

**REVIEW OF CAPTIVE-REARED MALLARD
REGULATIONS ON SHOOTING PRESERVES**

FINAL REPORT

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EXECUTIVE SUMMARY

As numbers of wild ducks declined and hunting opportunities became more restricted in the mid-1980s, interest in shooting captive-reared mallards on shooting preserves increased dramatically. In 1985, the U. S. Fish and Wildlife Service (Service) received a series of letters regarding the interpretation of regulations in 50 CFR 21.13 and the practice in Maryland of releasing captive-reared mallards in a free-flying condition on their State-licensed shooting preserves. Prior to this time, shooting preserves released flighted mallards from towers as a general practice to be shot immediately after release and maintained tighter control to prevent these birds from escaping to the wild. The Service responded to the State of Maryland by strictly reiterating the intent of these regulations, mainly "...that such birds may be killed by shooting, in any number, at any time, within the confines of any premises operated as a shooting preserve under State license, permit, or authorization." Since then, the practice of releasing captive-reared mallards on State-licensed shooting preserves has been more broadly interpreted to allow releases of free-flying birds. As a result of this de facto policy, the number of shooting preserves grew significantly in some areas. However, this practice has become more controversial as large numbers of these birds are being released into areas where they are free to intermingle with wild populations of migratory waterfowl.

At the urging of the four Flyway Councils and the International Association of Fish and Wildlife Agencies (now Association of Fish and Wildlife Agencies, AFWA), the Service was asked to conduct a review of the potential conflicts of releasing free-flying captive-reared mallards on State-licensed shooting preserves and to assess the resulting effects upon migratory waterfowl. With assistance from States and Flyway Councils, all aspects pertaining to enforcement of various regulatory statutes, genetic introgression, disease transmission, and impacts upon waterfowl management programs of wildlife agencies (e.g., population monitoring, banding, and harvest surveys) were examined during 2001-02, including authority and jurisdiction under the Migratory Bird Treaty Act (MBTA).

Based upon this review, the Service's Division of Migratory Bird Management concludes that releasing and shooting of captive-reared mallards on shooting preserves results in greater potential for violations of regulatory statutes, in particular, Federal waterfowl hunting regulations involving live decoys, baiting, over-bagging, and take of wild ducks out of season. The inability to distinguish between captive-reared and wild mallards in flight and the potential for problems caused by these birds intermixing, both on and off shooting preserves, are at the heart of law-enforcement issues regarding releases of free-flying captive-reared mallards on shooting preserves. If a hunter happens to take a wild duck on a shooting preserve, all hunting prohibitions will apply to that "take."

There is also evidence of increased risks of genetic introgression and hybridization, disease transmission, and confounding of established waterfowl-management databases that stem from these activities. The effects upon genetic diversity of, and hybridization with, wild ducks by captive-reared mallards are difficult to quantify at the population level. However, pairing and interbreeding of captive-reared mallards with wild mallards, black ducks, and mottled ducks have been documented. Small, isolated, non-migratory populations, such as mottled ducks in Florida, and perhaps some local breeding populations of black ducks and wild mallards in eastern United States, are most at risk. The genetic differentiation between mallards and black ducks has declined significantly during the past century, most likely due to hybridization. Captive-reared mallards are likely contributing to this breakdown, either directly by interbreeding with black ducks or indirectly through introgression into the wild mallard population that is interbreeding with black ducks. Thus, although the genetic impacts of captive-reared mallard releases on wild stocks are not readily apparent, the long-term effects of hybridization and introgression on the species integrity of mottled ducks, black ducks, and wild mallards should be of concern.

The threat of disease transmission is the primary concern among nearly all State wildlife agencies; however, determining the role of captive-reared mallards in the epidemiology of wild waterfowl

diseases is inherently difficult. Existing data on the topic are sparse, and as a result, documentation and illustration of disease transmission events in wild birds resulting directly from the release of captive-reared mallards are difficult. The primary concern however, when considering the importance of disease transmission in captive-reared mallard releases, is the risk associated with the activity. The potential for disease transmission dictates the precautions necessary for proactive and preventative management strategies. Diseases such as duck virus enteritis, avian influenza, and chronic wasting disease illustrate this disease potential and demonstrate the important role that captive-reared and free-ranging populations play in disease ecology.

Large-scale releases of captive-reared mallards in localized areas were found to affect waterfowl-management programs (e.g., population monitoring, banding, and harvest surveys) designed to track the status and harvest of migratory waterfowl, mainly in the Atlantic Flyway. For example, the estimated number of captive-reared mallards present in the Atlantic Flyway when the annual mid-winter waterfowl survey is conducted is more than half the total number of mallards counted during that survey, and captive-reared mallards may make up as much as 10 percent of the estimated total mallard breeding population in Atlantic Flyway States. These effects can introduce additional bias into important databases used by wildlife management agencies to manage our waterfowl resources. The less effective these databases become, the more difficulty and uncertainty these agencies have in making informed decisions regarding population status and trends, habitat utilization, and appropriate waterfowl hunting seasons. In addition, there are international waterfowl management concerns, since band-recovery data from free-flying mallard releases indicate that some of these birds are entering the wild population and being recovered in Canada.

While the intent of the regulation 50 CFR 21.13 was to allow privately-operated shooting preserves unlimited opportunity to shoot captive-reared mallards, provided there is a clear distinction from wild mallards, the Service's primary obligation is to safeguard migratory waterfowl protected under

the MBTA. Thus, our review suggests that there is sufficient ambiguity in the regulation 50 CFR 21.13, particularly as it relates to release methodology and containment of captive-reared mallards, to consider amending it or to devise corrective action to limit intermixing with wild migratory waterfowl. Clearly, it was not the intent of these regulations that private shooting preserves should in any way adversely affect our public migratory bird resources.

INTRODUCTION

Purpose

On June 1, 1993, the U.S. Fish and Wildlife Service (hereafter Service) published in the *Federal Register* (58 FR 31247-31249) a Notice of Intent (NOI) to review all aspects of regulations pertaining to the release and harvest of captive-reared mallards (*Anas platyrhynchos*) (Attachment 1). These regulations are specified in Title 50 of the Code of Federal Regulations, Part 21, Section 13 (50 CFR § 21.13), and pertain to harvest of captive-reared mallards on State-licensed shooting preserves (also known as Regulated Shooting Areas or RSAs). This NOI provided background information, informed the public of potential conflicts that may arise from these activities, and invited their participation. The review was postponed pending the completion of several studies. Upon completion of these studies, the Service published a subsequent NOI on August 28, 2001 (66 FR 45274-45275), announcing its intention to resume the review. This report is in fulfillment of those NOIs and represents the Service's efforts to gather and assess information pertaining to the potential conflicts associated with this issue.

Scope

This report is an assessment of potential conflicts regarding the management, health, and status of migratory waterfowl that may result from current regulations governing the release and harvest of captive-reared mallards on State-licensed shooting preserves (hereafter shooting preserves). This review does not address issues involving release and harvest of captive-reared mallards on areas outside of shooting preserves, where migratory bird hunting regulations apply.

“Migratory Birds” are defined in § 10.12, as meaning any bird, irrespective of its origin and whether or not raised in captivity (Attachment 2), which belongs to a species listed in §10.13, for the purpose of protection under the Migratory Bird Treaty Act (MBTA). Mallards are among those species

listed and, as defined, captive-reared mallards are protected under the MBTA and may be shot only in accordance with hunting regulations governing the taking of mallard ducks.

Regulations in § 21.13 allow captive-reared mallards, provided they are properly marked prior to 6 weeks of age by either removal of a hind toe, banding with a seamless metal band, pinioning, or tattooing, to be possessed and disposed of *except by shooting* in any number, at any time, by any person, without a permit. When so marked, such birds may be killed by shooting only in accordance with all applicable hunting regulations governing the take of mallard ducks from the wild, *with the exception* that such birds may be killed by shooting, in any number, at any time, within the confines of any premises operated as a shooting preserve under State license, permit, or authorization (Attachment 3).

BACKGROUND

Historical Perspective

Interest in shooting captive-reared mallards on shooting preserves increased dramatically during the mid-1980s when numbers of wild ducks declined and hunting regulations became more restricted to protect breeding populations. Private landowners on Maryland's Eastern Shore, who practiced releasing captive-reared mallards to be free-ranging, became increasingly frustrated with the loss of hunting opportunity associated with Federal regulations limiting the take of captive-reared mallards to seasons and bag limits set for wild mallards. In October, 1985 (Attachment 4), the Service was asked to send a letter to the Maryland Department of Natural Resources (DNR) to confirm the policy applying to shooting preserves (Maryland's terminology is Regulated Shooting Areas or RSAs) pursuant to regulations § 21.13. At that time, Maryland's regulations specified that the harvest of captive-reared mallards that were released to be free-ranging (hereafter referred to as "free-flying") could only occur within the regular statewide daily bag limits set in accordance with Federal regulatory frameworks (season dates and daily bag limits) established for wild mallards.

The Service responded to the Maryland DNR in a letter dated October 28, 1985, indicating that regulations contained in § 21.13 do apply to the confines of any premises operated as a shooting preserve under State license, which would allow captive-reared mallards to be killed by shooting, in any number, at any time of year (Attachment 5). However, this letter noted that “Wild birds may be killed in such situations only in circumstances that fully comply with the provisions of 50 CFR, Section 20, particularly Section 20.21(f) relating to live decoys, and Section 20.21(i) concerning baiting” and further noted that “full compliance with those laws may be difficult if captive-reared mallards are being fed or used as live decoys.”

In a follow-up letter dated November 21, 1985, the Maryland DNR indicated that as a result of this interpretation by the Service, it intended “to issue RSA licenses to individuals who wanted to release captive-reared mallards in a free-flying condition on their property” (Attachment 6). This interpretation of § 21.13, allowing “free-flying” captive-reared mallards to be taken in any number, at any time on shooting preserves is now recognized as de facto Service policy, but was never officially stated as such. However, as a result of this broader interpretation of § 21.13, interest in releasing and shooting free-flying, captive-reared mallards on shooting preserves expanded rapidly. The number of RSA permits in Maryland (including existing tower shoots) increased from 15 in 1985 to 132 in 1990 (Smith and Rohwer 1997).

Previously, shooting preserves taking captive-reared mallards in any number under regulations in § 21.13 were operated as “tower shoots” whereby captive-reared mallards are shot upon being released (note: hereafter defined as “flighted” releases). This release method consists of holding birds in pens until the release, and directing the flight of released birds past waiting gunners. The gunners are positioned on a flight path that leads to a pond, and released birds that are not shot land in the pond, whereupon they are trapped and taken back to pens or, if they are trained to do so, return to the pens by themselves. This method of release is cost-effective, since most birds are either shot immediately upon release or the

survivors later gathered up and contained for a subsequent release. Furthermore, the flighted release method contains captive-reared mallards and prevents them from intermingling freely with wild ducks, ensuring that few birds, if any, escape to the wild, thus minimizing any possible adverse effects on wild populations.

However, under the new policy interpretation, shooting preserves releasing free-flying mallards had an opposite effect, as much greater numbers (tens-of-thousands) of captive-reared mallards were released, fewer were shot directly, and the survivors were allowed to freely wander off the premises, increasing the potential to mix with wild ducks. Shooting preserves using the free-flying release method attempt to condition released birds to move freely among several impoundments on the preserve that serve as feeding and loafing areas. Once they are released, the birds are not trapped and put back in confinement, but the preserves maintain flooded grain crops that are intended to keep the birds on or near the preserve.

The Service prepared a fact sheet in 1986, providing information to the public regarding regulations governing the hunting of captive-reared mallards (Attachment 7). The information provided by the Service indicated that a conflict with Federal regulations prohibiting live decoys and baiting could result when captive-reared and wild ducks are both present and hunted on the same premises operated as a licensed shooting preserve.

