


**The Humane Society Institute for Science and Policy**  
**Animal Studies Repository**

2007

# Welfare Issues with Selective Breeding of Egg-Laying Hens for Productivity

The Humane Society of the United States

Follow this and additional works at: [http://animalstudiesrepository.org/hsus\\_reps\\_impacts\\_on\\_animals](http://animalstudiesrepository.org/hsus_reps_impacts_on_animals)

 Part of the [Agribusiness Commons](#), [Animal Studies Commons](#), and the [Business Law, Public Responsibility, and Ethics Commons](#)

---

## Recommended Citation

The Humane Society of the United States, "Welfare Issues with Selective Breeding of Egg-Laying Hens for Productivity" (2007). *HSUS REPORTS*. 13.  
[http://animalstudiesrepository.org/hsus\\_reps\\_impacts\\_on\\_animals/13](http://animalstudiesrepository.org/hsus_reps_impacts_on_animals/13)

This Report is brought to you for free and open access by the Humane Society Institute for Science and Policy. It has been accepted for inclusion by an authorized administrator of the Animal Studies Repository. For more information, please contact [eyahner@humanesociety.org](mailto:eyahner@humanesociety.org).



## An HSUS Report: Welfare Issues with Selective Breeding of Egg-Laying Hens for Productivity

### Abstract

Today's commercial laying hens have been selectively bred to produce more than 250 eggs per year. This unnaturally high level of productivity is metabolically taxing, often causing hens to suffer from "production diseases," including osteoporosis and accompanying bone fractures, and can lead to reproductive disorders. Research suggests that the problem of osteoporosis may be worsening, possibly due to industry's continuous push toward maximizing productivity. For decades, economic considerations have been valued and emphasized over the welfare of individual birds. An immediate change in priorities is needed to aggressively address welfare problems associated with selective breeding for egg production.

### Introduction

In the United States in 2008, more than 76.8 billion table eggs<sup>1</sup> were produced by approximately 280 million hens,<sup>2</sup> predominantly raised in barren, restrictive battery cages.<sup>3</sup> Breeding programs for commercial laying hens typically focus on feed efficiency and productivity, and have dramatically altered the birds' rates of lay. Indeed, the red jungle fowl, the presumed wild ancestor of today's commercial breeds, lays only 10-15 eggs per year.<sup>4</sup> At the turn of the 20th century, hens produced 100 eggs per year,<sup>5</sup> but today's hen lays an average of 266 eggs annually, with some producing 300 or more.<sup>6</sup> These lightweight birds sustain their high rate of egg production for 1-2 years, with eggs increasing in size after the first laying cycle. Breeding hens for productivity without due regard to the animals' welfare nor the diseases that occur as correlated side-effects of artificial selection is a significant and fundamental animal welfare problem of the egg industry.\*

### Osteoporosis

In 2004, it was estimated that 80-89% of commercial egg-laying hens suffer from osteoporosis,<sup>7</sup> a disease characterized by altered bone volume and mineralization.<sup>8,9</sup> Bone is the metabolic reservoir for calcium used in egg shell production, and moving calcium from bone to egg shell leaves the hen prone to osteoporosis, subsequent bone fragility, and bone fractures.<sup>10</sup> Over a laying year, the amount of calcium that a hen deposits in her egg shells can be up to 20 times the amount retained in her body.<sup>11</sup> Osteoporosis is not in itself painful, but the associated bone fractures cause both acute and chronic pain.<sup>12</sup>

Osteoporosis due to bone mineral depletion is exacerbated by the hen's inability to exercise in a battery cage and may also be caused by nutritional inadequacy, but the problem is principally genetic in origin.<sup>13</sup> It is the result of breeding energetically efficient, lightweight birds who are able to maintain a high rate of lay over a prolonged period of time.<sup>14,15</sup>

