Human–Wildlife Interactions 4(2):266–274, Fall 2010

Fate of captive-reared and released mallards on eastern Long Island, New York

CARRIE E. OSBORNE, State University of New York, College of Environmental Science and Forestry, 1 Forest Drive, Syracuse, NY 13210, USA *ceosborn@gw.dec.state.ny.us*

BRYAN L. SWIFT, New York State Department of Environmental Conservation, Bureau of Wildlife, 625 Broadway, Albany, NY 12233,USA

GUY A. BALDASSARRE, State University of New York, College of Environmental Science and Forestry, 1 Forest Drive, Syracuse, NY 13210, USA

***Abstract*:** We studied captive-reared mallards (*Anas platyrhynchos*; CRMs) released on eastern Long Island, New York, in 2006 to 2007 and 2007 to 2008 to determine: (1) survival rates of CRMs; (2) contribution to hunter harvest; (3) local movements; and (4) pair status, reproductive behavior, and production of CRMs. We banded and released 100 CRMs in November 2006 of which 20 were radio-marked. In November 2007, we banded and released 299 CRMs of which 60 were radio-marked. We used Program MARK to determine weekly survival estimates (0.53 to 1.00) up to 24 weeks after release; cumulative survival from November to May was 0.25. Seventeen percent (n = 17) of CRMs were reported harvested from 2006 to 2007, and 5% (n = 15) were reported harvested during 2007 to 2008. The median distance between harvest locations and release sites in both years was 3 km. CRMs intermingled with free-ranging waterfowl at town parks but tended to stay together in groups of 10 to 30 birds. We observed 22 pairs of CRMs, 2 pairs of CRMs with unmarked mallards, and 1 CRM with a brood. Overall, our data indicated that after some initial losses, many CRMs survived and settled in park settings where waterfowl were commonly fed by humans. Thus, CRMs appeared to contribute to feral waterfowl populations, which are a source of human–wildlife conflicts in many areas. Occurrence of CRMs in such settings also provides a means for disease transmission to free-ranging waterfowl.

Key words: *Anas platyrhynchos*, captive-reared, feral, human–wildlife conflicts, Long Island, mallard, New York, program MARK, survival

HUNTERS HAVE LONG BEEN INTERESTED in harvest of captive-reared and released mallards (*Anas platyrhynchos*; CRMs) made available on shooting preserves, which are widespread throughout the Untied States. Kouba (1976) defined shooting preserves as privately-owned-and-operated areas where captive-reared game is released to provide hunting opportunities without the constraints of state regulations. In 1911, New York became the first state to legalize shooting preserves. Intentional stocking of CRMs by the New York State Conservation Department during 1934 to 1952 was believed to be a principal factor in establishment of the mallard as a breeding species in New York (Foley et al. 1961); hence, many CRMs released today may survive and interact in some way with wild waterfowl populations.

Nearly a century after shooting preserves were legalized, there were an estimated 4,631 licensed shooting-preserves in the United States; 314 (7%) of these preserves released nearly 300,000 CRMs annually (U.S. Fish and Wildlife Service [USFWS] 2003). Numerous (64%) releases occurred in the Atlantic Flyway, and annual releases at some locations can be substantial. For example, a single shooting preserve in Maryland released some 37,000 to 122,000 mallards per year between 1981 and 1993, totaling 1.1 million birds (USFWS 2003). In New York, 85,000 CRMs were reported released on shooting preserves in 2005 (the most recent data available), of which 48,044 birds were reported harvested, 3,166 were still alive on the premises, and the fate of the remaining 33,457 birds was unknown at the end of the hunting season (B. L. Swift, New York State Department of Environmental Conservation, unpublished data).

Traditionally, most releases of CRMs on private shooting preserves were "tower shoots," where birds are released from a tower and shot at by hunters on the ground. Hence, most birds (about 70%; USFWS 2003) were shot immediately after release, limiting the number of birds mixing with wild populations. In 1985, however, a new interpretation of the USFWS regulations (50 CFR 21.13) for CRMs took effect, and shooting preserve owners began applying for permits to release "free-flighted," captive-

reared mallards (i.e., CRMs). This approach resulted in a larger number of released birds, fewer birds shot immediately (about 44%), and a greater number of escapees (USFWS 2003). A survey of state agencies found that 70% of shooting preserves in the Atlantic Flyway used free-flighted CRMs, compared to only 16% that used tower releases (Smith 1999). This increased number of surviving CRMs is significant because CRMs may increase the risk of disease transmission to wild populations, may hybridize with American black ducks (*Anas rubripes*), and may confound waterfowl surveys and databases (USFWS 2003).