Management Implications

As controversy surrounding the practice of releasing captive-reared mallards on shooting preserves intensified in the late 1980s and early 1990s, the four Flyway Councils and the International Association of Fish and Wildlife Agencies (now Association of Fish and Wildlife Agencies, AFWA) made several requests urging that the Service conduct a thorough review of all the information available and clarify the biological, regulatory, and enforcement conflicts pursuant to the management of migratory waterfowl (Attachment 8). The Service held a meeting attended by State and Federal personnel on

November 10, 1988, at the Patuxent Wildlife Research Center, Laurel, Maryland, to begin exploring the potential conflicts and management implications caused by the rapidly expanding interests in releasing large numbers of captive-reared mallards on shooting preserves. During the 1988-89 hunting season, more than 100,000 mallards were released on shooting preserves in Dorchester County, Maryland alone.

Because of concerns about conflicts with regulations prohibiting baiting and live decoys, and the potential for alteration of wild-stock genetics, introduction of disease, and confounding of management and data-collecting efforts, the Service proposed to review the regulations governing the release and harvest of captive-reared mallards on State-licensed shooting preserves in February 1992 (57 FR 43868). On June 1, 1993, the Service published a NOI (58 FR 31247) to inform the public of potential conflicts arising from these activities by providing background information, and to invite public comments (Attachment 1). Although the Service initiated the review and solicited input from State wildlife agencies and the public, the effort was suspended because of provisions attached to the 1994 Congressional Appropriations Bill requesting the Service to withhold promulgation of any new regulations until further studies were completed (Attachment 9). Accordingly, the Service suspended its review in March 1994.

The International Association of Fish and Wildlife Agencies, at its annual meeting in September 1999 (Attachment 10), and all four Flyway Councils by joint recommendation in July 2000 (Attachment 11), urged the Service to resume its review of the possible adverse effects of releasing captive-reared mallards into the wild for hunting purposes. Since the studies referenced in the language of the 1994 Congressional Appropriations Bill had concluded, the Service agreed to this request and published in the Federal Register on August 28, 2001 (66 FR 45274) a NOI to resume its review of § 21.13. The Service asked the Flyway Councils to assist with this review by providing information about the number of shooting preserves, those releasing captive-reared mallards, and the methods used in releasing mallards for shooting (Attachment 12). In addition, the Service requested information from its Regional Offices about the effects of captive-reared mallard releases occurring near National Wildlife Refuges or other

Federal lands, and from its Division of Law Enforcement regarding conflicts with enforcement of hunting regulations and the take of both wild and captive-reared mallards in areas where they come into close proximity, either on shooting preserves or adjacent habitats.

Applicable Regulations and Court Decisions

Several of the Service's regulations and some court decisions inform (but do not definitely resolve) whether (1) captive-reared mallards are protected as "migratory birds" under § 10.12, and (2) whether such birds become "wild" when released in free-flying situations and property rights are relinquished. In its regulations, the Service defines "migratory bird" (and "fish or wildlife") to "mean[] any bird, whatever its origin and whether or not raised in captivity, which belongs to a species listed in §10.13." 50 CFR 10.13 states that, "the following is a list of all species of migratory birds protected by the [MBTA] and subject to the regulations on migratory birds contained in this subchapter B of title 50 CFR." Thus, captive-reared mallards may be regulated under the MBTA by the Secretary of the Interior and administered by the Service because §10.12 and its reference to §10.13 include such birds raised in captivity as "migratory birds." This issue is particularly relevant, as the Service's responsibilities could be affected whenever releases of captive-reared mallards, indistinguishable from wild mallards, conflict with harvest management and hunting-regulations development, law-enforcement issues associated with existing baiting and live-decoy regulations, and the potential for transmission of disease between these groups.

The courts that have discussed this question have not conclusively resolved it: Koop v. United States, 296 F.2d 53 (8th Cir. 1961), United States v. Richards, 583 F.2d 491 (10th Cir. 1978), and United States v. Connors, 606 F. 2d 269 (10th Cir. 1979). The issue of control, or whether property rights are relinquished when captive-reared mallards are released in free-flying situations, was raised in Koop v. US. The court found that once Dr. Koop (the owner) released captive-reared mallards to the wild (free-flying), they were no longer under his control and no longer his property, and thus, reverted to ferae

naturae and property rights were destroyed. The court did not explicitly address what constitutes “release of control,” or whether ownership is retained following free-flying releases. But the court found that “[u]nder the circumstances existing on the ranch, therefore, it would seem perfectly clear that even the mallards raised by Dr. Koop, if they could have been identified or distinguished from the other ducks, were wild ducks within the meaning of the law and other regulations.” Koop, 296 F.2d 60.

In the 1978 10th Circuit case US v. Richards, defendant raised in captivity and sold kestrels, a species protected under 50 CFR 10.13. Though the case did not involve captive-reared mallards, its interpretation of the MBTA and the Secretary’s authorities may extend to captive-reared mallards. The court held that, “[t]he fact that captive birds do not migrate is immaterial. The question is whether the sparrow hawks which defendant sold belong to a species or group that migrate, not whether the particular birds migrate.” Richards, 583 F.2d at 495. The court later found that “[i]n the exercise of his statutory authority, the Secretary reasonably determined that the problems relating to captive birds required their inclusion within the definition of migratory birds.” Id., at 496. This opinion was not unanimous, with a dissent by Judge Logan.

However, in US v. Conners, again the 10th Circuit, the court held that “the provisions of the [MBTA] do not apply to the killing or attempted killing of “captive-reared” ducks.” This time, Judge Logan concurred with the majority opinion, with a new judge (who did not sit in the Richards case) dissenting. The Conners majority addressed the 10th Circuit’s earlier US v. Richards decision by distinguishing that “[n]one of the three treaties referred to in this case, and applicable in Richards, distinguish between “wild” and “captive-reared” kestrel or raptors... The unique fact that the treaties and regulations specifically refer to ‘wild ducks’ rather than simply ‘ducks’ distinguishes this case from Richards. Cf. Koop v. United States, 296 F. 2d 53, 59 (8th Cir. 1961.)” Conners, 606 F.2d 272, fn 4. The court was careful not to “question the authority of the [US FWS] to promulgate reasonable regulations designed to distinguish ‘captive-reared’ mallard ducks from ‘wild’ mallard ducks so as to

effectuate the intent of the treaties. See: e.g., 50 C.F.R. 21.13 (1977).” Connors, 606 F.2d 272. The Connors decision is limited only to the states within the 10th Circuit, so there may be a “split in the Circuits,” specifically with the 8th Circuit.

Regardless whether or not the MBTA applies to captive-reared mallards, the Secretary may promulgate regulations for captive-reared mallards to the extent that they have an effect on migrating mallards (which are without question protected under the MBTA). Under the authority delegated from the Secretary to the Service, the Service exercised that authority in 50 CFR 21.13, specifically under subsection (d), “When so marked, such live birds [captive-reared and properly marked mallard ducks] may be killed, in any number, at any time or place, by any means excepted shooting. Such birds may be killed by shooting only in accordance with all applicable hunting regulations governing the taking of mallard ducks from the wild: *Provided*, That such birds may be killed by shooting, in any number, at any time, within the confines of any premises operated as a shooting preserve under State license, permit or authorization....”

Louisiana State University Study Results

In 1989, a study proposal was submitted to the Service by Dr. Frank Rohwer, originally with the Appalachian Environmental Laboratory, University of Maryland System, Frostburg, Maryland, now with Louisiana State University, for partial funding to examine the survival, movements, habitat use, and pairing chronologies and interactions with other waterfowl, of captive-reared mallards (Attachment 13). This study was initiated in 1991 and received support from the Service, Maryland DNR, The Grand National Waterfowl Hunt Club, and The Past Shooters Association.

Results of the 3-year study conducted by Louisiana State University on RSAs in Maryland are described in a 1999 Ph.D. dissertation by David Smith (Attachment 14) and a paper published in the 1997 Transactions of the North American Wildlife and Natural Resources Conference by Smith and Rohwer

(Attachment 15). This study used radio-telemetry to examine the survival and movements of captive-reared mallards released in Maryland, and documented pair composition and social interactions between captive-reared mallards, wild mallards, and American black ducks (*Anas rubripes*, hereafter black ducks) based on direct observations of leg-banded birds. The study examined two main components of captive-reared mallard releases in Dorchester County, Maryland: (1) Maryland's State-release program, and (2) private releases on RSAs. Results from the State-release program indicated that more than 70 percent of the captive-reared mallards that were released died before the hunting season opened, largely because of nutritional deficiency. As a direct result of these findings, this program was discontinued by the Maryland DNR in 1993 for reasons of cost-effectiveness (Hindman et al. 1992, Smith and Rohwer 1997).

In contrast, mallards released free-flying on RSAs survived to the opening of the hunting season at rates exceeding 80 percent because of an active feeding program and managed habitats on the RSAs. Their overall survival probability from the release date to the end of the hunting season ranged from 0.32-0.54 (Smith 1999). Dispersal distances varied, depending on habitat available in proximity to the source RSA; ducks released on RSAs composed primarily of marsh habitat moved farther and had larger home ranges than those released on sites with more upland characteristics. Smith (1999) documented considerable movement of captive-reared mallards among RSAs and between RSAs and the Blackwater National Wildlife Refuge. The proportion of wild mallards on Blackwater National Wildlife Refuge decreased dramatically in January and February, while the number of mallards overall increased, based on refuge counts (Smith and Rohwer 1997). This indicates an influx of captive-reared birds onto the refuge from surrounding RSAs in late winter. Smith (1999) also observed wild mallards on RSAs, particularly in late winter; the proportion of mallards on RSAs that were wild birds increased from 2 percent in October to 25 percent in February.

Pairing appeared to be highly assortative (mating occurred more often within specific groups than among groups) between black duck and mallards (either wild or captive-reared) and between captive-

reared and wild mallards. From the sample of paired females of captive-reared origin, 86 percent were paired with males of the same origin, while only 13 percent were paired with wild male mallards. However, wild female mallards were observed more frequently with captive-reared male mates; 76 percent of wild females were paired with wild males, and the remaining 24 percent had captive-reared mates. Although Smith (1999) found a strong preference for assortative pairing rather than interspecific pairing between captive-reared mallards and black ducks, these findings were not gathered during the breeding season when hybridization is more likely to occur as the result of forced copulation or pairing during re-nesting (Ankney et al. 1987).

The Louisiana State University study provided some valuable insights into the survival, movements, and intra- and interspecific pairing of captive-reared mallards with wild mallards and black ducks. The results indicated that up to 50 percent of captive-reared mallards released free-flying on RSAs survived the hunting season, some of those survivors moved freely among RSAs and other habitats occupied by wild waterfowl, and some of them paired with wild mallards or, rarely, with black ducks. Thus, interactions between these groups on RSAs and surrounding areas in Maryland were not uncommon.

SURVEY RESULTS

In May 2001, the Service sent the wildlife agencies in the 48 contiguous States and Alaska a questionnaire concerning captive-reared mallard releases (Attachment 16). This questionnaire was distributed to the States through the Flyway Councils. Responses were compiled and used to estimate the extent and magnitude of captive-reared-mallard releases across the United States. Because of the number of shooting preserves in Maryland, more detailed information was gathered from records provided by the Maryland DNR. Additionally, a series of questions (Attachment 17) was sent to the Service's Regional Offices to determine what impacts were occurring on National Wildlife Refuges or other public lands.

State Agency Responses

All States except Alaska and Wyoming have State-licensed shooting preserves, 70 percent of which occur in the Atlantic and Mississippi Flyways (Table 1). Fewer than 10 percent (317 of 4,631, Table 1) of these preserves release captive-reared mallards for shooting, and the 317 preserves that do so are located in 27 States. Most of those States are in the Atlantic (12 States) and Mississippi (9 States) Flyways, and the greatest proportion of licensed shooting preserves releasing captive-reared mallards (86%) occurs in those 2 Flyways, mostly in the Atlantic Flyway (approximately 64%, Table 1). Two States with a combined total of 396 shooting preserves were unable to report the number of those preserves that release captive-reared mallards.

Table 1. Number of licensed shooting preserves and number of preserves releasing captive-reared mallards, by Flyway (data for 2001 or most recent prior year).

Flyway	Number of licensed shooting preserves		Number of licensed shooting preserves releasing captive-reared mallards		
	Number	No response ^a	Number	Unknown ^b	No response ^a
Atlantic	1,946	1	204	0	0
Mississippi	1,325	1	70	1	0
Central	902	0	6	1	0
Central/Pacific ^c	249	0	32	0	0
Pacific	209	0	5	0	0
Total	4,631	2	317	2	0

^a Number of States that did not include a response to this question.