---

\* For more information on the egg industry, see "An HSUS Report: The Welfare of Animals in the Egg Industry" at [www.hsus.org/web-files/PDF/farm/welfare\\_egg.pdf](http://www.hsus.org/web-files/PDF/farm/welfare_egg.pdf) and "An HSUS Report: A Comparison of the Welfare of Hens in Battery Cages and Alternative Systems" by Drs. Shields and Duncan at [www.hsus.org/web-files/PDF/farm/hsus-a-comparison-of-the-welfare-of-hens-in-battery-cages-and-alternative-systems.pdf](http://www.hsus.org/web-files/PDF/farm/hsus-a-comparison-of-the-welfare-of-hens-in-battery-cages-and-alternative-systems.pdf).

Osteoporosis-induced bone fractures may occur as hens are put into or pulled out of battery cages, during the laying period, or during transport for slaughter. Studies conducted during the 1990s estimated that the incidence of bone fractures for caged laying hens was 0-20%,<sup>16,17,18</sup> while more recent studies from 2004 and 2005 report 11-26%.<sup>19,20</sup> In a study published in 2003, bone fractures were the main cause of mortality in caged hens.<sup>21</sup> After 1-3 egg-laying cycles, productivity begins to wane, and hens are considered “spent.” When they are removed from their cages, 16-25% suffer from newly broken bones.<sup>22,23,24</sup> If hens are transported, unloaded, and shackled for slaughter, the proportion of birds with broken bones may increase, and studies have reported that up to 31% of hens have new bone fractures following this process.<sup>25,26</sup>

Based on limited data from cage-free flocks, the Scientific Panel on Animal Health and Welfare<sup>†</sup> noted that the problem of bone fractures due to osteoporosis appears to be worsening.<sup>27</sup> A 1991 study reported that free-range hens suffered old bone breaks, sustained during the laying period, at the rate of 2-42% while 11-30% of hens in perchery housing had old breaks.<sup>28</sup> Compared to estimates from 2004 and 2006 that put the incidence at 50-78%,<sup>29,30</sup> the earlier reports were much lower, although at least one recent study from 2004 reported no bone fractures at all for cage-free hens.<sup>31</sup>

Different hen strains vary in their susceptibility to weak bones.<sup>32,33</sup> Skeletal fragility is a production disease, an undesirable side-effect of selective breeding programs that focus primarily on productivity, and is not found in unselected lines<sup>34</sup> or heritage breeds.<sup>35</sup> Susceptibility to osteoporosis is moderately to strongly heritable,<sup>36</sup> and it is possible to selectively breed hens for stronger bones.<sup>37</sup> New strains show a six-fold decrease in humeral fractures after four generations, and two-fold increase in tibia strength after seven generations.<sup>38,39</sup> A scientific review of skeletal problems in both broiler (meat) and egg-laying chickens concluded that “[g]enetic selection seems to offer the best prospects for improving bone quality and resistance to osteoporosis in hens.”<sup>40</sup>

## Reproductive Problems

Consumer demand is greatest for extra-large and large egg sizes.<sup>41</sup> The production of these eggs by small birds is one factor that can lead to cloacal prolapse, a condition in which the outer end of the reproductive tract fails to retract following oviposition (egg-laying).<sup>42,43</sup> Normally, the shell gland (the lower part of the hen’s reproductive tract, the oviduct) is momentarily everted. However, muscle elasticity can become inadequate after a hen has laid many eggs, leaving a small portion of the oviduct to rest outside of the cloacal opening.<sup>44</sup> Cage-mates may peck at the prolapsed part of the oviduct, leading to hemorrhages, infection, cannibalism, and possibly even death in the hens suffering cloacal prolapse.<sup>45,46</sup> The provision of a nest box, as is practiced in non-cage housing systems, minimizes visibility of the cloaca during oviposition, and may reduce the likelihood that laying hens will become victims of cloacal cannibalism.<sup>47</sup>