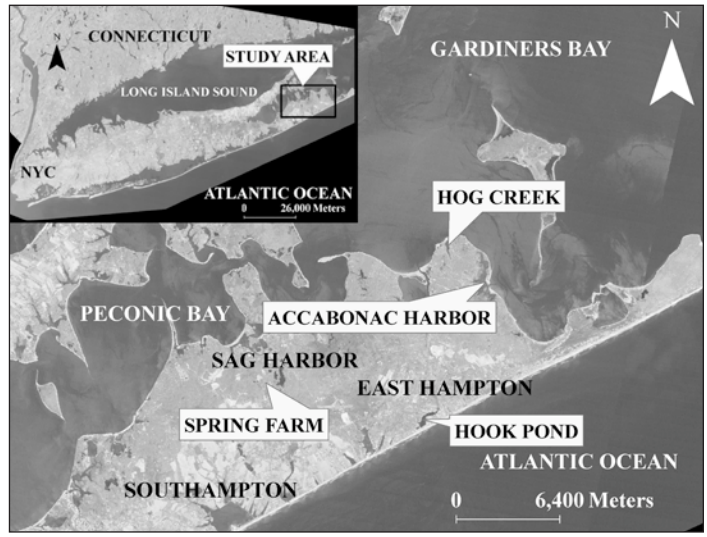

Figure 1. Study area in Township of East Hampton, Long Island, New York.

In New York, Long Island has been a center of CRM releases on the eastern seaboard for nearly a century. Currently, shooting-preserve owners and game-bird breeders release approximately 20,000 CRMs on eastern Long Island, many in or near habitats used by wild waterfowl populations (B. L. Swift, unpublished data). These habitats include marshes, bays, harbors, and shores that provide regionally important wintering waterfowl habitat for more than 30 species of waterfowl, with total numbers in the tens of thousands (Swift 2007).

To date, the only major field studies of CRMs were conducted in Minnesota (Schladweiler and Tester 1972) and Maryland (Soutierre 1989, Hindman et al. 1992, Smith 1999). However, habitat in these states is dramatically different from the Long Island habitat, which has hundreds of small urban ponds that dot the island and provide hunting-free areas where humans feed waterfowl. Long Island also has a long history of CRM releases, and interest in this activity seems likely to continue in the future. Hence, assessing the potential effects of CRMs on native waterfowl is of great interest to managers. Our objectives were to (1) determine survival rates, movements, and hunter harvest rates of CRMs and (2) assess pair-status and association with wild mallards and black ducks.

Study area

We conducted our research within the township of East Hampton on the south shore of Long Island, New York. East Hampton is a peninsula at the easternmost point of New York State (Figure 1). It is bordered to the south by the Atlantic Ocean, to the east by Block Island Sound, to the north by several bays emanating from Long Island Sound (including Gardiners Bay and Fort Pond Bay), and to the west by the town of Southampton. The landscape was a flat, coastal plain characterized by rich agricultural soil and associated farmland (Town of East Hampton 2005). The land use of East Hampton (180 km^2) was 38% residential development, 37% open space and permanently protected farmland, 14% commercial or industrial, and 11% vacant land (Town of East Hampton 2005). The town had many coastal bays, wetlands, and freshwater ponds, including many artificial feeding stations, such as shooting preserves and town parks, where visitors fed ducks.

We released CRMs during 2006 at 2 sites chosen because of their use as regular CRM release sites by the East Hampton chapter of Waterfowl U.S.A., which annually released approximately 300 mallards. Hook Pond (site 1) was located between the Atlantic Ocean and the village of East Hampton. Hunting was prohibited at this site due to its location within the village. The shoreline of the pond was residentially developed with large, well-kept

lawns, a golf course, natural shrub habitat, and sand dunes. Accabonac Harbor (site 2) was a 267-ha coastal bay and wetland complex with limited development, shallow open water, salt marsh, sand spits, and small wooded islands. Much of this site was owned by the Nature Conservancy or the Peconic Land Trust, and hunting was permitted. The distance between the 2 release sites was 8.6 km.