^b Number of States that indicated that they did not have records to answer this question.

^c States that are divided between the Central and Pacific Flyways, i.e., Montana, Wyoming, Colorado, and New Mexico.

Methods of release were reported for 212 of the 317 shooting preserves releasing captive-reared mallards (Table 2). In the Atlantic Flyway, 80 percent of those use free-flying releases, whereas only 18 percent use the more traditional flighted mallard tower-release methods (Table 2). In contrast, 59 percent of the shooting preserves in the Mississippi Flyway utilize flighted mallard tower-releases and only 20 percent release free-flying birds. Thus, 88 percent of all free-flying release operations occur in the Atlantic Flyway. There were relatively few licensed shooting preserves that release captive-reared mallards reported in the Central and Pacific Flyways (Table 2).

Table 2. Number of licensed shooting preserves using tower, free-flying, and other release methods, by Flyway (data for 2001 or most recent prior year).

Flyway	Release method			Total	States w/o data ^b
	Tower	Free-flying	Other ^a		
Atlantic	29	128	3	160	1
Mississippi	26	9	9	44	2
Central	0	1	0	1	3
Central/Pacific ^c	0	4	0	4	1
Pacific	0	3	0	3	0
Total	55	145	12	212	7

^a In the Atlantic Flyway, these operations hand throw or use “launchers” to release birds. In the Mississippi Flyway, a “hybrid” method where birds are kept on a home pond, captured before the shoot, released, and allowed to fly to their home pond.

^b Number of States that indicated that they did not have records to answer this question.

^c States that are divided between the Central and Pacific Flyways, i.e., Montana, Wyoming, Colorado, and New Mexico.

In the Atlantic Flyway, the estimated number of captive-reared mallards released annually in free-flying situations is similar to the number released from flighted tower-release operations (Table 3). However, 53,000 birds released in New York could not be classified by release method. Most of these releases probably were controlled, tower-release operations, since most shooting preserves are located in upstate New York, which would not be conducive to maintenance of free-flying flocks (B. L. Swift, New

York Department of Environmental Conservation, personal communication). In the Mississippi Flyway, the clear majority of birds released annually on shooting preserves is from tower-release operations (Table 3). More than 270,000 captive-reared mallards are released annually on shooting preserves in the United States, of which more than 210,000 (approximately 79%) are released in the Atlantic Flyway (Table 3). Because records from several States were not available or incomplete, Table 3 does not include data from at least 85 shooting preserves that release captive-reared mallards. The average number of captive-reared mallards released annually per shooting preserve exceeds 1,000 (Tables 2 and 3), thus, the actual nationwide total is probably well over 300,000 birds.

Table 3. Number of captive-reared mallards released on licensed shooting preserves using tower, free-flying, and other release methods, by Flyway (data for 2001 or most recent prior year).

Flyway	Release method				Total	States w/o data ^b
	Tower	Free-flying	Other ^a	Unknown		
Atlantic	76,235	83,223	2,300	53,413	215,171	0
Mississippi	33,963	3,300	10,710	0	47,973	3
Central	0	100	0	32	132	2
Central/Pacific ^c	0	0	0	0	0	2
Pacific	0	10,000	0	0	10,000	0
Total	110,198	96,623	13,010	53,445	273,276	7

^a In the Atlantic Flyway, these operations hand throw or use “launchers” to release birds. In the Mississippi Flyway, a “hybrid” method where birds are kept on a home pond, captured before the shoot, released, and allowed to fly to their home pond.

^b Number of States that indicated that they did not have records to answer this question.

^c States that are divided between the Central and Pacific Flyways, i.e., Montana, Wyoming, Colorado, and New Mexico.

At least 60 percent of the harvest on shooting preserves (excluding those for which release method is unknown) is derived from the flighted mallard tower-release method in each of the two eastern Flyways (Table 4). Also, harvest data from shooting preserves are not readily available for 20 percent of the States, including 3 that did provide data on the number of mallards released.

Table 4. Number of captive-reared mallards harvested on licensed shooting preserves using tower, free-flying, and other release methods, by Flyway (data for 2001 or most recent prior year).

Flyway	Release method				Total	States w/o data ^b
	Tower	Free-flying	Other ^a	Unknown		
Atlantic	56,142	34,369	1,140	36,900	128,551	0
Mississippi	19,663	1,399	8,131	0	29,193	5
Central	0	0	0	0	0	3
Central/Pacific ^c	0	0	0	0	0	2
Pacific	0	8,000	0	0	8,000	0
Total	75,805	43,768	9,271	36,900	165,744	10

^a In the Atlantic Flyway, these operations hand throw or use “launchers” to release birds. In the Mississippi Flyway, a “hybrid” method where birds are kept on a home pond, captured before the shoot, released, and allowed to fly to their home pond.

^b Number of States that indicated that they did not have records to answer this question.

^c States that are divided between the Central and Pacific Flyways, i.e., Montana, Wyoming, Colorado, and New Mexico.

The apparent harvest rates (number harvested/number released) differed by release method (Table 5). A higher percentage (approximately 69%) of the birds released from tower settings were harvested than those released in free-flying situations (approximately 45%). Thus, the apparent harvest rate of tower-released, flighted birds was about 1.5 times that for free-flying birds. Apparent harvest rates for the birds released in New York with “unknown” release methods (and for 10,000 unclassified releases in the Mississippi Flyway) are more similar to those for tower-released birds than free-flying released birds (Table 5), which supports the contention that these likely were tower-type releases.

Table 5. Apparent harvest rates of captive-reared mallards released and harvested on licensed shooting preserves using tower, free-flying, other, and unknown release methods, by Flyway.

Flyway	Tower	Free-flying	Other ^a	Unknown
Atlantic	0.736	0.413	0.496	0.691
Mississippi	0.579	0.424	0.759	N/A
Central	N/A	0.000	N/A	0.000
Central/Pacific ^b	N/A	N/A	N/A	0.000
Pacific	N/A	0.800	N/A	N/A
Total	0.688	0.452	0.713	0.690

^a In the Atlantic Flyway, these operations hand throw or use “launchers” to release birds. In the Mississippi Flyway, a “hybrid” method where birds are kept on a home pond, captured before the shoot, released, and allowed to fly to their home pond.

^b States that are divided between the Central and Pacific Flyways, i.e., Montana, Wyoming, Colorado, and New Mexico.

In accordance with the statutes outlined in § 21.13, most States across the country (67%) have regulations that allow licensed shooting preserves to harvest captive-reared mallards in excess of daily bag limits for wild ducks, or outside of their regular duck-season dates (Table 6). This includes 24 of the 27 States in which some shooting preserves release captive-reared mallards, and 9 of the 22 States in which no preserves currently release mallards. Of the 4 States that did not provide this information, only 1 has shooting preserves that release captive-reared mallards.

Table 6. Number of States in each Flyway that allow or do not allow shooting preserves to harvest captive-reared mallards in any number and/or during periods outside the regular hunting season for wild ducks.

Flyway	Allow	Do not allow	Unknown ^a
Atlantic	11	6	0
Mississippi	12	2	0
Central	5	1	0
Central/Pacific ^b	1	1	2
Pacific	4	2	2
Total	33	12	4

^a Number of States that did not provide this information.

^b States that are divided between the Central and Pacific Flyways, i.e. Montana, Wyoming, Colorado, and New Mexico.

Most States (61%) did not limit the location of licensed shooting preserves relative to the distribution of migratory ducks (Table 7). Some States specifically prohibited the operation of shooting preserves on or near natural wetland habitats and prohibited the attraction of wild waterfowl to the premises. Recent regulatory changes in Maryland no longer permit RSAs to release or feed birds on tidal wetlands. Several States indicated that they have adopted State laws either prohibiting the releases of captive-reared mallards on shooting preserves or strictly regulating their release and harvest methodology. However, many States commented that they did not have good records or closely track the release and harvest of captive-reared mallards.

Table 7. State responses, by Flyway, to the question, “Do you limit the locations of shooting preserves releasing captive-reared mallards relative to the distribution of wild ducks?”

Flyway	Yes	No	Not applicable ^a	No response ^b
Atlantic	2	13	2	0
Mississippi	5	7	1	1
Central	1	4	1	0
Central/Pacific ^c	0	3	0	1
Pacific	2	3	1	2
Total	10	30	5	4

^a Number of States that indicated that this question is not applicable, e.g. they do not allow release of mallards.

^b Number of States that did not include a response to this question.

The majority (71%) of State wildlife agencies viewed the practice of releasing captive-reared mallards for hunting as negative (Table 8). Twenty-two percent of the States were neutral, and 6 percent had no position, indicating that this practice was not a “popular topic” in their State and the issue had not been addressed. No State agency reported a positive view of these practices.

Table 8. State responses, by Flyway, to the question, “Does your State agency view captive-reared mallard releases as positive, negative, or neutral?”

Flyway	Positive	Neutral	Negative	No position
Atlantic	0	2	13	2
Mississippi	0	3	11	0
Central	0	1	4	1
Central/Pacific ^a	0	3	1	0
Pacific	0	2	6	0
Total	0	11	35	3

^a States that are divided between the Central and Pacific Flyways, i.e., Montana, Wyoming, Colorado, and New Mexico.

Only 16 percent of the States reported documented law-enforcement problems; 80 percent documented no problems, and 4 percent did not respond (Table 9). All of the States reporting documented law-enforcement problems were in the Atlantic and Mississippi Flyways, where most of those releases occur. The most frequent enforcement problems cited by States involved violations associated with live decoys, baiting, over-bagging of wild ducks, and shooting of wild ducks after the hunting season had closed. The number of citations issued and convictions for these violations was not reported, but 3 States reported convictions for use of captive-reared mallards as live decoys on shooting preserves, and 2 States reported baiting convictions. Several States noted that violations associated with captive-reared releases on shooting preserves are difficult to detect and prosecute, especially the taking of wild ducks when the regular hunting season is closed.

Table 9. State responses, by Flyway, to the question, “Do you have any information pertaining to enforcement problems associated with captive-reared mallard releases?”

Flyway	Yes	No	No response ^a
Atlantic	5	12	0
Mississippi	3	11	0
Central	0	5	1
Central/Pacific ^b	0	4	0
Pacific	0	7	1
Total	8	39	2

^a Number of States that did not include a response to this question.

^b States that are divided between the Central and Pacific Flyways, i.e., Montana, Wyoming, Colorado, and New Mexico.

Nationwide, 73 percent of the State responses favored more restrictive Federal regulations to control the release of captive-reared mallards into the wild for shooting, and 10 percent did not. Of the rest, 6 percent were neutral, 6 percent had no position, and 4 percent either did not respond to this

question or were unsure of their position on this question (Table 10). Support by several States for more restrictive Federal regulations was, however, contingent upon the States and other parties collaborating in the development of these regulations, and that these regulations focus more specifically on reducing the interactions between captive-reared mallards and wild waterfowl. A few States commented that they would favor better clarification of the Federal regulations regarding the release of captive-reared mallards on shooting preserves.

Table 10. State responses, by Flyway, to the question, “Does your agency favor more restrictive Federal regulations controlling the release of captive-reared mallards into the wild for shooting?”

Flyway	Yes ^a	Neutral	No	No position	No response ^b	Unknown ^c
Atlantic	15	0	1	1	0	0
Mississippi	10	1	2	1	0	0
Central	5	0	0	1	0	0
Central/Pacific ^d	2	1	1	0	0	0
Pacific	4	1	1	0	1	1
Total	36	3	5	3	1	1

^a Several States indicated that support for more restrictive Federal regulations was conditional.

^b Number of States that did not include a response to this question.

^c Number of States that indicated that they did not have information to answer this question.

^d States that are divided between the Central and Pacific Flyways, i.e., Montana, Wyoming, Colorado, and New Mexico.