Hormonal activity associated with heavy egg production is a factor predisposing hens to salpingitis, an inflammation of the reproductive tract caused by bacterial *E. coli* infection. In severely affected hens, the oviduct thins, and masses of caseous exudate (oozing material with a cheese-like consistency) form, which can expand and fill the body cavity, leading to further complications and eventually to the death the bird.<sup>48</sup>

Laying hens selectively bred for high egg production can also suffer from tumors of the oviduct. Adenomas (benign glandular tumors) and adenocarcinomas (malignant glandular tumors) are commonly found in commercial laying hens, possibly due to prolonged exposure of the oviduct to steroid sex hormones controlling egg production.<sup>49</sup>

---

<sup>†</sup> The Scientific Panel on Animal Health and Welfare is an advisory group within the European Food Safety Authority, an independent European agency that produces scientific opinions and guidance to and for European policies and legislation, the European Commission, European Parliament, and EU Member States.

## Longevity

After approximately one year of egg-laying, hens typically are either sent to slaughter, killed on-site, or are force-molted, a process of starving the birds for up to 14 days or temporarily feeding a diet that is deficient, in excess, or reduced in nutrients. Nutritional stress combined with changes in the lighting program induce the birds to molt—i.e., to lose their old plumage and grow a new set of feathers during a temporary period of reproductive quiescence. Egg production wanes as hens age, and “spent” hens are replaced after two or three (though rarely) laying cycles. While the life of a commercial laying hen is never more than approximately three years in length, some chickens, especially when not bred for extreme production, have a natural lifespan of 5-8 years and can live up to 30 years.<sup>50</sup>

## Conclusion

It would be unfair to say that breeding goals have never focused on animal health. Primary breeders have successfully lowered mortality rates and eradicated diseases such as lymphoid leucosis from pedigree chickens during the 1980s and 1990s.<sup>51</sup> As well, some breeding companies show interest in new technologies that could enhance their ability to select disease-resistant animals and some are actively selecting against behavioral abnormalities, such as cannibalism. Nevertheless, welfare improvements are compromised by the industry’s insistence on placing productivity before welfare. The ethical impact of current breeding practices deserves more serious consideration by breeding companies.

In the United States, virtually all egg-laying hens now come from strains produced by three primary breeding companies.<sup>52</sup> With support from the rest of the egg industry, these breeding companies could have a tremendous impact on the welfare of hens. As producers begin to switch from cage to cage-free egg production, the problem of osteoporosis and bone fractures will become an even greater concern. It is essential that breeding companies prioritize over all else, hen health and well-being.

---

<sup>1</sup> U.S. Department of Agriculture National Agricultural Statistics Service. 2009. Chickens and eggs: 2008 summary. <http://usda.mannlib.cornell.edu/usda/current/ChickEgg/ChickEgg-02-26-2009.pdf>. Accessed March 13, 2009.

<sup>2</sup> United Egg Producers. 2009. U.S. egg industry: general U.S. stats. [www.unitedegg.org/useggindustry\\_generalstats.aspx](http://www.unitedegg.org/useggindustry_generalstats.aspx). Accessed March 13, 2009.

<sup>3</sup> United Egg Producers. 2008. United Egg Producers Animal Husbandry Guidelines for U.S. Egg Laying Flocks, 2008 Edition (Alpharetta, GA: United Egg Producers). [www.uepcertified.com/media/pdf/UEP-Animal-Welfare-Guidelines.pdf](http://www.uepcertified.com/media/pdf/UEP-Animal-Welfare-Guidelines.pdf). Accessed June 18, 2009.

<sup>4</sup> Romanov MN and Weigandt S. 2001. Analysis of genetic relationships between various populations of domestic and jungle fowl using microsatellite markers. *Poultry Science* 80:1057-63.

<sup>5</sup> Ensminger ME. 1992. *Poultry Science*, 3rd Edition (Danville, IL: Interstate Publishers, p. 5).