During 2007, we released CRMs at both 2006 release sites and at Hog Creek, which was also a release site used by Waterfowl U.S.A. Hog Creek was a small, tidal inlet on Block Island Sound. The shoreline consisted of a marina, lawns, small woodlots, and grasslands. Hunting was permitted at this site. The average distance between the 3 release sites was 7.7 km.

Methods

Acquiring and radio-marking captive-reared mallards

2006–2007 season. We purchased 100 CRMs of unknown age (67 males, 33 females) from Spring Farm in Sag Harbor, New York, in cooperation with the East Hampton chapter of Waterfowl U.S.A. Spring Farm was a state-licensed shooting preserve and game bird breeder. The farm annually releases more than 10,000 mallards on its own premises and was the main supplier of mallards to other shooting preserves and breeders in the area.

We banded all birds with colored plastic and metal leg bands (National Band and Tag Company, Newport, Ky.), each with unique identification numbers and a toll-free telephone number for harvest and other mortality reports. U.S. Fish and Wildlife Service bands are not permitted on CRMs. Additionally, we fitted 20 CRMs (10 males, 10 females) with a prong and suture radio transmitter (Model A4460, Advanced Telemetry Systems, Isanti, Minn.; Mauser and Jarvis 1991). Transmitters weighed 11 g, and a mortality switch was triggered after 10 hours of no movement. We released 50 birds (ten with radios, forty with leg-bands only) at each location (Hook Pond and Accabonac Harbor) on November 18, 2006, 4 days before opening of the hunting season. Mean weight of the birds was 1.23 kg.

2007–2008 season. We purchased 300 CRMs of unknown age from Spring Farm and banded 299 (148 males, 151 females) with colored plastic and metal leg bands. Mean weight of the birds was 1.18 kg. We fitted 60 birds (30 males and 30 females) with backpack 2-stage transmitters that weighed approximately 27 g and had a mortality switch triggered after 10 hours of no movement (Sirtrack Limited, Havelock North, New Zealand). We attached transmitters with a backpack harness made of Teflon ribbons (Malecki et al. 2001). Backpack-style harnesses were used the second year due to poor retention of prong and suture transmitters during 2006 to 2007. Approximately equal numbers of birds (20 with radios and 80 with leg-bands only) were released at Hook Pond, Accabonac Harbor, and Hog Creek on November, 21 2007, 8 days before the opening of the hunting season.

Tracking and field observations

After we released CRMs, we regularly checked the 3 release sites and numerous other locations in the towns of East Hampton and Southampton to collect visual and radio-telemetry data. We used a receiver and a car-top mounted antenna to locate radio-marked birds between sunrise and sunset. During the 2006–2007 season, we located radio-marked birds once per week for the first 4 weeks after release, 3 to 7 times per week from December, 18 2006, to April 25, 2007, and once per week from April 26 to May 29, 2007. During the 2007–2008 season, we located radio-marked birds 4 to 7 times per week from December 16, 2007, to May 6, 2008. Most birds were detected by homing with a Yagi antenna and radio receiver. We assigned date of death as the first date the mortality signal was located. The fates of radio-marked mallards were categorized as follows: (1) survived the 6-month study period, (2) died of a natural cause, (3) censored when fate became unknown, (4) harvested and reported to toll-free number, (5) returned to Spring Farm by homing after release, or (6) unreported harvest.

We used a 20× spotting scope or binoculars and *ad libitum* sampling methods to record the daily activities, associations with wild mallards and black ducks, pair status, and breeding efforts of radio-marked and banded-only CRMs. We conducted observations 4 to 7 times per week in the core area near East Hampton and once per month at sites distant from the core study area.

Data analysis

We used the known-fate binomial model in Program MARK to estimate weekly survival ($\hat{S}_i$, the maximum likelihood estimation) of radio-marked CRMs (Cooch and White 2008). This model was chosen because each radio-marked bird met 1 of the 3 following possible scenarios for a binomial known-fate design: (1) survived to the end of the study and was detected during each sampling occasion so that fate was known for each interval; (2) died during the study and the mortality signal and carcass were detected during the interval of death so that fate was known; and (3) survived up to a point that its fate was last known, at which time it was censored (i.e., removed from analysis).

