2000). However, these food-restricted birds exhibit behavioral symptoms that indicate greatly reduced welfare (Mench & Falcone, 2000; Savory, 1989). Once again, the producer is in a dilemma. If the birds are fed to appetite, they will become obese and long-term welfare will be reduced; if they are restricted, then they show symptoms of hunger and extreme distress. It may be possible to alleviate the problem in the short term by diluting the diet with nonnutritive substances such as cellulose (Savory, Hocking, Mann, & Maxwell, 1996; Zuidhof et al., 1995). However, in the long term, the solution must be to develop parent stock with smaller appetites. When the primary breeding companies stop selecting for growth rate, perhaps this problem will be resolved.

The swine industry already has encountered this problem, with breeding sows having to be kept severely food restricted during gestation. There is evidence that it is the food restriction during gestation as much as the stall environment that leads to the development of stereotyped oral activities in sows in dry stalls (Appleby & Lawrence, 1987). In this case, it seems to be too late to learn from the poultry industry mistake.

Hyperaggressive Behavior in Broiler Breeder Males

A new problem emerged in the poultry industry in the 1990s. An increasing number of reports described broiler breeder males being very aggressive toward females (Mench, 1993). This is highly unusual because male domestic fowl dominate females passively and seldom show any overt aggression toward them (Wood-Gush, 1956). Because females are being harassed, badly injured, and even killed by males, this is a welfare as well as a production problem. Investigation has shown that most broiler breeder males of various strains are very aggressive toward females (Millman, Duncan, & Widowski, 2000). This cannot be explained in terms of a general increase in aggression, because game fowl males who have been bred for fighting and who are much more aggressive toward other males than are broiler breeder males (Millman & Duncan, 2000c) show little, if any, aggression toward females (Millman & Duncan, 2000b). The aggression is not caused by the males being food restricted during either the rearing phase (Millman & Duncan, 2000b) or the adult phase (Millman et al., 2000) and almost certainly has a genetic basis. It also has been shown that broiler breeder males are deficient in certain elements of courtship behavior (Millman et al., 2000). The result is that the females do not react appropriately when the males approach but move away and avoid them (Millman & Duncan, 2000a).

Now, we only can speculate how this problem has arisen. It is not clear whether the courtship deficiency and the hyperaggressiveness are separate or linked problems. It may be that these traits are linked genetically to some production trait, such as broad-breastedness, for which the breeding companies have been selecting. On the other hand, poor fertility is a problem with broiler breeders, particularly toward the end of the breeding year. It is widely thought within the poultry industry that this is due to decreased libido. However, it is actually due to the males being unable to achieve cloacal contact with the females because of their conformation (Duncan, Hocking, & Seawright, 1990). Therefore, the breeding companies may have been selecting males who approach females very quickly in the mistaken belief that they are very sexy. In fact, these males are aggressive.

The rest of animal agriculture should be very wary of intensive genetic selection for a particular trait without taking account of the animal's total biology.

GENERAL WELFARE PROBLEMS IN THE POULTRY INDUSTRY

Elective Surgeries or Mutilations

The poultry industry carries out several elective surgeries routinely. For example, most laying hens in North America are beak-trimmed or debeaked. Male chicks destined for breeding are often *dubbed*; that is, they have their combs trimmed so that the comb grows as a more compact mass and has a rounded top surface less likely to be damaged in adulthood (Leeson & Summers, 2000). Male turkeys usually are *desnooded* as chicks; that is, they have the fleshy protuberance that hangs over their beaks trimmed so that the shortened snoods are less likely to be damaged in adulthood. As chicks, broiler breeder males often have the tip of the third phalanx removed from the inside toe or the two inside toes with a hot blade so that they cause less damage to the hen when mounting her in adulthood (Leeson & Summers, 2000). Many turkeys, male and female, also have this surgery as chicks so that in adulthood they cause less scratching damage if they panic and clamber over one another. Therefore, the reason for all these surgeries is to prevent damage later in life. The appendages causing the damage (the beak or the toes) are modified so that they cause fewer injuries, and the appendages likely to be damaged (the combs and the snoods) are modified so that they are less likely to be injured.

It could be argued that all these surgeries are carried out for welfare reasons—to prevent pain and injury later in life. When these surgeries have been carefully investigated, however, welfare costs have been found that should be balanced against the benefits. This is illustrated best using the example of beak trimming or debeaking.

In fact, neither of these terms—beak trimming or debeaking—is strictly accurate. When the birds are in the growing phase, one third of the upper beak can be amputated using a sharp heated blade. Alternatively, a precision machine with a laser beam or a powerful electric spark can punch a hole in the beak when the birds are still chicks, and the end of the beak sloughs off a few days later. The beak of the fowl is well innervated and contains both mechanoreceptors and nociceptors (Breward, 1984). It has been shown that when the beak is partially amputated using a hot-blade debeaker during the growing phase (6–16 weeks), the severed nerves grow back into the damaged stump and form neuromas (benign fibrous tumors), which then send spontaneous pain signals back to the brain (Breward & Gentle, 1985). This seems similar to the phenomenon that causes phantom limb pain in human amputees.

In addition, behavioral changes suggestive of acute pain have been found to occur in the 2 days following surgery. These are followed by changes indicating chronic pain that last at least 5 or 6 weeks after the surgery (Duncan, Slee, Seawright, & Breward, 1989; Gentle, Waddington, Hunter, & Jones, 1991). This neural and behavioral evidence suggests that the idea of beak trimming being a short-lived discomfort may be far from accurate; beak trimming causes a reduction in welfare through causing pain. The problem is that beak trimming is carried out for the very good reason of preventing or controlling feather pecking and cannibalism, which can cause great suffering. The evidence suggests that it is not possible to control feather pecking completely by keeping hens in other, more extensive, environments (Appleby, Hughes, & Elson, 1992), that it has hereditary characteristics (Cuthbertson, 1980; Kjaer & Sørensen, 1997; Richter, 1954), and that unintentional genetic selection may have increased its incidence (Cuthbertson, 1980).