Several State responses expressed concern regarding genetic introgression or contamination of the wild-mallard gene pool, and interbreeding with black ducks and mottled ducks (*A. fulvigula*), particularly when free-flying captive-reared birds migrate or intermingle with wild stocks. In addition to the negative impacts associated with hybridization with wild birds, they cited concerns that captive-reared mallards escaping from shooting preserves often become feral, creating nuisance problems and potential

disease transmission problems. Although most States were not opposed to the practice of shooting captive-reared mallards on shooting preserves, they were strongly opposed to releasing free-flying birds that escape into the wild. A few States commented that this practice sends the wrong message regarding game management (i.e., a “quick fix”), and detracts from habitat management and protection programs that remain the key factors in maintaining healthy and viable waterfowl populations.

Maryland

Maryland has the largest number of shooting preserves, or Regulated Shooting Areas (RSAs), that release and shoot captive-reared mallards. Between 1985 and 1990, more than 100,000 captive-reared mallards were released annually on RSAs in Maryland (records from the Grand National Waterfowl Association). However, since the early 1990s, these numbers have declined by more than 60 percent. As of 2007, there were 30 commercial and 84 noncommercial RSAs in operation, mostly located on Maryland’s Eastern Shore of the Chesapeake Bay. Prior to 2008, preserves were required to be at least 200 acres in size to qualify under State regulations. The minimum acreage for preserves releasing free-flying mallards was reduced to 100 acres in 2008 at the same time new State regulations went into effect that prohibited the release of captive-reared mallards except on RSAs, for retriever training, and for sanctioned field trials and hunt tests. Of the 78 RSAs on Maryland’s Eastern Shore, 59 release mallards in a free-flying condition, whereas 19 use the more traditional tower-release or flighted-bird method.

In Dorchester County, there are 3 commercial and 40 noncommercial RSAs, which is the highest concentration in the State. Records from annual reports filed with the Maryland DNR indicate that numbers of free-flying mallards released from 2002 to 2007 totaled less than 20,000 per year; the total number available to shoot, including birds carried over from the previous year, was less than 25,000 per year (Table 11). Apparent harvest rates ranged from 40-50 percent (Table 11). However, the numbers of captive-reared mallards released and carried over from year to year were under-reported because some RSAs did not file reports of their releases. Therefore, the percentage of birds harvested from all captive-

reared mallards in the environment, including survivors that have accumulated from releases during previous years, is actually far less than half. The fate of those unaccounted-for birds is unknown, but they either move away from the RSAs, are shot on adjacent properties, die from other causes, or immigrate into the wild population.

Table 11. Number of captive-reared mallards (CRM) released and harvested, and wild ducks harvested on non-commercial regulated shooting areas (RSAs) in Dorchester County, Maryland, based on annual reports submitted by RSA owners/operators to the Maryland Department of Natural Resources.

Hunting season	CRM released	CRM carried over ¹	CRM harvested (%)	CRM un-accounted ²	Wild mallards	Black ducks	Other ducks
2002-03	4,700	800	2,377 (43)	—	14	3	160
2003-04	10,650	2,687	5,821 (44)	436	439	29	931
2004-05	18,475	6,057	10,266 (42)	1,459	495	73	1,497
2005-06	19,300	4,666	11,910 (50)	9,600	992	85	1,955
2006-07	9,650	2,388	5,631 (50)	9,668	322	65	1,237
2007-08	15,300	4,290	7,140 (40)	2,117	581	75	1,602
Average	13,013	3,481	7,191 (44)	4,656	474	55	1,230

¹Number of CRM remaining after harvesting that are carried over from previous years.

²Number of CRM released, plus carried over birds from previous years, minus birds harvested, minus the next years' carryover birds.

The RSA reports also indicate that 2,000 or more wild ducks, mostly mallards, black ducks, green-winged teal (*A. crecca*), and wood ducks (*Aix sponsa*), are shot on these preserves annually during the regular duck season (Table 11). This county is an important breeding and wintering area for many

migratory waterfowl and encompasses significant State and Federal wildlife habitat, including Fishing Bay Wildlife Management Area and Blackwater National Wildlife Refuge, respectively. As a result of the close proximity of these areas, free-flying captive-reared mallards and wild ducks readily intermix (Smith 1999).

National Wildlife Refuges

A query of the Service's Regional Offices to determine whether National Wildlife Refuges (refuges) are being adversely affected by releases of captive-reared mallards from shooting preserves, either impacting their mission to provide habitat for wild ducks or their operational management practices, indicated that most refuges generally are not influenced by mallard releases on shooting preserves. Only Region 4 (Southeast) and Region 5 (Northeast) responded that certain refuges have reported concerns regarding the presence of captive-reared mallards from nearby shooting preserves or other properties releasing mallards to supplement their hunting. Several refuges in South Carolina (Santee Refuge) and North Carolina (Mattamuskeet, Pee Dee, and Pocosin Lakes Refuges) reported that captive-reared mallards from adjoining properties interfere with their operational banding program (by consuming bait used to trap wood ducks) and population surveys. In the mid-Atlantic region, Blackwater (Maryland), Bombay Hook and Prime Hook (Delaware), Iroquois (New York) and Supawna Meadows (New Jersey) Refuges are located in close proximity to shooting preserves and reported receiving considerable usage by captive-reared mallards, as evidenced by the fact that refuge personnel routinely trap captive-reared mallards during banding operations. Blackwater Refuge estimated that 1,000 captive-reared mallards use the refuge annually, and Bombay Hook Refuge stated that one of its usual banding sites has been rendered ineffective by the preponderance of captive-reared mallards at the site. Some refuges indicated concerns about pairing with wild mallards, interbreeding with black ducks and mottled ducks, and exploiting habitats for wild ducks.

Summary

The survey of State wildlife agencies indicated that at least 270,000 captive-reared mallards are released annually on shooting preserves in the United States, mainly in the Atlantic and Mississippi Flyways. Most States that permit shooting preserves to release captive-reared mallards allow those birds to be taken on shooting preserves in numbers that exceed bag limits for wild ducks, or during periods that are closed to hunting for wild ducks. Nonetheless, more detailed reports from RSAs in Maryland indicated that significant numbers of captive-reared mallards survive the shooting preserve hunts and subsequently accumulate in the vicinity of their release sites or disperse, either of which results in intermixing with wild waterfowl. Although few States reported documented cases of disease transmission and law enforcement problems associated with captive-reared mallard releases, most of them (>70%) had a negative view of captive-reared mallard releases and favored more restrictive regulations that would limit intermingling with wild waterfowl. National Wildlife Refuges reported few impacts of captive-reared mallards other than disruption of their banding programs for wild ducks.

ACCUMULATION

Several studies have shown that some captive-reared mallards escape from shooting preserves, survive, and subsequently associate with wild birds (e.g., Soutiere 1989, Smith 1999), but assessing the potential impacts of those birds requires an estimate of abundance. The following deterministic model was used to estimate the number of captive-reared mallards that accumulate in the environment as a result of surviving the hunting season and not being recaptured at the end of that period:

$$N(t) = \sum_{i=1}^t N(0) \cdot S(pre) \cdot S(h) \cdot [1 - p(r)] \cdot S(post) \cdot S(a)^{t-1},$$

where

$N(t)$ = number of captive-reared mallards alive in August of year t ,

$N(0)$ = number of captive-reared mallards released each year,

$S(pre)$ = pre-hunting survival rate (probability of surviving from release in August to start of hunting period),

$S(h)$ = hunting period survival rate (probability of surviving from beginning to end of hunting period),

$p(r)$ = probability of recapture at end of hunting,

$S(post)$ = post-hunting period survival rate (probability of surviving from the end of the hunting period to 31 July), and

$S(a)$ = annual survival rate from 1 August to 31 July for every year after the year of release.

Several of these model parameter values differ by release method (tower or free-flying), thus, the result also varies by release method. Assuming that the birds released on shooting preserves in New York are tower releases, and that the birds released by “other” and “unknown” release methods are divided evenly between tower and free-flying releases, at least 170,000 captive-reared mallards are released annually [$N(0)$] for tower shoots, and at least 103,000 are released free-flying (Table 3). $S(pre)$ for the tower release method is 1.0 because birds are held in pens until release, whereas Smith (1999) estimated $S(pre)$ for free-flying released mallards at 0.81-0.85. $S(h)$ can be estimated as 1 – the kill rate. The apparent harvest rate for tower shoots is 0.69 (Table 5). Unretrieved kill (crippling loss) is probably negligible because of the highly controlled nature of tower shoots, therefore estimated $S(h)$ for tower-released birds is 0.31. The apparent harvest rate for free-flying releases is lower (0.45, Table 5), but there is also probably some additional mortality due to crippling loss. Crippling loss is typically estimated as

20 percent of the total hunting mortality of ducks (Anderson and Burnham 1976). Adjusting the apparent harvest rate to account for crippling loss yields an estimated kill rate of 0.56 and an estimated $S(h)$ of 0.44 for the free-flying release method, which is very similar to the hunting survival rate that Smith (1999) and Osborne et al. (2010) found for free-flying captive-reared mallards (0.42 and 0.40, respectively). The ability of tower shoot operations to recapture birds that survive a shoot varies, ranging from recapture rates [$p(r)$] of at least 50 percent under poor or normal conditions to 90 percent under ideal conditions (L. J. Hindman, Maryland DNR, personal communication). Shooting preserves that release free-flying birds do not attempt to recapture them, thus, $p(r) = 0$ for that method.

$S(post)$ and $S(a)$ are assumed to be similar for both release methods. Soutiere (1989) found that post-hunting survival rates [$S(post)$] of captive-reared mallards were about 18 percent lower than wild mallard survival rates during the same period. Likewise, Dunn et al. (1995) found a similar relationship between annual survival rates of captive-reared and wild mallards >1 year after release. Annual survival probabilities of adult wild mallards vary by sex, but average about 0.62 (Trost 1987); thus, $S(a)$ is estimated at 0.52, or 18 percent less than 0.62. Estimated $S(post)$ is based on the same rate, but adjusted because $S(post)$ only encompasses 6 months (February through July), whereas $S(a)$ is an annual (12-month) survival probability. Therefore, $S(post)$ is estimated as $S(a)^{6/12} = 0.72$. Table 12 shows the model parameters for two tower release models (one with a 90 percent recapture rate and the other with a 50 percent recapture rate) and one free-flying release model.

Table 12. Model parameters for estimating the number of captive-reared mallards present in the environment as the result of tower and free-flying releases on shooting preserves.

Release method	$N(0)$	$S(pre)$	$S(h)$	c	$p(r)$	$S(post)$	$S(a)$
Tower	170,000	1.00	0.31	0.00	0.90	0.72	0.52
Tower	170,000	1.00	0.31	0.00	0.50	0.72	0.52
Free-flying	103,000	0.83	0.44	0.20	0.00	0.72	0.52

For each model, the estimated number of captive-reared mallards in the environment as a result of releases on shooting preserves stabilizes after about 10 years, assuming that $N(0)$ does not change from year to year. The models yield estimates of the number of surviving captive-reared birds present on 1 August; estimates for the number of captive-reared mallards present on the previous 1 January and on 1 May were calculated by dividing the August estimate by $S(a)^{7/12}$ and $S(a)^{3/12}$, respectively (Table 13).

Table 13. Estimated number of captive-reared mallards present in summer (1 August), winter (1 January), and spring (1 May) as the result of tower and free-flying releases on shooting preserves. Tower models 1 and 2 assume recapture probabilities of 0.9 and 0.5, respectively.

Release method	1 August	1 January	1 May
Tower (model 1)	7,900	11,600	9,300
Tower (model 2)	39,500	58,100	46,500
Free-flying	56,400	82,900	66,400

Although more birds are released from towers, the free-flying release method results in the most captive-reared mallards in the environment. The number of surviving “escapees” from tower release operations is probably between the two estimates in Table 13 because the actual recapture rate [$p(r)$] is likely between the two extreme values used. However, $N(0)$ for each model is a minimum value,

therefore all models likely underestimate the number of captive-reared mallards in the environment as a result of releases on shooting preserves.