<sup>6</sup> U.S. Department of Agriculture National Agricultural Statistics Service. 2009. Chickens and eggs: 2008 summary. <http://usda.mannlib.cornell.edu/usda/current/ChickEgg/ChickEgg-02-26-2009.pdf>. Accessed March 13, 2009.

<sup>7</sup> Webster AB. 2004. Welfare implications of avian osteoporosis. *Poultry Science* 83(2):184-92.

<sup>8</sup> Riddell C. 1992. Non-infectious skeletal disorders of poultry: an overview. In: Whitehead CC (ed.), *Bone Biology and Skeletal Disorders in Poultry*. Poultry Science Symposium Number Twenty-three (Oxfordshire, U.K.: Carfax Publishing Company, pp. 119-45).

<sup>9</sup> Whitehead CC. 2004. Overview of bone biology in the egg-laying hen. *Poultry Science* 83:193-9.

<sup>10</sup> Riddell C. 1992. Non-infectious skeletal disorders of poultry: an overview. In: Whitehead CC (ed.), *Bone Biology and Skeletal Disorders in Poultry*. Poultry Science Symposium Number Twenty-three (Oxfordshire, U.K.: Carfax Publishing Company, pp. 119-45).

<sup>11</sup> Whitehead CC, Fleming RH, Julian RJ, and Sørensen P. 2003. Skeletal problems associated with selection for increased production. In: Muir WM and Aggrey SE (eds.), *Poultry Genetics, Breeding and Biotechnology* (Wallingford, U.K.: CABI Publishing, pp. 29-52).