Results

Survival of 2006–2007 CRMs

From 2006 to 2007, 4 (20%; 2 males and 2 females) of the 20 radio-marked CRMs lost their radios after 8 weeks but were identified by leg-band observations at town parks on or after May 10, 2007 (183 days). Two females (10%) were taken by hunters, 7 birds (35%; 4 males, 3 females) had radios that emitted mortality signals within 4 weeks of release but were not recovered, 4 birds (20%; 2 males, 2 females) emitted mortality signals after 8 weeks but were not recovered, and 3 (15%) were never located again after initial release. We experienced poor retention of the prong-and-suture transmitters, as evidenced by recovery of radios and observations of individual birds, so that data collected from radio-tagged birds released in 2006 were not included in the Program MARK survival analysis. Eleven radios (55%) were not recovered, but we could not determine if loss of the radio or actual mortality had triggered the signal.

Our observations of leg bands indicated that 17 (21%; 14 males and 3 females) of the 80 banded-only CRMs survived the field season to May 2007. Fifteen (19%; 10 males, 5 females) were reported harvested by hunters, 1 female was reported as a vehicle mortality, 1 female was killed by a predator, and 46 (57%; 33 males, 13 females) birds were recorded as fate-unknown.

Survival of 2007–2008 CRMs

From 2007 to 2008, we calculated survival estimates based on 58 radio-marked birds, including six not detected after release (Table 1). We used a known-fate model with 21 weekly intervals, the first of which was 4 weeks and the remainder equal to 1 week, due to the delayed onset of radio-tracking after the birds were released. The 4-week interval was accounted for in the model and was comparable to 1-week intervals.

The cumulative seasonal survival of radio-marked birds over the 6-month study period was 0.25 (SE = 0.06, 95% CI: 0.15-0.39), and weekly survival estimates ranged from 0.53 to 1.00 (Figure 2). Survival was lowest at 0.53 during the first 4 weeks (November 21, 2007, to December 18, 2007) after release when 26 radio-marked birds died and the fate of 6 birds was unknown. Survival ranged from 0.74 to 1.00 over the second 4-week period (December 19, 2007, to January 15, 2008) when 12 more birds died, and ranged from 0.92 to 1.00 over the third 4-week period (January 16, 2008, to February 12, 2008) when 4 more birds died. Survival was constant at 1.00 for the last 12 weeks of the study (February 13, 2008, to May 6, 2008); no birds died during that period. After 24 weeks, 11 radio-marked birds (19%) were confirmed alive. Among the mortalities noted above, 5 radio-marked birds (8%) were reported

Table 1. Fate of 58 captive-reared mallards (CRMs), radio-marked and released on Long Island, New York, November 2007.

Fate	Number	Comments
Survived	11	Survived the 6-month study period
Died of natural cause	32	Presumably died from predation or malnutrition
Censored	6	signals not located after release
Harvested	5	Reported to toll-free number
Returned to Spring Farm	2	Mortality signal located at Spring Farm
Unreported harvest	2	1 radio found with straps cut, 1 mortality signal tracked to private residence

harvested, and 2 (3%) were confirmed harvested but not reported (Table 1).

We could not calculate periodic survival estimates for banded-only birds due to insufficient resightings. However, we did observe 64 banded-only birds (27%) at the end of the initial 4-week interval, 70 (29%) during the second 4-week period, 75 (31%) during the third 4-week period, and 59 (25%) during the remaining 12 weeks of the study. Thus, at least 25% were confirmed alive after 12 weeks, when survival estimates for radio-marked birds became 100%. Ten (4%) banded-only birds were reported as harvested by hunters, but no other mortality data were collected from this group.