LAW ENFORCEMENT ISSUES

Captive-reared mallards released on shooting preserves in a free-flying condition in areas frequented by wild ducks increase the potential for violations of Federal waterfowl hunting regulations. Under Federal provisions listed in § 21.13, hunters on shooting preserves are exempted from regulations set for wild ducks and allowed to take captive-reared mallards by shooting at any time of year and in any number. But if a hunter shoots a wild duck, all the requirements of the Federal hunting regulations apply to the taking of that duck. Thus, a closed-season violation [§ 20.22 and § 20.32], involving take or possession of wild ducks, will occur if a hunter shoots a wild duck outside the hunting season dates selected by a State for wild ducks. In these cases, a State must limit its shooting preserves, specified by licenses, to operate only during the period of take set for wild ducks in that State's regulations. Therefore, in these situations, regulations in § 21.13 conflict with hunting regulations set for wild mallards in accordance with the MBTA.

Hunters also may commit violations when wild ducks are taken on shooting preserves if the captive-reared birds that are present serve as live decoys under § 20.21(f), or if they exceed the daily bag limit of wild ducks in § 20.24. Live-decoy violations can occur when wild ducks are attracted to the presence or audible calls of captive-reared mallards on sites operated as shooting preserves. Also, some hunters may not be fully aware that any captive-reared mallard taken outside the premises of a shooting preserve must count towards their daily bag limit for wild ducks or that they may be put at risk by hunting within the "zone of influence" involving live decoys and/or taking with the aid of bait [§ 20.21(i)]. The legality of whether free-flying captive-reared mallards released from one shooting preserve can be shot in

any number on another shooting preserve in accordance with § 21.13 is uncertain and should also be clarified.

Although the taking of captive-reared mallards on shooting preserves is exempted from Federal waterfowl hunting regulations by § 21.13, the potential for violations is greatly increased where free-ranging captive-reared mallards and wild ducks intermingle on the same premises (Attachment 19). In these situations, legal conflicts usually arise because hunters find it difficult or impossible to distinguish between captive-reared and wild mallards on the wing. Low light or poor weather can exacerbate problems with identification of other species of wild ducks such as black ducks, northern pintails (*A. acuta*), and gadwalls (*A. strepera*). Therefore, Federal regulations under § 21.13, permitting shooting preserves to operate at any time of year, and to take in any number, are seriously compromised whenever wild birds intermix with captive-reared mallards on the same premises. Federal regulations allowing the take of wild waterfowl are strict liability statutes [with the exception of the baiting regulation, § 20.21(i)], and do not require that the violator has knowledge of the unlawful situation. Waterfowl hunters who hunt near a shooting preserve may also experience increased liability due to the release of free-flying captive-reared mallards. These ducks often move between different shooting preserves and the surrounding areas, and thus, the possibility of hunting by the use or aid of live decoys may exist if all the elements of the violation are present. Although each hunting situation is unique, some increased potential for violation usually exists for hunters that shoot both captive-reared mallards and wild ducks near a shooting preserve. State agency responses to the survey discussed previously indicate that several violations of these Federal regulations occur each year in areas where large numbers of captive-reared mallards are released, in particular the mid-Atlantic region.

POTENTIAL AREAS OF CONFLICT

Genetic Diversity and Hybridization

Another concern of biologists and resource-managers about the release of captive-reared mallards is the potential to introduce heritable traits into wild mallard populations that reduce fitness under natural conditions (Banks 1971, Shoffner 1971, Smith 1999, Cizkova et al. 2012). Although largely speculative, the concern is that captive-reared mallards from various game-farm stocks may interbreed with wild mallards and adversely affect the wild characteristics of the native stock. Studies comparing these different mallard strains indicate that differences in egg production, fertility, growth rates, and body weights may be linked to genetic differences (Prince et al. 1970, Greenwood 1975). Such studies relied on breeding and back-crossing experiments to determine the genetic nature of these differences, but differences between these groups were not determined with molecular-genetics techniques. More recent research has focused on identifying the specific genes that influence reproductive traits and other traits associated with fitness. For example, quantitative trait loci (QTL) have been identified that influence variation in mallard fertility (Huang et al. 2006) and body condition (Wu et al. 2008). Although QTL comparisons between wild and captive-reared mallards have not been conducted to date, recent studies such as these confirm that interbreeding between mallard strains can influence morphological and reproductive traits associated with fitness.

Game-farm mallard hens began egg-laying earlier, laid for a longer time, laid larger clutches, and had greater incubation time than wild hens bred in captive-breeding situations (Prince et al. 1970, Greenwood 1975, Cheng et al. 1980). Cheng et al. (1980) felt that these differences might explain the frequent reproductive failure of released mallards. They reasoned (Cheng et al. 1980:1974-1975) that these traits led to improper timing of migration and nest initiation (resulting in ducklings hatching before environmental conditions permitted good survival) and that large clutch size and decreased broodiness could be the cause of a high rate of nest and brood abandonment.

The flow of genes from captive-reared to wild mallards, and thus the likelihood of introducing “nonadaptive” traits to wild populations, depends in part on the extent of interbreeding between the strains. The extent of interbreeding that occurs, in turn, depends on the time of release, area of release, age of the birds when released, composition of the released flocks (Cheng et al. 1979:424), and mating behavior of the strains. Cheng et al. (1978) found that in captive conditions, both wild and game-farm mallard drakes preferred mates of their own strain, if they were raised with their own kind. When drakes were raised with hens of the opposite strain, this preference became less pronounced. Mallard hens preferred or paired with drakes with which they were raised, regardless of whether the drakes were from wild or game-farm strains (Cheng et al. 1978). Thus, there may be barriers related to courtship behaviors that could limit the mixing of wild and game-farm mallards (Cheng et al. 1979). However, these studies were conducted in pens, and as Greenwood (1975) has pointed out, interactions between game-farm and wild mallards may be different in wild situations than in pen situations.

Smith (1999) reported a largely assortative (like-kind) mating pattern among wild mallards and free-ranging game-farm mallards in Maryland. Of known-origin hens that were observed to be mated, 13 percent ($n = 124$) of the captive-reared mallard hens paired with wild drakes and 24 percent ($n = 95$) of the wild mallard hens paired with captive-reared drakes (Smith 1999:52). Although these findings support the idea that the majority of mallard pairings were assortative, nearly one-quarter of the matings of wild hens were with captive-reared drakes, which suggests that a considerable amount of intermixed mating does occur in certain wild situations. Thus, as has been found in in Europe (Champagnon 2011, Cizkova et al. 2012) introgression (the spread of genes from one population or species into another) of captive-reared mallards into North America’s wild mallard populations is certainly occurring, but the magnitude and genetic impacts are unknown.

Another major concern related to the release of captive-reared mallards is their potential to contribute to hybridization with, and genetic swamping of, mallard-like species. Small, isolated populations of species that are closely related to mallards are most at risk from hybridization (Rhymer and Simberloff 1996). The magnitude of the threat to mallard-like species under those conditions is illustrated by the status of the New Zealand grey duck (*A. superciliosa superciliosa*). In the 1860s, mallards were introduced to New Zealand and produced reproductively viable hybrids with the native grey duck (Haddon 1984, Gillespie 1985). By 1981-82, 51 percent of one mallard/grey duck population appeared to be hybrids based on morphology, and only 4.5 percent pure grey duck (Gillespie 1985). Subsequent genetic analysis suggested that hybridization was even more extensive (Rhymer et al. 1994). It is currently estimated that about 95 percent of grey ducks in New Zealand are mallard-grey duck hybrids (J. M. Rhymer, personal communication).

In Florida, hybridization with feral mallards is seen as the major threat to the State's mottled duck population (Moorman and Gray 1994). Florida's breeding population of mottled ducks is estimated at only about 30,000-40,000 birds (Florida Fish and Wildlife Conservation Commission, unpublished report), and the population is non-migratory (Moorman and Gray 1994) and genetically isolated (McCracken et al. 2001). Recently, Williams et al. (2005) analyzed microsatellite DNA and estimated that 11 percent of Florida's mottled ducks are actually mallard-mottled duck hybrids. Because Florida lies far south of the breeding range of wild mallards (Bellrose 1980), this hybridization situation is primarily attributed to the release of captive-reared mallards in Florida and their subsequent establishment as resident breeders (Moorman and Gray 1994, Williams et al. 2005). However, biologists of the Florida Fish and Wildlife Conservation Commission have also documented ingress movements of captive-reared mallards from release programs in South Carolina. The hybrid offspring from crossbreeding are fertile because mottled ducks and mallards are closely related. Because of the danger of genetic swamping from this introgression by feral mallards, the Florida Fish and Wildlife Conservation Commission has taken

management action to protect the mottled duck as a discrete entity by prohibiting all further releases of free-ranging captive-reared mallards (Williams et al. 2005).

Probably the most widely-known instance of mallard hybridization in North America involves the black duck. The mallard was considered a wanderer or occasional visitor in most of the northeastern United States at the beginning of the twentieth century (Heusmann 1974, 1991). Over the past 100 years, however, mallard numbers in the northeastern United States and eastern Canada have increased as western populations expanded eastward into traditional black duck nesting range (Johnsgard and DiSilvestro 1976, Heusmann 1991). Also, there were large-scale release programs in several States, mainly New York (1946-52; Foley et al. 1961), Pennsylvania (1951-1982; Dunn et al. 1995), and Maryland (1974-1987; Hindman et al. 1992), where mallards were raised and released to augment declining duck populations.

Concurrent with mallard intrusion into black duck breeding and wintering range, black duck populations have declined (Johnsgard and DiSilvestro 1976, Rusch et al. 1989, Serie 1990). Although the nature of the relationship between mallard expansion and black duck decline is uncertain (Ankney and Dennis 1988, Ankney et al. 1987, 1988, Conroy et al 1989, Ankney et al. 1989, Merendino et al. 1993), the release of game-farm mallards may add competition pressure on black duck populations, including the increased likelihood of hybridization.

Black ducks and mallards are nearly identical genetically (Ankney et al. 1986, Ankney and Dennis 1988, Hepp et al. 1988, Avise et al. 1990). Hybridization between these species is well documented (Johnsgard 1960, Heusmann 1974), and the offspring of such matings are fertile (Phillips 1915 *in* Heusmann 1974). Documented hybridization rates are variable. Morgan et al. (1984) reported hybrid frequencies of mallards and black ducks above the frequencies expected from random mating in Maryland (49%) and Massachusetts (62%), whereas, D'Eon et al. (1994) reported a 2 percent hybridization rate in New Brunswick, Canada. From bag-checks of hunters, Smith (1999) reported 8.4

percent hybrids based on plumage characteristics. Although plumage-coloration traits of F1 hybrids are detectable and have been well described (Kirby et al. 2000), identification of hybrids based on plumage becomes increasingly difficult as backcrossing with parent stocks increases (Phillips 1915 *in* Heusmann 1974, Mank et al. 2004).

The dynamics of mallard-black duck hybridization are uncertain. Mixed pairing during winter was observed frequently by Brodsky and Weatherhead (1984) near Ottawa, Ontario, Canada and by Heusmann (1974) in Massachusetts. Brodsky and Weatherhead (1984) found that male mallards courted female black ducks only when all female mallards were paired. In the Chesapeake Bay area of Maryland, little mixed pairing appears to occur, and mixed pairing could not account for observed hybridization rates (Morton 1998, Smith 1999). D'Eon et al. (1994) felt that mixed pairings likely were responsible for the hybridization rates that they observed in New Brunswick. However, these studies cover limited geographic areas in relation to both the wintering and breeding ranges of the black duck.

Forced copulation is another potential cause of hybridization. Forced copulation is a common reproductive strategy in wild mallard males, but infrequently observed in black duck males (McKinney et al. 1983 *in* Morton 1998). Seymour (1990) found a low frequency of attempted and successful interspecific forced copulation in Nova Scotia, Canada, but concluded that the frequency was much greater than expected given the dispersed distribution of the breeding populations. Ankney et al. (1987) reasoned that because pairing on wintering grounds is highly assortative and nearly all birds arrive on their breeding grounds already paired, most mallard-black duck hybridization probably occurs as a result of forced copulation during reneesting. Captive-reared male mallards may have a greater tendency toward forced copulation than wild males because the breeding systems used in captivity tend to select for those males that force-copulate rather than pair (McKinney et al. 1984 *in* Morton 1998). Thus, if forced copulation during reneesting is a significant cause of hybridization, the release of large numbers of captive-reared mallards may pose a serious threat to local black duck breeding populations.