- 
- <sup>12</sup> Webster AB. 2004. Welfare implications of avian osteoporosis. *Poultry Science* 83(2):184-92.
- <sup>13</sup> Fleming RH, McCormack HA, McTeir L, and Whitehead CC. 2006. Relationships between genetic, environmental and nutritional factors influencing osteoporosis in laying hens. *British Poultry Science* 47(6):742-55.
- <sup>14</sup> Whitehead CC and Wilson S. 1992. Characteristics of osteopenia in hens. In: Whitehead CC (ed.), *Bone Biology and Skeletal Disorders in Poultry* (Oxfordshire, U.K.: Carfax, pp. 265-80).
- <sup>15</sup> Whitehead CC, Fleming RH, Julian RJ, and Sørensen P. 2003. Skeletal problems associated with selection for increased production. In: Muir WM and Aggrey SE (eds.), *Poultry Genetics, Breeding and Biotechnology* (Wallingford, U.K.: CABI Publishing, pp. 29-52).
- <sup>16</sup> Gregory NG, Wilkins LJ, Eleperuma SD, Ballantyne AJ, and Overfield ND. 1990. Broken bones in domestic fowls: effect of husbandry system and stunning method in end-of-lay hens. *British Poultry Science* 31(1):59-69.
- <sup>17</sup> Gregory NG, Wilkins LJ, Knowles TG, Sørensen P, and van Niekerk T. 1994. Incidence of bone fractures in European layers. *Proceedings of the 9th European Poultry Conference, Vol. II* (Glasgow, U.K.: pp. 126-8).
- <sup>18</sup> Gregory NG and Wilkins LJ. 1991. Broken bones in hens. *The Veterinary Record* 129(25-26):559.
- <sup>19</sup> Budgell KL and Silversides FG. 2004. Bone breakage in three strains of end-of-lay hens. *Canadian Journal of Animal Science* 84(4):745-7.
- <sup>20</sup> Sandilands V, Sparks N, Wilson S, and Nevison I. 2005. Laying hens at depopulation: the impact of the production system on bird welfare. *British Poultry Abstracts* 1:23-4.
- <sup>21</sup> Weber RM, Nogossek M, Sander I, Wandt B, Neumann U, and Glünder G. 2003. Investigations of laying hen health in enriched cages as compared to conventional cages and a floor pen system. *Wiener Tierärztliche Monatsschrift* 90(10):257-66.
- <sup>22</sup> Gregory NG, Wilkins LJ, Eleperuma SD, Ballantyne AJ, and Overfield ND. 1990. Broken bones in domestic fowls: effect of husbandry system and stunning method in end-of-lay hens. *British Poultry Science* 31(1):59-69.
- <sup>23</sup> Gregory NG and Wilkins LJ. 1989. Broken bones in domestic fowl: handling and processing damage in end-of-lay battery hens. *British Poultry Science* 30(3):555-62.
- <sup>24</sup> Sandilands V, Sparks N, Wilson S, and Nevison I. 2005. Laying hens at depopulation: the impact of the production system on bird welfare. *British Poultry Abstracts* 1:23-4.
- <sup>25</sup> Gregory NG and Wilkins LJ. 1989. Broken bones in domestic fowl: handling and processing damage in end-of-lay battery hens. *British Poultry Science* 30(3):555-62.
- <sup>26</sup> Gregory NG, Wilkins LJ, Knowles TG, Sørensen P, and van Niekerk T. 1994. Incidence of bone fractures in European layers. *Proceedings of the 9th European Poultry Conference, Vol. II* (Glasgow, U.K.: pp. 126-8).
- <sup>27</sup> Scientific Panel on Animal Health and Welfare. 2005. Opinion of the Scientific Panel on Animal Health and Welfare on a request from the Commission related to the welfare aspects of various systems of keeping laying hens. *The EFSA Journal* 197:1-23. [www.efsa.europa.eu/EFSA/Scientific\\_Opinion/lh\\_opinion1.pdf](http://www.efsa.europa.eu/EFSA/Scientific_Opinion/lh_opinion1.pdf). Accessed July 24, 2008.
- <sup>28</sup> Gregory NG and Wilkins LJ. 1991. Broken bones in hens. *The Veterinary Record* 129(25-26):559.
- <sup>29</sup> Nicol CJ, Brown SN, Glen E, et al. 2006. Effects of stocking density, flock size and management on the welfare of laying hens in single-tier aviaries. *British Poultry Science* 47(2):135-46.
- <sup>30</sup> Wilkins LJ, Brown SN, Zimmerman PH, Leeb C, and Nicol CJ. 2004. Investigation of palpation as a method for determining the prevalence of keel and furculum damage in laying hens. *The Veterinary Record* 155(18):547-9.
- <sup>31</sup> Fleming RH, McCormack HA, McTeir L, and Whitehead CC. 2004. Incidence, pathology and prevention of keel bone deformities in the laying hen. *British Poultry Science* 45(3):320-30.
- <sup>32</sup> Leyendecker M, Hamann H, Hartung J, et al. 2005. Keeping laying hens in furnished cages and an aviary housing system enhances their bone stability. *British Poultry Science* 46(5):536-44
- <sup>33</sup> Budgell KL and Silversides FG. 2004. Bone breakage in three strains of end-of-lay hens. *Canadian Journal of Animal Science* 84(4):745-7.
- <sup>34</sup> Rennie JS, Fleming RH, McCormack HA, McCorquodale CC, and Whitehead CC. 1997. Studies on effects of nutritional factors on bone structure and osteoporosis in laying hens. *British Poultry Science* 38(4):417-24.
- <sup>35</sup> Budgell KL and Silversides FG. 2004. Bone breakage in three strains of end-of-lay hens. *Canadian Journal of Animal Science* 84(4):745-7.