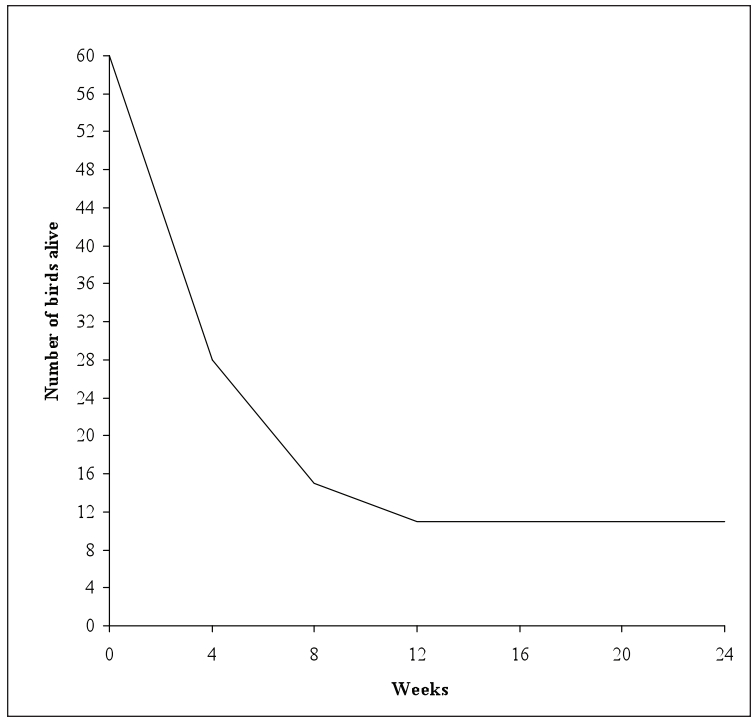

Figure 2. Mortality pattern of captive-reared mallards (CRMs) radio-marked and released on Long Island, New York, 2007–2008.

Harvest

Seventeen (17%; 2 radio-marked, 15 banded only; 10 males, 7 females) of all CRMs we released in 2006 were reported harvested during the 2006–2007 hunting season. Distance between the release and harvest site ranged from <1 to 17 km, with a median distance of 3 km. Fifteen (5%; 5 radio-marked birds and 10 birds banded-only; 8 males and 7 females) of all CRMs we released in 2007 were reported harvested during the 2007–2008 hunting season. Distance between the release and harvest sites ranged from <1 to 55 km, with a median distance of 3 km.

Associations with wild birds, pair status, and breeding

We observed CRMs mixed with unmarked mallards at several town parks, but CRMs generally tended to stay in their own group. Domestic ducks and geese were also residents of the town parks where many CRMs settled and engaged in typical mallard courtship behavior, including head pumping, nod-swimming, head-up-tail-up and 3-bird flights (Lebret 1961).

The breeding effort of CRMs at town parks was intense during April of 2006 and 2007. Forced copulations between and antagonistic displays among CRMs and unmarked mallards were common; however, copulation events were rarely observed between paired mates. Generally, CRMs tended to pair with CRMs, and unmarked male mallards generally paired with unmarked female malards. Only 2 CRM hens were observed paired with unmarked males versus 22 pairs of CRM hens paired with CRM drakes (eight in 2007 and fourteen in 2008). One hen from the 2007 release was seen paired with a male from the 2006 release. We observed only 1 CRM hen with a brood (July 2008), which included 7 juveniles that were near flight stage.

Discussion

Survival

Survival of CRMs was low within the first 4 weeks after release (i.e., 53% during 2007–2008). However, survival was high (>75%) over the next 8 weeks, and 100% for the last 12 weeks of the study. The overall survival of CRMs from November to May was close to 25%, suggesting that significant numbers of released birds persist in local areas. On Long Island, public feeding

and prohibition of hunting at town parks ensured high survival of CRMs that settled at these sites. Similarly, Smith (1999) found that survival of CRMs was high when they were released and fed on private shooting preserves versus state lands. The CRMs in our study were not intentionally provided supplemental food, but public feeding at town parts was common. Three CRMs that did not settle in a park were brought to a local wildlife rehabilitation center by the public and determined to be weakened from malnutrition; this suggests that some CRMs did not readily exploit natural foods in the environment.

Long Island is a densely-populated area, and CRMs released in natural wetlands are always in close proximity to human development where they may be fed. Park visitors provided CRMs with a reliable food source during this study, which allowed released birds to remain sedentary. Hence, CRMs in parks had abundant food and a reduced risk of hunting pressure or predation associated with natural wetlands. Stanton et al. (1992) stated that game-farm mallards in Maryland prospered in urban areas, parks, and some game preserves where food supply was plentiful and predation risk was reduced compared to other areas. Figley and VanDruff (1982) found that mallards in an urban New Jersey lagoon relied heavily on handouts from people as their primary food source and seldom left the lagoon

Harvest

Only 11% of all CRMs we released were reported shot by hunters, which is comparable to hunter return rates for CRMs elsewhere (Foley et al. 1961, Hindman et al. 1992). However, we believe the lower return-rate during 2007–2008 (5% versus 17% during 2006 to 2007) may have been due in part to intentional non-reporting. Several hunters we interviewed suggested the decrease in reported harvest in 2007 was related to possible concern of increase regulation of CRMs resulting from our study.