The potential for interbreeding between captive-reared mallards and wild ducks depends on the number of captive-reared mallards that avoid being shot during the hunting period and “escape” into environments where they can intermix with wild ducks. Survival modeling indicated that at least 75,000 – 112,900 captive-reared mallards are present in early May, at the beginning of the duck breeding season (Table 13). Although this number is small relative to the breeding population of mid-continent mallards (8.5 million in 2009; U.S. Fish and Wildlife Service 2009a), impacts could be significant in the Atlantic Flyway, where the survival models described above (Table 12) estimate that at least 61,600 – 90,200 captive-reared mallards are present on 1 May. A waterfowl breeding population survey that is conducted annually in most of the Atlantic Flyway’s north and mid-latitude States during April and May (Heusmann and Sauer 2000) estimated long-term (1993-2008) average breeding populations of 777,000 mallards and 68,400 black ducks; estimates for 2009 were 666,800 mallards and 39,500 black ducks (U.S. Fish and Wildlife Service, unpublished report). In Maryland, where many of the Atlantic Flyway’s captive-reared mallards are released, the 2009 survey estimated 32,200 mallards and 2,400 black ducks. Thus, even the limited frequency of mixed pairings documented by Smith (1999) could result in genetic introgression impacts on wild ducks in the Atlantic Flyway.

The net effects of genetic introgression on survival, reproduction, and behavioral characteristics are uncertain (Cade 1983), but it is clear that introgression is occurring and that captive-reared mallards are likely involved. Small, isolated, non-migratory populations, such as mottled ducks in Florida, and perhaps some local breeding populations of black ducks and wild mallards in eastern United States, are most at risk. Although mallards and black ducks are both migratory, Mank et al. (2004) demonstrated a significant reduction in genetic differentiation between mallards and black ducks collected prior to 1940 and birds collected in 1998. They termed this change a “breakdown in species integrity most likely due to hybridization.” Captive-reared mallards are likely contributing to this breakdown, either directly by interbreeding with black ducks or indirectly through introgression into the wild mallard population that is interbreeding with black ducks. Thus, although the genetic impacts of captive-reared mallard releases on

wild stocks are not readily apparent, the long-term effects of hybridization and introgression on the species integrity of mottled ducks, black ducks, and wild mallards should be of primary concern (Rhymer and Simberloff 1996).

Risk of Disease Transmission

Determining the role of captive-reared mallards in the epidemiology of wild waterfowl diseases is inherently difficult. Existing data on the topic are sparse, and as a result documentation and illustration of disease transmission events in wild birds resulting directly from the release of captive-reared mallards are difficult. The primary concern however, when considering the importance of disease transmission with regard to captive-reared mallard releases, is the risk associated with the activity. The potential for disease transmission is the key to this area of conflict, and dictates the precautions necessary for proactive and preventative management strategies.

Stemming the increasing impacts and challenges diseases pose for wildlife conservation relies on the active prevention of disease emergence. Global infectious disease emergence has increased dramatically over the past several decades (Jones et al. 2008). Likewise, the importance of managing activities involving wildlife to eliminate disease threats is also increasing (Simpson 2002). Factors influencing disease emergence include: 1) the increasing interface between humans, livestock, and wildlife; 2) the increasing popularity of wildlife-associated and captive-wildlife industries; and 3) alterations to the environment, such as introductions of nonnative species or the same species from a different location (Rhymer and Spraker 2010). The emergence of infectious diseases in wildlife species not only impacts wildlife conservation efforts, but can also have severe impacts on economic stability, agricultural commerce, and human health.

Described below are a few examples of avian and mammalian diseases which have emerged in wildlife species over the past century. These diseases cross the boundaries between captive-reared and

free-ranging wildlife populations, and since emergence, have continued to cause decreased productivity, clinical disease, and mortality in both groups.

Duck Virus Enteritis - Duck virus enteritis (DVE, also known as duck plague) was first isolated from domestic waterfowl in the Netherlands in 1923. In 1967, DVE caused a major mortality event in the white Pekin duck industry on Long Island, New York, as well as in wild and captive-reared waterfowl in that same geographic area (Leibovitz and Hwang 1968). This represented the first detection of DVE in the United States, as well as the first report of DVE in free-ranging wild waterfowl (Leibovitz and Hwang 1968). Since 1967, DVE has been reported in 21 States, the District of Columbia, and 4 Canadian Provinces (USGS National Wildlife Health Center [NWHC], unpublished data). These cases include three major DVE outbreaks among wild migratory waterfowl. The 1967 outbreak on Long Island, New York affected black ducks (89), mallards (19), Canada geese (*Branta canadensis*) (1), and bufflehead (*Bucephala albeola*) (1). The second outbreak occurred in 1973 at Lake Andes Refuge in South Dakota, where an estimated 42,000 mallards, 270 Canada geese, and lesser numbers of other species died (Pearson and Cassidy 1997). The latest outbreak occurred in 1994, when approximately 1,200 waterfowl carcasses (mostly black ducks and mallards) were recovered in the Finger Lakes region of western New York (Converse and Kidd 2001).

Duck virus enteritis is caused by a herpes virus. The virus is transmitted to naïve birds through direct contact with infected birds or via environmental contamination (water) by infected birds (Wobeser 1981, Sandhu and Leibovitz 1997). The virus can persist in water for up to 60 days under certain conditions (Wolf and Burke 1982). Transmission may also occur via the egg, as has been demonstrated in mallards (Burgess and Yuill 1981). Several findings demonstrate that transmission of DVE is occurring amongst domestic, captive-reared, and wild waterfowl: 1) duck virus enteritis does not appear to be enzootic in free-ranging, migratory waterfowl in North America; 2) each DVE outbreak in migratory waterfowl has been associated with cases in captive or feral birds (Brand and Docherty 1984,

1988; Friend 1999); 3) viral shedding and the presence of antibodies to DVE have been recorded in both wild and captive-reared birds sharing the same geographic areas; and 4) duck virus enteritis vaccine virus, which is only licensed for use in domestic waterfowl, has been detected in wild and captive-reared mallards, as well as Canada geese captured in Maryland (NWHC, unpublished findings).

Highly Pathogenic Avian Influenza - The last decade has seen a marked increase in highly pathogenic avian influenza (HPAI) outbreaks (Munster and Fouchier 2009). After initial detection in domestic poultry in Hong Kong in 1996, the Asian strain of highly pathogenic avian influenza subtype H5N1 has spread throughout Asia and into Europe and Africa and is officially reported in 61 countries (Alexander 2000, Alexander and Brown 2009, World Health Organization 2010). Outbreaks have involved not only domestic poultry and waterfowl, but free-ranging and captive-reared wild bird species as well (Stallknecht and Brown 2007). Outbreaks have caused significant mortalities in wild birds in China, Mongolia, Kazakhstan, and Russia and more isolated cases in Europe and Africa. Over 6,000 wild birds, predominantly bar-headed geese (*Anser indicus*), were reported to have died during one event in China at Qinghai Lake (Chen et al. 2005, Liu et al. 2005). Smaller numbers of grebes and swans have been affected in Europe in isolated events (Globig et al. 2009, Artois et al. 2009). Outbreaks continue to be reported, and the additive impact on wild bird populations is unknown.

Avian influenza virus is an orthomyxovirus and is transmitted to naïve birds primarily via contaminated water and direct contact. Oral ingestion of infectious particles and droplet infection also occur. Like DVE, AI viruses can persist in water; HPAI H5N1 wild type viruses have been shown to persist for over two weeks under certain conditions (Brown et al. 2007). This persistence allows for transmission of viruses between bird groups which do not physically interact.

Phylogenetic analysis of HPAI H5N1 strains isolated from domestic birds, wild birds, and captive-reared wild bird species demonstrate that influenza virus transmission is occurring between these groups (Neumann et al. 2010). The Asian trade in wild bird species reared for sale in markets and

eventual release into the surrounding ecosystem serves as a link between domestic poultry/waterfowl and wild birds; mortality due to H5N1 continues to be documented in these birds (Promed-Mail 2007, Ellis et al. 2009). Global illegal trade and transportation of wild birds is rife and presents a strong risk for introduction of HPAI H5N1 Asian strain into North America (Van Borm et al. 2005, van den Berg 2009). Once introduced to North America, HPAI H5N1 circulation may be difficult to eradicate due to the interactions between domestic, wild, and captive-reared birds.

Chronic Wasting Disease - Chronic wasting disease (CWD), a transmissible spongiform encephalopathy, was first recognized in 1967 among captive mule deer (*Odocoileus hemiolus*) in Colorado (Williams and Young 1992). Cases in captive cervids have since been diagnosed in 11 States and two Canadian Provinces, and cases in free-ranging mule deer, white-tailed deer (*O. virginianus*), elk (*Cervus canadensis*), and moose (*Alces alces*) have been documented in 13 States and two Canadian Provinces (Chronic Wasting Disease Alliance 2010). The disease is considered to have a 100 percent case-fatality rate. Preliminary modeling suggests that CWD could be detrimental at the population scale in endemic areas (Williams et al. 2001).

The geographic extent of endemic CWD in free-ranging wildlife was initially thought to be quite limited and its natural rate of expansion slow; however, recent investigations have revealed that CWD has been inadvertently spread much more widely via market-driven movements of infected, farmed elk and deer (Miller and Williams 2004). CWD is contagious; epidemics are self-sustaining in both captive and free-ranging cervid populations (Miller et al. 1998, 2000). Decontamination attempts on infected properties have been unsuccessful, resulting in continued CWD case occurrences at these locations (Williams et al. 2001). Direct contact and shared grazing areas between captive-reared and free-ranging cervids therefore represent a high CWD transmission risk.

In addition to the three diseases cited above, several other diseases demonstrate the potential for disease emergence within wildlife populations and associated captive-reared wildlife species.

Mycoplasma and avian cholera in avian species, as well as whirling disease and viral hemorrhagic septicemia in fish, illustrate the potential for disease transmission between captive and wild populations (Botzler 1991, Goldberg et al. 1995, Gilbert and Granath 2003, Skall et al. 2005). Extreme difficulties have been faced in attempting to control and eradicate these diseases. Because the interface between captive and wild animals increases the risk of disease transmission and amplification, prevention of diseases, rather than reactive responses to disease occurrence, should be the primary focus for addressing wildlife health. Clearly, proactive approaches for combating disease in migratory waterfowl are consistent with Service obligations under the MBTA and require further advancement because of global challenges associated with infectious disease emergence and resurgence.

Waterfowl Management Programs

Management of migratory waterfowl in North America is dependent upon a series of coordinated surveys and other monitoring programs to assess the status of waterfowl and to determine what public-use opportunities exist, including regulated hunting opportunities. Each year, waterfowl managers representing Federal, State, and Provincial wildlife agencies, as well as a few private conservation organizations such as Ducks Unlimited, Inc., review and analyze biological information from both operational and special data-gathering activities to assist them in conserving migratory waterfowl populations at satisfactory levels. This information is used to promulgate hunting-season frameworks, to justify purchase and management of important habitats, and to guide activities among various joint ventures coordinated under the North American Waterfowl Management Plan (U.S. Fish and Wildlife Service et al. 1998). The Service is concerned about how and to what extent large-scale releases of free-ranging, captive-reared mallards on shooting preserves confound these databases and conflict with management efforts by public wildlife agencies to protect wild populations and make informed decisions regarding their welfare. State waterfowl managers share this concern; in May, 2008, each of the four Flyway Councils sent a letter to the Service's Director, in which they pointed out that such releases "compromise several population monitoring tools used to manage wild stocks" of ducks.

Mid-Winter Waterfowl Surveys - The Midwinter Waterfowl Survey (MWS), initiated in the 1930s, is the longest-term source of information on wintering waterfowl populations in the United States. Its principal objectives are to obtain annual indices of winter abundance for certain species or populations and to assess changes in distributions. The survey is a cooperative effort that relies heavily on State and Federal involvement throughout most of the United States. The potential conflict between this survey and the release of captive-reared mallards arises from the fact that the MWS is largely an aerial survey, but captive-reared and wild mallards cannot be differentiated from the air.

