THE MIDWINTER WATERFOWL SURVEY IN THE CENTRAL FLYWAY

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Introduction

Since its inception, the Midwinter Waterfowl Survey (MWS) has undergone a long history of reviews and modifications. The original objectives for the MWS have changed and the primary and secondary uses of the data derived for this survey have evolved over time. Recent reviews critical of the MWS prompted the Central Flyway Council to review the MWS and make a recommendation in March 2000 that stated:

1. The MWS should be continued annually in the traditionally surveyed areas in the Central Flyway and throughout North America.
2. That winter surveys conducted by the Service continue in Mexico.
3. That a review of the MWS be conducted by the Service and the Flyways, with the objective of improving or refining the survey. Included should be a review of objectives and design, inconsistencies in the collecting and reporting of data, and concerns related to safety or logistical problems.

The purpose of this report is to in part address the third part of the above recommendation. We acknowledge the reviews of earlier drafts of this report by D.S. Benning (retired FWS), J.E. Cornely (FWS), T.J. Moser (FWS) and J.F. Voelzer (FWS).

Historical Perspective

The MWS, initiated in 1935, is the oldest large-scale population survey of migratory birds that is conducted on an operational basis in North America (Reeves 1984). Surveys were conducted irregularly prior to World War II, were curtailed during the war years, but have been completed without interruption since that time. The MWS is cooperatively conducted each winter by State and Federal personnel in the lower 48 states and is an example of the strong, long-term, Federal/State partnership that has been developed to address legal mandates for monitoring migratory birds. The MWS is conducted in each Flyway during early January and provides a general inventory of all waterfowl species, an index to their abundance, and an indication of their relative distribution on wintering habitats.

Since 1935, survey methods and geographic coverage have been modified in some areas, but the analytical strength of information collected is based on the maintenance of **consistent** methodology of this survey over time. The MWS was known as the “Midwinter Waterfowl Inventory”, when it was initially implemented as a simple tabulation or count of ducks observed from the ground on wintering habitats. Aerial survey techniques were initiated after World War II and expanded to include geese and swans. The evolution continued as biologists in some areas began to change from cruise surveys to sampling procedures using transect or block counts expanded into population estimates for an area. However, most biologists have favored the use of cruise survey approaches for the majority of habitats sampled, because the clumped distribution of waterfowl typically found during winter does not lend itself to sampling procedures

developed for more uniformly distributed breeding populations of most birds (Johnson et al. 2001).
In the late 1940's the use of the MWS was central to development of differential Flyway frameworks for hunting ducks, geese, and swans. During 1935-54, the MWS provided the primary information used in the development of annual waterfowl hunting regulations, as the vast remote breeding areas were a formidable logistic obstacle at that time (Blohm 1989). After the development of the aerial waterfowl breeding ground surveys in 1955, winter survey data received less emphasis in the regulatory process. The MWS is the only waterfowl population survey that provides indices of abundance and species composition unique to a Flyway.

The original objectives of the MWS were to provide an annual index of waterfowl abundance, to track population trends of major duck species, and a means of describing winter distributions and habitat use. Additionally, the MWS serves as a independent check of the results gathered from other surveys and strengthens interpretations from these surveys. Information gathered from the MWS provides for several other indirect uses that have changed over time. Today, the MWS provides useful data that are largely unavailable from other sources. If the MWS were disrupted, either flyway-wide or in some States, the long-term continuity and application of this database would be compromised and we would be unable to respond to future information needs concerning status and winter distribution of many waterfowl species.

Ancillary Winter Surveys

For most migratory bird species, there are only two periods during their annual cycle when they are relatively sedentary and suited for large-scale population survey development. Ancillary surveys during the winter period have from time to time been implemented to augment the MWS. In addition, the coverage of the MWS has been expanded to other areas and other non-waterfowl species have been included on an irregular basis.

1. The Pacific Flyway conducts surveys for specific goose populations during October, November, and December.
2. During 1969-98, the Mississippi and Central Flyways utilized a special December survey for some goose populations.
3. Mexico is currently surveyed for all waterfowl species and sandhill cranes during January every three years.
4. A special Redhead Winter Survey (recently expanded to include scaup) that starts in Florida and extends westward along the Gulf Coast of Mississippi, Louisiana, Texas, and into Mexico is conducted annually.
5. Sea Duck surveys are conducted in the Atlantic Flyway.
6. Brant Surveys are conducted in the Pacific Flyway and Mexico.
7. Addition of American coots to annual MWS coverage.
8. Irregular inclusion of non-waterfowl species such as sandhill cranes, bald eagles, and shorebirds.

Mexico

Records indicate that a FWS commitment to the Mexico Survey Program began in 1936. This survey was instrumental for the signing of the Migratory Bird Treaty with Mexico in 1946. The survey has been conducted at variable intervals, either annually, at three, or five year intervals. Currently this survey is conducted at three-year intervals in all areas and annually on the west

coast including the Baja Peninsula and the east coast from the Laguna Madre to Tampico.