- 
- <sup>36</sup> Bishop SC, Fleming RH, McCormack HA, Flock DK, and Whitehead CC. 2000. Inheritance of bone characteristics affecting osteoporosis in laying hens. *British Poultry Science* 41(1):33-40.
- <sup>37</sup> Fleming RH, McCormack HA, McTeir L, and Whitehead CC. 2006. Relationships between genetic, environmental and nutritional factors influencing osteoporosis in laying hens. *British Poultry Science* 47(6):742-55.
- <sup>38</sup> Bishop SC, Fleming RH, McCormack HA, Flock DK, and Whitehead CC. 2000. Inheritance of bone characteristics affecting osteoporosis in laying hens. *British Poultry Science* 41(1):33-40.
- <sup>39</sup> Whitehead CC. 2004. Overview of bone biology in the egg-laying hen. *Poultry Science* 83:193-9.
- <sup>40</sup> Whitehead CC, Fleming RH, Julian RJ, and Sørensen P. 2003. Skeletal problems associated with selection for increased production. In: Muir WM and Aggrey SE (eds.), *Poultry Genetics, Breeding and Biotechnology* (Wallingford, U.K.: CABI Publishing, pp. 29-52).
- <sup>41</sup> Jacob JP, Miles RD, and Mather FB. 2000. Egg quality. University of Florida, Institute of Food and Agricultural Sciences, Cooperative Extension Service. <http://edis.ifas.ufl.edu/PS020>. Accessed July 24, 2008.
- <sup>42</sup> Keshavarz K. 1990. Causes of prolapse in laying hens. *Poultry Digest*, September, p. 42.
- <sup>43</sup> Alberta Agriculture and Rural Development. 2002. Common laying hen disorders: prolapse in laying hens. [www.agric.gov.ab.ca/livestock/poultry/prolapse.html](http://www.agric.gov.ab.ca/livestock/poultry/prolapse.html). Accessed July 24, 2008.
- <sup>44</sup> Keshavarz K. 1990. Causes of prolapse in laying hens. *Poultry Digest*, September, p. 42.
- <sup>45</sup> Alberta Agriculture and Rural Development. 2002. Common laying hen disorders: prolapse in laying hens. [www.agric.gov.ab.ca/livestock/poultry/prolapse.html](http://www.agric.gov.ab.ca/livestock/poultry/prolapse.html). Accessed July 24, 2008.
- <sup>46</sup> Newberry RC. 2004. Cannibalism. In: Perry GC (ed.), *Welfare of the Laying Hen*. Poultry Science Symposium Series 27 (Wallingford, U.K.: CABI Publishing).
- <sup>47</sup> Newberry RC. 2004. Cannibalism. In: Perry GC (ed.), *Welfare of the Laying Hen*. Poultry Science Symposium Series 27 (Wallingford, U.K.: CABI Publishing).
- <sup>48</sup> Barnes HJ, Vaillancourt JP, and Gross WB. 2003. Colibacillosis. In: Saif YM, Barnes HJ, Glisson JR, Fadly AM, McDougald LR, and Swayne DE (eds.), *Diseases of Poultry*, 11th Edition (Ames, IA: Iowa State Press, pp. 631-52).
- <sup>49</sup> Anjum AD, Payne LN, and Appleby EC. 1989. Oviduct magnum tumours in the domestic fowl and their association with laying. *The Veterinary Record* 125(2):42-3.
- <sup>50</sup> Wolfensohn S and Lloyd M. 2003. Birds. In: Wolfensohn S and Lloyd M (eds.), *Handbook of Laboratory Animal Management and Welfare*, 3rd Edition (Oxford, U.K.: Blackwell Publishing Ltd., pp. 365-79).
- <sup>51</sup> Flock DK, Laughlin KF, and Bentley J. 2005. Minimizing losses in poultry breeding and production: how breeding companies contribute to poultry welfare. *World's Poultry Science Journal* 61(2):227-37.
- <sup>52</sup> Arthur JA and Albers GAA. 2003. Industrial perspective on problems and issues associated with poultry breeding. In: Muir WM and Aggrey SE (eds.), *Poultry Genetics, Breeding and Biotechnology* (Wallingford, U.K.: CABI Publishing, pp. 1-12).

The Humane Society of the United States is the nation's largest animal protection organization—backed by 11 million Americans, or one of every 28. For more than a half-century, The HSUS has been fighting for the protection of all animals through advocacy, education, and hands-on programs. Celebrating animals and confronting cruelty. On the Web at [humanesociety.org](http://humanesociety.org).