The MWS is conducted in early January, when at least 94,500-141,000 captive-reared mallards are present in the United States (see Table 13, page 26), most of them (at least 76,900-112,600) in the Atlantic Flyway. The 2009 MWS mallard count for the Atlantic Flyway was 139,300 birds, of which 58,300 were counted in Maryland (U.S. Fish and Wildlife Service, unpublished report). Thus, although the survey does not cover the entire Flyway, captive-reared mallards could make up a large proportion of the Atlantic Flyway's mallard count, particularly in Maryland.

Large numbers of captive-reared mallards are presumably recorded in the survey on Maryland's Eastern Shore, where MWS zones encompass several shooting preserves. These counts comprise an increasing proportion of Maryland's total mallard index since the expansion of shooting preserves in the late 1980s (Fig. 1). While numbers of mallards observed in the surrounding States of Delaware, Pennsylvania, Virginia, and New Jersey show a declining trend ($r^2 = 0.059$) since 1973, Maryland numbers ($r^2 = 0.302$), and in particular Dorchester County ($r^2 = 0.346$), show increasing trends. These data clearly show the influence that Dorchester County's numbers have on Maryland's total counts.

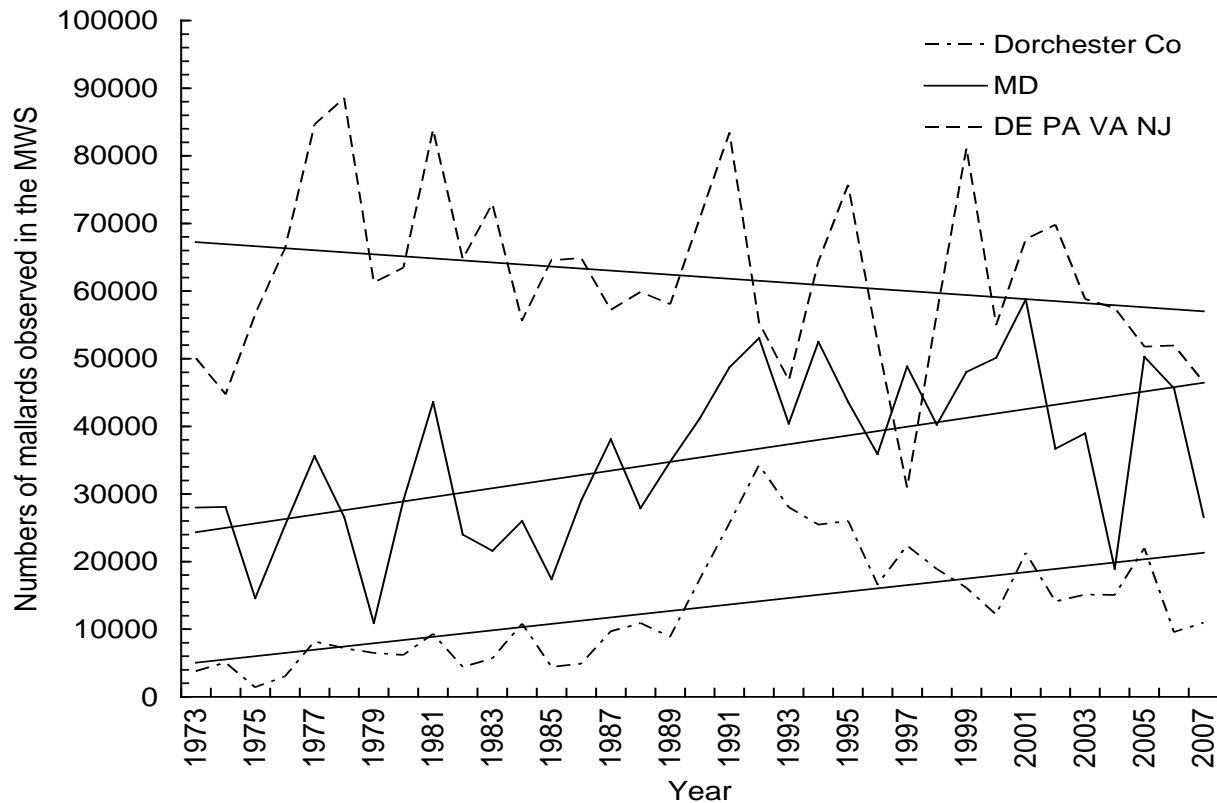


Figure 1. Numbers and trends of mallards observed annually during the Mid-winter Waterfowl Survey in Dorchester County, and its influence on Maryland’s total, compared with surrounding States (Delaware, Pennsylvania, Virginia, and New Jersey).

Although it is possible that the trends in Dorchester County, Maryland, and surrounding States reflect a change in the distribution of wintering wild mallards, it seems much more likely that the increases in Maryland, especially since the beginning of large-scale releases of captive-reared mallards in the late 1980s, are the result of counting increasing numbers of captive-reared mallards during the survey. If so, then these same biases from the releases of captive-reared mallards are reflected in the Atlantic Flyway mallard totals.

Thus, the release of large numbers of free-flying captive-reared mallards into areas historically surveyed as part of the MWS confound the data used by biologists and managers to inform them about the status and trends of wild mallards at the State and Flyway levels. Over time, biased indices of

abundance and distribution may influence the capabilities of wildlife agencies to prescribe appropriate management strategies. For example, in the early 1990s, the rapidly growing resident Canada goose population masked the precipitous decline in the Atlantic Population (AP) of Canada geese, which eventually led to a closure of the hunting season to protect the migrant Canada geese in the Atlantic Flyway (Malecki et al. 2001).

Waterfowl Breeding Population Surveys - The release of free-flying captive-reared mallards into areas where States annually conduct waterfowl breeding population surveys may result in another source of bias. In 1989, several States in the Northeast and Mid-Atlantic Regions, including Vermont, New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, and Virginia, established waterfowl breeding-pair surveys (Heusmann and Sauer 2000) to improve knowledge of eastern mallard populations. Results of these surveys are combined with mallard population estimates derived from May aerial surveys in the North-central States, Western and Eastern Canada, and Maine and are used in the Adaptive Harvest Management (AHM) process to set hunting regulations for duck seasons (U.S. Fish and Wildlife Service 2009b). As noted previously, at least 61,600-90,200 captive-reared mallards are present in the Atlantic Flyway when this survey is conducted; if those birds are counted during the survey, the wild mallard breeding population (666,800 in 2009; U.S. Fish and Wildlife Service, unpublished report) is overestimated by at least 10 percent. In addition, large-scale releases of captive-reared mallards at specific locations would almost certainly influence the results of the Breeding Bird Survey conducted by the U.S. Geological Survey (USGS, Patuxent Wildlife Research Center, Laurel, MD).

Banding Programs - Information from the leg-banding and recovery of migratory waterfowl is an important management tool used by Federal/State/Provincial wildlife agencies and researchers to assess distributions, harvest pressure, and survival rates, and to evaluate the effects of hunting regulations on wild waterfowl. The bird-banding program in North America is jointly administered by the USGS Bird

Banding Laboratory (BBL; Patuxent Wildlife Research Center, Laurel, MD) and the Bird Banding Office of the Canadian Wildlife Service (Ottawa, ON, Canada). These agencies issue permits and uniquely-coded, seamed bands to banders and maintain records of species and numbers banded and records of bands recovered by hunters and recoveries obtained from birds recaptured or found dead.

Large-scale releases of banded captive-reared mallards may affect reporting rates of bands on wild ducks near release sites. Reporting rates tend to be lower near sites where large numbers of Federally-banded ducks are marked, presumably because of a loss of “novelty” among hunters about shooting banded birds (Henny and Burnham 1976). The suppression of band-reporting rates caused by the increased frequency of harvesting banded birds makes Federal banding programs less efficient, so more ducks must be banded to get reliable information. This potential bias in reporting rates adds uncertainty to harvest-rate estimates for wild mallards, which affects the development of annual hunting regulations and, more specifically, the population models used in the AHM process. Although current regulations in § 21.13 (b)(3) allow marking of captive-reared mallards with seamless leg-bands, they do not specifically prohibit the use of seamed, non-Federal (i.e., private) bands that are very similar in appearance to Federal bands. The use of seamed bands on captive-reared mallards further exacerbates the reporting rate problem.

Harvest Surveys - Waterfowl harvests are estimated annually by the Service from a Hunter Questionnaire Survey (HQS) and a Parts Collection Survey (PCS), which sample approximately 70,000 hunters each year and collect more than 100,000 waterfowl parts (wings and tails) from hunters to assess the species, sex, and age composition of the harvest (Carney 1992). The randomly selected hunters solicited to participate in these surveys are not asked to exclude captive-reared mallards from their harvest reports or wing submissions, therefore some captive-reared mallards shot on shooting preserves or adjacent properties are reported in the HQS and wings are submitted to the PCS (Chief, Branch of Harvest Surveys, USFWS, personal communication). The total number of harvested, captive-reared mallards that

is reported to these surveys is unknown, but in a study of Maryland's now-discontinued release program, Hindman et al. (1992) found that alula-clipped wings of the Maryland DNR's released birds accounted for an average of 13.9 percent of immature mallard wings and 3 percent of the total duck wings submitted to the PCS from Maryland.

However, the alula-clipping technique is not used routinely to mark captive-reared mallards; and, there is no other completely reliable technique to distinguish captive-reared mallards from wild mallards based on wings submitted to the PCS, nor is there any means for distinguishing them from a hunter's response to the HQS. Wings of captive-reared mallards can sometimes be distinguished from those of wild mallards based on wear patterns, unusual molting patterns, or plumage characteristics, but these determinations are subjective and probably fail to identify many captive-reared mallards (Chief, Branch of Harvest Surveys, USFWS, personal communication). Therefore, the magnitude of survey bias resulting from hunter reports of harvested captive-reared mallards is difficult to assess and likely is not consistent through time.

The problem associated with captive-reared mallards potentially introducing bias into the U.S. harvest-surveys database is probably greatest in the Atlantic Flyway, where there are greater numbers of shooting preserves that release free-ranging birds. The surveys estimated that about 473,000 mallards were harvested in the Atlantic Flyway during the 2001 hunting season (U.S. Fish and Wildlife Service 2007). If all 128,500 captive-reared mallards harvested on shooting preserves in the Atlantic Flyway (Table 4) were included in the estimate, the Flyway's wild mallard harvest was overestimated by about 37 percent. In general, captive-reared mallards included in harvests reported in the HQS inflate the estimates of wild-mallard harvests, but equally important, they also affect the harvest estimates for other species, since the species composition of the PCS wing sample is used to apportion the HQS duck-harvest estimate among species. Also, because the mallards being released on shooting preserves are largely

young-of-the-year birds, these submissions to the PCS will inflate harvest age ratios (young per adult) and estimates of wild mallard productivity.

INTERNATIONAL ISSUES

Protection of migratory waterfowl in North America is provided by Conventions between the United States and Great Britain (for Canada), August 16, 1916; the United Mexican States, February 7, 1936 (amended March 10, 1972); Japan, March, 4, 1972; and the Soviet Union, November 19, 1976. Further, these obligations to protect shared migratory bird populations are implemented in the United States under the Migratory Bird Treaty Act, July 3, 1918. Movement patterns of captive-reared mallards away from release sites have been well-documented using leg-band recoveries in several studies (Dunn et al. 1995, Hindman et al. 1992, Smith 1999, Soutiere 1986, Wielicki 2001). Although most recoveries occur within close proximity to release sites, a smaller percentage (< 20%), usually indirect recoveries of males, occur considerable distances from the site, in other States as well as in Provinces of Canada. Hindman et al. (1992), Soutiere (1986), and RSA owners in Maryland have reported captive-reared mallard recoveries occurring in several Provinces of Canada, particularly Ontario. Dunn et al. (1995) found that only 2 percent of 1,953 direct recoveries of banded captive-reared mallards were reported from Canada, but 9 percent of 605 indirect recoveries were birds shot in Canada. This evidence indicates that some portion of the captive-reared mallards that survive the first hunting season will move longer distances and are integrating into the wild migratory mallard population. Because less than half of the captive-reared mallards released in free-flying conditions are actually harvested on shooting preserves, the majority of these birds begin dispersing greater distances to surrounding areas or establishing migratory patterns similar to wild birds. Many are harvested elsewhere, but an undetermined number become established in the migratory population.