The Mexico winter survey served as the basis for preservation of Laguna de Babicora and the delineation of many other important habitats for wintering waterfowl. Although the Mexico survey is not part of the MWS, it augments North American coverage of waterfowl in the U.S. portion of the MWS and was originally intended to provide necessary coverage of waterfowl species that also winter in Mexico. The survey is currently divided into three regions, i.e. the Interior Highlands, the East Coast and the West Coast and is conducted by staff and aircraft from the FWS with participation of Mexican (SEMARNAT) biologists.

Waterfowl Species Surveyed in the MWS

The Migratory Bird Treaty Act (1918) requires that monitoring information including annual indices of "...migratory game bird abundance and distribution must be maintained to determine when, to what extent, if at all, and by what means, it is compatible to allow hunting..." . The Fish and Wildlife Conservation Act (1980) and its 1988 (Forsythe/Chaffee) and 1989 (Mitchell) amendments extended monitoring responsibilities to all migratory birds. To satisfy these legal monitoring responsibilities, the MWS, in concert with ten other surveys has been designated by the FWS as a "Core Survey" of critical importance for the management of North America's migratory bird resources.

In the U.S., we currently designate 58 species of migratory game birds in 5 avian families specified by Treaty (Appendix 1). Forty of these species belong to the Family Anatidae; however, a recent court decision has added the introduced mute swan and now 41 species of waterfowl are listed. In varying degrees, the MWS can be used to track the status of many of these species. In some situations, biologists have been able to define winter ranges of various subspecies or populations of some swans and geese, and the MWS has been the principle survey used to track the status of many of these populations.

Non-waterfowl Species

Since its inception, survey biologists have attempted to survey other species wildlife during waterfowl coverage of the MWS. The greatest limitation for these ancillary survey efforts of other wildlife species is related to the MWS's limited coverage to waterfowl habitats that primarily cover wetlands associated upland habitats, including agricultural fields used for feeding. This sampling frame does not encompass the entire range and habitat usage for most other species of wildlife.

The American coot, a member of the rail family, is intimately tied to wetland habitats, and is conspicuous on most wetland habitats during winter. As such, coots have been tabulated on MWS surveys since the 1940s. Wintering sandhill cranes tend to use wetland habitats and upland agricultural fields for feeding in association with several waterfowl species. Although spring and fall migration surveys have been developed to monitor their annual population status, wintering surveys have been valuable for understanding distribution changes in response to habitat changes. Although sandhill cranes are not operationally tabulated on all MWS surveys they continue to be surveyed in several areas, such as on the Mexican portions of the survey. During the late 1960's until the early 1980's, eagles were counted on most portions of MWS surveys. Although bald eagles are still counted in some areas, it was found that eagle indices of abundance and distributions during the MWS did not reflect overall abundance or

distributions because of the limited types of habitats surveyed. Experimental efforts to survey flock size of size classes of shorebirds was attempted during surveys in the Mexican Interior Highlands, however the inability to identify species of shorebirds during the aerial coverage for waterfowl decreased the utility of conducting concurrent surveys for these species.

Timing and Environmental Conditions

Environmental conditions and hunting greatly influence winter distributions of waterfowl. Habitat conditions can change rapidly and many species of waterfowl in response to changing environmental conditions such as temperature and precipitation can markedly alter distributions in an extremely short time period. Waterfowl also tend to disperse into habitats where they are less visible after hunting seasons have ended. For these reasons, the MWS in each Flyway should be conducted simultaneously in a short a time period as possible.

The Central Flyway MWS is scheduled in early January as follows: If the first work-week in January falls on Monday or Tuesday, the survey period will be the first 5 work-days. If the first work-day occurs Wednesday - Friday, the survey period will be the 5 days beginning with the following Monday.

Annual Costs

The FWS Survey Review, completed in February 2000, indicated the following costs for operation of the MWS:

	Staff		Operational	Total
	Days	Costs [1]	Costs	Costs
Atlantic Flyway	228	$ 29,640	$ 35,000	$ 64,640
Mississippi Flyway	358	$ 46,540	$ 46,650	$ 93,190
Central Flyway	252	$ 32,760	$ 53,650	$ 86,410
Pacific Flyway	186	$ 24,180	$ 36,860	$ 61,040
FWS (U.S.)	189	$ 24,570	$ 69,540	$ 94,110
FWS (Mexico) [2]	240	$ 31,200	$ 57,040	$ 61,240
	1,403	$188,890	$298,740	$469,630

[1] Each staff days was valued at an approximate cost of $130

[2] Mexico Interior Highlands portion is conducted on a three-year cycle, coastal portions are surveyed annually.

Concerns and Problems

The MWS has been criticized for its shortcomings. Some biologists have suggested that the survey be discontinued (Heusmann 1999). Over the years the MWS has been subject to periodic reviews which have noted a number of concerns and problems, including:

1. MWS coverage, timing, and design have been inconsistent among years and resulted in data that are not comparable over the entire survey period.
2. The predominant use of low bid contract aircraft for the conduct of the MWS is a safety concern.
3. MWS databases that are 10-20 years old are not germane to current waterfowl management.