More than half of the radios we recovered were attached to a consumed carcass, but we could not determine if the birds were depredated or scavenged after death from another cause. Seventeen of the 32 carcasses were recovered in an area where hunting was permitted and may have been unretrieved hunting losses. However, we believe many birds became easy prey during the first few weeks after release. Schladweiler and Tester (1972) concluded that CRMs were more vulnerable to predation than wild birds because of their tameness, tendency to remain in large groups, and unfamiliarity with the release sites. Overall, CRMs appeared to somewhat boost local hunting opportunities, with most birds harvested within about 3 km of release sites.

Pairing and reproduction

Pairing among CRMs was evident in this study primarily among CRMs rather than between CRMs and unmarked wild birds. Behavioral barriers that influence courtship and pairing may exist that reduce genetic introgression among CRMs, wild mallards, and black ducks (Cheng et al. 1979, Kruijt et al. 1982). However, while pairing and courtship were not observed between these groups in this study, CRMs may have produced offspring through forced copulation with wild mallards at town parks. Black ducks were plentiful at the parks, but we did not observe courtship behavior, pairing behavior, or copulation events between black ducks and CRMs. Smith (1999) also noted that early breeding season pairing of CRMs, wild mallards, and black ducks was primarily assortative (i.e., occurring within groups rather than among groups). These results are important for managers because released CRMs have been identified as a potential contributing factor to declines in black duck populations due to hybridization (Johnsgard 1967).

Our data also support earlier evidence that CRMs do not enhance local breeding populations (Yerkes and Bluhm 1998). We did observe nesting attempts during both years, but only 1 CRM hen was observed with a brood. However, many of our CRMs were likely second-year birds in spring (hatched the same year we released them), which typically have low reproductive success. For example, hen success of second-year wild mallards in the St. Lawrence Valley of New York was only 11% (Losito et al. 1995). Even among unmarked park birds, only 4 broods were observed, so lack of CRMs with broods may have been due to factors other than low fitness for reproduction. Soutiere (1989) suggested that the large numbers and relative tameness of CRMs

released on game farms contributed to poor brood survival. Stanton et al. (1992) determined that survival and recruitment of CRMs at a game farm with managed wetlands were not sufficient to have maintained population levels without annual releases. Batt and Nelson (1990) reviewed the literature and found that CRMs had consistently lower breeding success than wild mallards, and that reproductive success of CRM hens did not improved with age. Despite these findings, annual releases of CRMs during 1934 to 1952 likely established the mallard as a breeding species in New York (Foley et al. 1961).

The tendency of CRMs to settle into parks and other locations where people enjoy feeding waterfowl is of management concern because CRMs that depend on human handouts sustain human interest in this activity; and, yet, supplemental feeding of wildlife has been debated by wildlife managers for many years (The Wildlife Society 2007). This practice encourages people, especially children, to take an interest in wildlife, but there are many negatives for waterfowl populations in urban areas, including poor nutrition, unnatural behavior and crowding, hybridization, water pollution, delayed migration, and spread of disease (see Heusmann 1988). Waterfowl are susceptible to many diseases, and when waterfowl are maintained in high densities, there is an increased risk of infectious disease transmission both within the group and to other species (Gilchrist et al. 2007). Hence, if CRMs are infected with a contagious disease (e.g., avian influenza) when released, the spread of that disease to wild waterfowl may be facilitated by the mixing and congregation of these groups at supplemental feeding sites.

The mallard is a potential vector of highly pathogenic avian influenza (HPAI) because of its ability to remain healthy when infected, while also excreting large amounts of the virus into the environment (Keawcharoen et al. 2008). Year-round resident ducks can act as a reservoir of Type A influenza viruses late into the season and potentially throughout the winter (Stallknecht et al. 1990, Clark and Hall 2006). For example, Slemons et al. (2003) tested wild, free-flying, nonmigratory waterfowl and captive-reared, free-flying mallards on the eastern shore of Maryland and found the frequency of AI virus isolates was 17% for CRMs versus 8% for wild mallards. In 2006, low-pathogenic forms of H5 and N1 avian influenza subtypes were detected in wild waterfowl in Michigan, Ohio, and Pennsylvania, as well as captive-reared and released mallards in Maryland (U.S. Geological Survey, National Wildlife Health Center 2006). Consequently, CRMs and nonmigratory park mallards provide an opportunity for early detection of avian disease and should be included in avian influenza surveillance programs. It may be prudent also for regulatory agencies to include annual sampling of CRMs before releases occur to ensure that no HPAI-infected birds are released into the wild.