The long-term solution to this problem undoubtedly will be a genetic one. Muir and Craig (1998) showed that it is possible to select against feather pecking and cannibalism using a kin selection method. They kept groups of closely related hens with intact beaks in cage conditions likely to stimulate feather pecking and cannibalism. Any groups showing feather-pecking damage or damage from cannibalism were eliminated from the breeding program. Through this selection procedure, Muir and Craig produced a line of birds that they claim do not require beak trimming. The challenge will be to persuade the primary breeding companies to adopt such a procedure. If a breeding company were to start selecting against feather pecking and cannibalism, it would have to relax selection on at least some of the economic traits and, thus, put itself at a competitive disadvantage. Naturally, the breeding companies are reluctant to do this.

There has been little investigation into the welfare costs of the other elective surgeries carried out on poultry. However, Gentle and Hunter (1988) produced neuronal evidence suggesting that detoeing may be painful at the time of amputation but is less likely than beak trimming to be followed by chronic pain. There also are reports that toe clipping turkeys depresses growth rate and increases mortality (Newberry, 1992; Owings, Balloun, Marion, & Thomson, 1972), which is highly suggestive of decreased welfare.

Chopping off parts of animals that create a problem in modern intensive husbandry systems seems such a crude solution. The surgeries all are performed without anesthesia or analgesia and, at the very least, will cause some acute pain.

Other sectors of animal agriculture would do well to consider elective surgeries very carefully and be wary of introducing new surgeries such as tail docking of dairy cows. Are they all necessary? Are there alternative solutions? Could the surgeries be more humane?

Catching and Transportation

Of all the things we do to our animals on the farm, the things we do to them in the 24 hr before they are slaughtered reduce their welfare the most (Duncan, 1994). The surveys that have been carried out during catching and transportation have shown that this is just as true for poultry species as for other farm livestock (Broom & Knowles, 1989; Duncan, 1989). Birds often are injured during catching and crating, frightened by novel stimuli, stressed by disruptions to their social and physical environment throughout the catching and transportation process, and subjected to climatic extremes during transportation. Weeks and Nicol (2000) discussed these problems in detail.

A great deal of effort has gone into improving the whole catching and transportation process. For example, chicken-catching machines have been developed that pick up birds from the barn floor and very gently place them in transportation crates. This process causes much less stress and damage to the birds than does traditional manual catching (Duncan, Slee, Kettlewell, Berry, & Carlisle, 1986). In addition, transportation vehicles are being developed that monitor and control the environment of the birds to minimize stress (Mitchell, Carlisle, Hunter, & Kettlewell, 2000; Mitchell & Kettlewell, 1993). Ideally, the whole catching, transportation, and preslaughter system should be integrated with an automated catching machine placing birds in crates, modules of crates being placed on environmentally controlled trucks, and the crates moving straight into a gas-stunning unit at the processing plant (Kettlewell, Hampson, Berry, Green, & Mitchell, 2000). The challenge now is to get the poultry industry to adopt these methods; again, there will be a cost involved.

Other sectors of the livestock industry should look carefully at catching, transportation, and preslaughter management; there probably are better methods available.

Water-Bath Stunning

In most of the civilized countries of the world, poultry are stunned in a water bath before being killed by exsanguination. In Canada, more than 90% of all birds slaughtered, including meat chickens, spent laying hens, and turkeys, are stunned in this way. The exceptions are birds killed according to religious slaughter laws. In the United States, on the other hand, poultry are not included under humane slaughter laws, and a lower proportion of birds are electrically stunned.

Although water-bath stunning, when introduced about 40 years ago, represented a huge increase in welfare, it is far from ideal—not very efficient and not very humane (Duncan, 1997). When birds arrive at the processing plant, they are taken out of the crates in which they have been transported and hung by the legs on a shackle line. The line moves into the plant and over a water bath so that the birds' heads go into the water. An electrical potential between the line and the water should render every bird unconscious. However, the system contains many variables. Differences in the size of the birds, differences in the conductivity of the birds, changes in the conductivity of the water as it becomes dirty, and other variables all affect how much current travels through the birds' brains and, therefore, how well they are stunned (Duncan, 1997). There is much research going on to try to make this process more efficient and foolproof (Fletcher, 2000; Raj, 1998, 2000).

An alternative method of stunning poultry is gas or modified atmosphere stunning. This method uses the inert gas argon or a mixture of argon and carbon dioxide (Raj, 1993). It has many welfare advantages. Birds are stunned in the crates in which they have been transported, thus avoiding the stress of being shackled while conscious. Losing consciousness through anoxia is extremely quick and painless (Woolley & Gentle, 1988). There is no recovery. The birds actually are killed by anoxia before being shackled and bled. Switching from water-bath stunning to gas stunning would add a small cost to the final product. However, there are other commercial advantages. For example, the conditions for the people hanging birds on the shackles is much better as there is less noise, less dust, and more light. In addition, the workers can stand in a more ergonomically correct position. Compared with electrical stunning as it is used in Europe and Canada, gas stunning also gives a better quality product with less damage and bruising and allows for quicker further processing. Because the gas is inert, its use also means a very safe working environment (Duncan 1997; Raj, 1993).

The lesson here is that we should examine all slaughter procedures carefully; there may be better methods available.

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