The Canadian Wildlife Service has expressed its strong concern about captive-reared mallards that escape from shooting preserves in the United States, migrate to Canada, and integrate into wild mallard populations (Attachment 18). Canadian regulations and established policy strictly prohibit any bird held under an Aviculture Permit to be shot or released from captivity to the wild without a written application and authorization by Canada's Minister of the Environment. A written application is required to release wild-stock birds and must show qualifications, experience, and suitable facilities to propagate wild-stocks. Further, the applicant must demonstrate that his/her activities comply with an existing environmental review process and will not significantly affect wild stocks of birds or any other natural component. Canadian biologists are particularly concerned about the effects that mallard releases in the eastern U.S. could have on wild populations of black ducks breeding in eastern Canada. Competition and/or hybridization with mallards is felt to be one of the factors leading to the decline of black ducks. Further, the Canadian Wildlife Service has encouraged the Service to broaden its review and implement policy and regulations that will prevent the release or escape of captive-reared waterfowl of any species into wild populations (Attachment 18).

CONCLUSIONS

While the intent of the regulation § 21.13 was to allow privately-operated shooting preserves unlimited opportunity to shoot captive-reared mallards, provided there is a clear distinction from wild mallards and other migratory waterfowl, the Service is legally mandated to safeguard migratory waterfowl protected under the MBTA. Although this issue is largely confined to the eastern United States, and predominately the Atlantic Flyway, the influx of large numbers of captive-reared mallards released annually in a free-flying condition into areas inhabited by wild ducks has raised concerns by the Service, all Flyway Councils, the AFWA, and other conservation organizations.

This review provides evidence to indicate that large-scale releases of captive-reared mallards on shooting preserves increase the risks of several potential conflicts. When captive-reared mallards on shooting preserves are released in a free-flying condition and allowed to intermingle with wild ducks, there is an increased potential for violations of Federal waterfowl hunting regulations involving live decoys, baiting, over-bagging, and take of wild ducks out-of-season. These violations occur both on-site and on properties adjacent to the shooting preserves. Some States do not allow their licensed shooting preserves to operate outside of the dates of their regular Statewide duck seasons because of the high potential for shooting wild ducks on these areas. These State restrictions may decrease the potential for violations, but they also reduce the number of days available to harvest captive-reared mallards permitted under Federal regulations in § 21.13. When season lengths for wild ducks are severely restricted, as they have been at times in the past to protect wild ducks, the days available to shoot captive-reared mallards on shooting preserves are also severely reduced.

The inability to distinguish between captive-reared and wild ducks in flight and the potential for problems caused by misidentification, both on and off shooting preserves, are at the heart of law-enforcement issues regarding releases of free-ranging, captive-reared mallards. Curtailing releases of free-flying, captive-reared mallards on premises operated as shooting preserves is an identifiable way to alleviate the intermixing with wild ducks.

The range of movements by free-flying captive-reared mallards greatly affects the potential for interactions with wild waterfowl, thereby increasing risks of genetic introgression and hybridization, disease transmission, and conflicts with management programs. Smith (1999) reported considerable movements among RSAs and between RSAs and the Blackwater National Wildlife Refuge (and presumably the Fishing Bay WMA), and that movements of captive-reared mallards were positively related to the size and habitat availability on the source shooting preserve. Also, evidence from other

studies (Dunn et al. 1995) suggests that captive-reared mallards that survive the first year will move longer distances in successive years.

Genetic introgression and hybridization, and their effects on genetic diversity of wild ducks, are difficult to demonstrate and quantify at the population level. Pairing and interbreeding of captive-reared mallards with wild mallards, black ducks, and mottled ducks have been documented. Adverse effects have been observed in mottled ducks in Florida, and local breeding black ducks in Maryland are at risk of hybridization with captive-reared mallards. In these particular situations, care should be taken that the release of free-flying captive-reared mallards does not further contribute to the decline of these species. Genetic differences between mallards and black ducks have declined significantly in the past 50 years, probably due to hybridization (Mank et al. 2004), and interbreeding between black ducks and captive-reared mallards is likely contributing to that decline. Although the genetic impacts of interbreeding between captive-reared and wild mallards are unknown, extensive genetic introgression has been documented in wild populations of other game bird species as a result of interbreeding with released captive-reared birds (e.g., Blanco-Aguilar et al. 2008). Thus, it is prudent to avoid any potential for adverse effects of genetic introgression or hybridization with captive-reared mallards wherever possible, and thereby maintain the genetic integrity of wild stocks.

When considering the importance of disease transmission in captive-reared mallard releases, the primary concern is the risk associated with the activity. The potential for disease transmission is the key to this area of conflict, and dictates the precautions necessary for proactive and preventative management strategies. Stemming the increasing impacts and challenges diseases pose for wildlife conservation relies on the active prevention of disease emergence and an active decrease in the factors that provide potential for disease transmission. The interface between captive-reared and wild populations increases the risk of disease transmission and amplification. Measures to prevent or reduce the potential for both existing and emerging diseases to be introduced into either of these populations should be strongly encouraged.

Prevention of disease, rather than reactive responses to disease occurrence, should be the primary focus for addressing wildlife health. Clearly, proactive approaches for combating disease in migratory waterfowl are consistent with Service obligations under the MBTA and require further advancement because of global challenges associated with infectious disease emergence and resurgence.

Large-scale releases of captive-reared mallards in localized areas were found to have a potential for undesirable impacts on waterfowl-management programs (e.g., population monitoring, banding, and harvest surveys) designed to track the status and harvest of migratory waterfowl, mainly in the Atlantic Flyway, and particularly in Maryland. Estimates of wintering and breeding wild mallards, as well as estimates of the harvest of wild mallards, are likely inflated by the presence of captive-reared mallards when and where the surveys that provide those estimates are undertaken. In areas where captive-reared mallards marked with seamed bands are released in large numbers, band reporting rates for wild waterfowl may become depressed as band recoveries become commonplace. These effects may impart additional bias into important databases used by public wildlife-management agencies to manage our waterfowl resources. The less effective these databases become, the more uncertainty these public agencies have in making informed decisions regarding population status and trends, habitat utilization, appropriate waterfowl hunting seasons, and other management issues.

Whether ownership or property rights are relinquished or maintained once captive-reared mallards are released in a free-flying condition is unclear, since these birds are no longer within the possession and control of the respective shooting preserve. Under such conditions, does the status of captive-reared mallards change regarding regulatory statutes to that of a protected class (wild ducks) covered by the MBTA? Such mallards harvested by hunters outside the premises of a shooting preserve are subject to the regulatory statutes that apply to the taking of wild mallards. Also, property rights and regulatory statutes are unclear when free-flying captive-reared mallards released on one shooting preserve are then harvested on another shooting preserve.

The fact that many RSAs releasing free-flying, captive-reared mallards in Maryland are also actively managing their habitats by flooding food crops is further problematic. Such feeding and/or habitat-management practices on shooting preserves tend to attract wild ducks and consequently, increase the potential for conflicts with wild waterfowl. Some hunters have objected to shooting preserves attracting large numbers of wild waterfowl by feeding or by flooding various crops to provide food when the preserve is not hunted (Maryland DNR, personal communication). They maintain that these areas hold wild waterfowl, thus reducing hunting opportunity on surrounding properties. These situations usually occur in areas where shooting preserves that are allowed to release free-flying mallards are permitted to operate in close proximity to habitats occupied by migratory waterfowl. This brings into direct question the appropriateness of the Federal statutes in § 21.13, which allows captive-reared mallards to “be killed by shooting, in any number, at any time, within the confines of any premises operated as a shooting preserve under state license, permit, or authorization,” while coincidentally allowing shooting preserves to attract and harvest wild waterfowl protected under the MBTA and Federal/State statutes. If the ducks shot cannot be distinguished until retrieved and in-hand, there is a conflict in terms of what regulations are in effect at the time of shooting.

Results of this review suggest that the language of Federal regulation § 21.13 is ambiguous, particularly as it relates to release methods and control of captive-reared mallards on shooting preserves. Therefore, we believe some corrective action should be taken to limit intermixing of captive-reared mallards with wild waterfowl populations. Canada, with whom we share treaty obligations concerning the welfare of migratory bird populations, has voiced strong opposition to the releasing of captive-reared mallards on shooting preserves. Also, more than 70 percent of the States favor more restrictive Federal regulations controlling the release of free-flying, captive-reared mallards on shooting preserves and preventing them from entering the wild population. This lack of clear definition regarding regulations in § 21.13 was the basis for the series of correspondences between the Service (Attachment 5) and the Maryland DNR (Attachment 6) in 1985. This led to the de facto understanding that the Service would

allow captive-reared mallards on shooting preserves to be released in a free-flying condition and shot in any number, at any time of year under regulations in § 21.13. Previously, these shooting preserves were operated as “tower shoots” using flighted mallards, and precautions were taken to control the captive-reared mallards so they would not become free-ranging on these properties. If captive-reared mallards are released in a flighted method and shot upon release, as is the practice with “tower shoots,” the potential risk of violations and liabilities to hunters shooting captive-reared mallards on or near these facilities are reduced substantially or alleviated. More importantly, by minimizing interactions with wild ducks, shooting preserves can operate outside the regular duck-season dates and without regard to daily bag limits, as the regulations in § 21.13 were intended. Also, shooting preserves releasing flighted birds operate more efficiently by harvesting a greater proportion of the birds they release annually. In most cases, less than half of the captive-reared mallards released free-flying on shooting preserves each year are harvested that same year, while the remainder are allowed to move about freely.

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LIST OF ATTACHMENTS

Attachment	Title
1	Notice of Intent to review the release of captive-reared mallards, 1 June 1993 (58 FR 31247-31249)
2	Code of Federal regulations, Title 50, Part 10, Sections 11 and 12
3	Code of Federal regulations, Title 50, Part 21, Section 13
4	Letter dated October 4, 1985 from Representative John Breaux to Ronald Lambertson, Acting Deputy Director, U.S. Fish and Wildlife Service
5	Letter dated October 28, 1985 from Ronald Lambertson to Donald E. MacLauchlan, Director of the Maryland Forest, Park, and Wildlife Service
6	Letter dated November 21, 1985 from Donald E. MacLauchlan to Ronald Lambertson
7	Draft "Fact Sheet on Hunting Captive Reared Mallards" prepared by the U.S. Fish and Wildlife Service in response to a request from Congressman Beryl Anthony
8	Requests and recommendations from the Flyway Councils and International Association of Fish and Wildlife Agencies for the Service to conduct a review of captive-reared mallard releases
9	Memorandum from the Deputy Director, U.S. Fish and Wildlife Service to the Director of Regulatory Affairs, U.S. Fish and Wildlife Service announcing the postponement of the review of captive-reared mallard releases
10	Letter from the International Association of Fish and Wildlife Agencies to the Director, U.S. Fish and Wildlife Service urging the completion of the Service's review of captive-reared mallard releases
11	Letter from the National Flyway Council to the Chief, Division of Migratory Bird Management, U.S. Fish and Wildlife Service urging the completion of the Service's review of captive-reared mallard releases

Attachment	Title
12	Letter to the Chairman, National Flyway Council, requesting that the Council query State agencies about captive-reared mallard release programs in their States
13	Proposal cover letter and abstract from Dr. Frank Rohwer for a study of the effects of releases of captive-reared mallards
14	Title page and abstract of the Ph.D. dissertation resulting from the study of the effects or releases of captive-reared mallards
15	First page and abstract of: Smith, D. B., and F. C. Rohwer. 1997. Perceptions of releases of captive-reared mallards with emphasis on an intensive program in Maryland. Transactions of the North American Wildlife and Natural Resources Conference 62:403-411
16	Questionnaire concerning releases of captive-reared mallards sent to State waterfowl biologists
17	Questionnaire concerning releases of captive-reared mallards sent to Service Regional Offices
18	Letter from the Canadian Wildlife Service concerning the release of captive-reared waterfowl and supporting regulations
19	Memorandum from Assistant Director for Law Enforcement, U.S. Fish and Wildlife Service, regarding the release of free-flying captive-reared mallards and their influence on the enforcement of the MBTA