Management implications

The 25% survival rate that we observed for CRMs would not likely sustain a wild breeding population. However, if that rate is typical of the tens of thousands of CRMs released in New York State that are not immediately harvested on shooting preserves, then, it represents a substantial annual stocking of birds that would still be alive the following year. Over a period of years, those survivors may account for a significant number of mallards observed in the environment. Currently, there is no easy way to distinguish surviving CRMs from normal wild mallards during standard waterfowl or harvest surveys, although individual studies show that releases of CRMs do provide some local hunting opportunities in the vicinity (i.e., within 3 km) of release areas. Such releases are not very cost-effective, as Hindman et al. (1992) documented during a large-scale mallard release program in Maryland; in that program, CRMS accounted for <6% of total duck harvest in that state at an estimated average cost of $43 per duck bagged. We obtained our CRMs for $15 each.

Acknowledgments

This study was funded by the New York State Department of Environmental Conservation (NYSDEC), including funds from Federal Aid in Wildlife Restoration Grant WE-173-G. We thank Spring Farm Shooting Preserve and the East Hampton chapter of Waterfowl U.S.A. for logistical support, and C. Kochanny (SirTrack, Inc.) for technical support. L. Masi (NYSDEC) assisted with banding, weighing, and release of CRMs in this study. S. Sheaffer (Livingston

Ripley Waterfowl Conservancy) provided assistance with Program MARK. M. Kaminski (Ducks Unlimited) assisted with attachment of radio transmitters to CRMs in 2006, as did R. Malecki (Livingston Ripley Waterfowl Conservancy) in 2007. Others assisting with attachment of radios were I. Gereg and M. Goodman (Livingston Ripley Waterfowl Conservancy), E. Rehm (SUNY-ESF), and G. Gagliano (NYSDEC). We also thank L. Penny (East Hampton Department of Natural Resources), and the many Long Island duck hunters who reported harvesting CRMs.

Literature cited

Batt, B. D. J., and J. W. Nelson. 1990. The role of hand-reared mallards in breeding waterfowl conservation. Transactions of the North American Wildlife and Natural Resources Conference 55:558–569.

Cheng, K. M., R. N. Shoffner, R. E. Phillips, and F. B. Lee. 1979. Mate preference in wild and domesticated (game-farm) mallards, part II: pairing success. Animal Behaviour 27:417–425.

Clark, L., and J. Hall. 2006. Avian influenza in wild birds: status as reservoirs, and risks to humans and agriculture. Ornithological Monographs 60:3–29.

Cooch, E., and G. White. 2008. Program MARK: a gentle introduction, <http://www.phidot.org/software/mark/docs/book>. Accessed March 8, 2010.

Figley, W. K., and L. W. VanDruff. 1982. The ecology of urban mallards. Wildlife Monographs 81.

Foley, D. D., D. Benson, L. W. DeGraff, and E. R. Holm. 1961. Waterfowl stocking in New York. New York Fish and Game Journal 8:37–48.

Gilchrist, M. J., C. Greko, D. B. Wallinga, G. W. Beran, D. G. Riley, and P. S. Thorne. 2007. The potential role of concentrated animal feeding operations in infectious disease epidemics and antibiotic resistance. Environmental Health Perspectives 115:313–316.

Heusmann, H W. 1988. The role of parks in the range expansion of the mallard in the Northeast. Pages 405–412 *in* M. W. Weller, editor. Waterfowl in winter. University of Minnesota Press, Minneapolis, Minnesota, USA.

Heusmann, H W. 1991. The history and status of the mallard in the Atlantic Flyway. Wildlife Society Bulletin 19:14–22.

Heusmann, H W., and R. Burrell. 1984. Park waterfowl populations in Massachusetts. Journal of Field Ornithology 55:89–96.

Hindman, L. J., W. F. Harvey IV, and V. D. Stotts. 1992. Harvest and band recovery of captive-reared mallards released by the state of Maryland, 1974–1987. Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies 46:215–222.

Johnsgard, P. A. 1967. Sympatry changes and hybridization incidence in mallards and black ducks. American Midland Naturalist 77:51–63.

Keawcharoen, J., D. van Riel, G. van Amerongen, T. Bestebroer, W. E. Beyer, R. van Lavieren, A. D. M. E. Osterhaus, R. A. M. Fouchier, and T. Kuiken. 2008. Wild ducks as long-distance vectors of highly pathogenic avian influenza (H5N1). Emerging Infectious Diseases 14:600–607.

Kouba, L. J. 1976. The evolution of shooting preserves in the United States. Professional Geographer 28:142–146.

Kruijt, J. P., I. Bossema, and G. J. Lammers. 1982. Effects of early experience and male activity on mate choice in mallard females (*Anas platyrynchos*). Behaviour 80:32–43.

Lebret. T. 1961. The pair formation in the annual cycle of the mallard, *Anas platyrhynchos*. Ardea 49:98–158.

Losito, M. P., G. A. Baldassarre, and J. H. Smith. 1995. Reproduction and survival of female mallards in the St. Lawrence River Valley, New York. Journal of Wildlife Management 59:23–30.

Malecki, R. A., B. D. Batt, and S. E. Scheaffer. 2001. Spatial and temporal distribution of Atlantic population of Canada geese. Journal of Wildlife Management 65:242–247.

Mauser, D. M., and R. L. Jarvis. 1991. Attaching radio transmitters to 1-day-old mallard ducklings. Journal of Wildlife Management 55:488–491.

Schladweiler, J. L., and J. R. Tester. 1972. Survival and behavior of hand-reared mallards released in the wild. Journal of Wildlife Management 36:1118–1126.

Slemons, R. D., W. R. Hansen, K. A. Converse, and D. A. Senne. 2003. Type A influenza virus surveillance in free-flying, nonmigratory ducks residing on the eastern shore of Maryland. Avian Diseases 47:1107–1110.

Smith, D. B. 1999. Survival, behavior, and movements of captive-reared mallards released in Dorchester County, Maryland. Dissertation,

Louisiana State University, Baton Rouge, Louisiana, USA.

Soutiere, E. C. 1989. Survival rates of hand-reared mallards released on 2 private farms. Journal of Wildlife Management 53:114–118.

Stallknecht, D. E., S. M. Shane, P. J. Zwank, D. A. Senne, and M. T. Kearney. 1990. Avian influenza viruses from migratory and resident ducks of coastal Louisiana. Avian Diseases 34:398–405.

Stanton III, J. D., E. C. Soutiere, and R. A. Lancia. 1992. Survival and reproduction of game-farm mallards at Remington Farms, Maryland. Wildlife Society Bulletin 20:182–188.

Swift, B. L. 2007. January waterfowl counts, 2005–2007, and some observations on long-term trends. Kingbird 57:198–213.

The Wildlife Society. 2007. Final TWS position statement: baiting and supplemental feeding of game wildlife species. The Wildlife Society, Bethesda, Maryland, USA.

Town of East Hampton. 2005. Town of East Hampton comprehensive plan, <http://www.town.east-hampton.ny.us/comp_plan.cfm>. Accessed March 8, 2010.

U.S. Fish and Wildlife Service. 2003. Review of captive-reared mallard regulations on shooting preserves, final draft. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Washington D. C., USA.

U.S. Geological Survey National Wildlife Health Center. 2006. Wildlife health bulletins: avian influenza, <http://www.nwhc.usgs.gov/publications/wildlife_health_bulletins>. Accessed March 8, 2010.

Yerkes, T., and C. Bluhm. 1998. Return rates and reproductive output of captive-reared female mallards. Journal of Wildlife Management 62:192–198.

CARRIE E. OSBORNE is a wildlife technician for the New York State Department of Environmental Conservation Bureau of Wildlife waterbird program.

BRYAN L. SWIFT is the game bird unit leader for the New York State Department of Environmental Conservation Bureau of Wildlife.

GUY A. BALDASSARRE is a distinguished teaching professor in the wildlife science program at the State University of New York, College of Environmental Science and Forestry, where he teaches courses in ornithology, waterfowl ecology, and wildlife ecology and management. He received his B.S. degree from the University of Maine, his M.S. degree from the University of Wisconsin–Stevens Point, and his Ph.D. (1982) degree from Texas Tech University. He is a past editor-in-chief of *The Journal of Wildlife Management* (1998–1999), author of *Waterfowl Ecology and Management* (1994; second edition, 2006), and editor of *Conservation Biology of Flamingos*, a special publication of the Waterbirds Society (2000).