4. Variable environmental conditions (flooding, temperature, precipitation) compromise survey comparisons among years.
5. MWS is too costly for the value of information derived from the survey.
6. The MWS, including Mexico, gives an incomplete picture of winter distribution of waterfowl, as some species continue to migrate to wintering areas in the Carribean and into Central and South America.
7. MWS numbers represent a minimum estimate of birds present at any one point in time.
8. Many MWS survey biologists are inexperienced and vary in their ability to accurately "estimate" flock sizes and identify various waterfowl species.

Uses of MWS Information

Despite the MWS's shortcomings in precision and accuracy, this long-term database continues to provide useful comparisons valuable to Flyway waterfowl management. In 2000, the Central Flyway Council reviewed the MWS and concluded that the winter survey should be continued and possibly upgraded to be more efficient, and that data processing and storage should be modernized in a computerized format to be more readily available and easily summarized for analyzes (Appendix 2).

The following is an attempt to list and briefly describe some of the past and present uses of the information from the MWS:

1. Provide Winter Population Status Information - The MWS and the Audubon Christmas Bird Count provide the only long-term source of population information for migratory bird species on the wintering grounds. For some waterfowl species, such as brant, tundra swans, many populations of geese, and those populations of ducks that predominantly nest outside the breeding ground survey strata the MWS is the only status information currently available during the entire annual cycle. Winter population information on waterfowl species is used to augment status information from breeding surveys. Without this information, biologists would have little quantitative basis for determining whether changes in wintering waterfowl numbers are occurring at the Continental, Flyway, or regional levels. As an index of winter abundance, the MWS provides management agencies with critical information from which to prescribe appropriate harvest management actions.

   MWS data does not allow an "estimate" of population size; rather it serves as "index" to abundance. Information can not, in any direct manner, be related to other waterfowl breeding or harvest surveys. However, simultaneous surveys conducted during the MWS provide regional, Flyway and Continental indices of abundance that are of considerable value to resource managers.

2. Assess Distributional Changes - MWS data are the only source of information about distributional changes in winter concentrations of waterfowl over the long-term, both within and among Flyways. Such distributional changes have been noted for many species (i.e. snow geese, Ross's geese, white-fronted geese, Canada geese, swans, black ducks, canvasbacks, scaup, and various stocks of mallards) and have often been attributed to winter habitat changes. However, these changes may reflect changes in breeding derivations or harvest pressure as well. Shifts in relative distributions of wintering waterfowl over time have a major impact on hunting traditions and economics at regional and Flyways scales. In the Central Flyway, increases in locally-nesting

resident Canada geese has also been accompanied by a northward shift of the wintering distribution of Canada geese in the Flyway.

3. Develop Management Programs - Winter waterfowl population and distribution information from the MWS are an important component of many Flyway and agency developed management plans. In many instances, these data were used to establish population objectives for the 1986 North American Waterfowl Management Plan. Progress towards meeting these population and distribution objectives are evaluated directly from MWS survey data. MWS data are the only source of wintering waterfowl population information available for NAWMP's Joint Ventures, such as the Playa Lakes, Lower Mississippi River and Gulf Coast Joint Ventures, to prioritize objectives, direct habitat projects, evaluate progress, and inform management agencies.

4. Support Research Projects - MWS data are an important source of comparative information to support various research projects. Several research projects have documented critical species/habitat associations and shown significant changes that have taken place over the long-term. Various reviews, summaries, and reports on a multitude of issues have used winter survey data to complete assessments (e.g. captive-reared mallards, species management plans, special seasons, etc.). New analytical techniques have increased the utilization of long-term databases, such as winter surveys, using models and trends to address fundamental questions of population dynamics. Problems associated with data storage and retrieval continues to limit the summarization and application of MWS data for research purposes.

5. Formulate Hunting Regulations - Winter survey data have been used extensively in the past to develop proposals and evaluate effects of various hunting seasons (e.g. zoning, management units, regular and special seasons on ducks and geese, and Cooperative Flyway Management Plans. MWS information was an important source of data used in the development of harvest management strategies for eastern mallards, pintails, canvasbacks, and black ducks. MWS information has also been useful when hunting regulations have been challenged by legal actions (e.g. Mid-Continent Light Geese and American black ducks).

6. Support Acquisition Programs - MWS data have been an important source of information to guide State and Federal acquisition programs and to establish priorities for wintering habitats (e.g. FWS Concept Plans). These habitat priorities were based on rankings of selected species (e.g. National Species of Special Emphasis) and the threat of future loss of habitat within each Flyway.

7. Assess Environmental Impacts - MWS information has often been an important element in the development and assessment of environmental impact statements. The 1975 Federal Environmental Impact Statement on "Issuance of Annual Regulations Permitting Sport Hunting of Migratory Birds" and the 1988 Supplemental Environmental Impact Statement on "The Sport Hunting of Migratory Birds" made extensive use of MWS data. In addition, these MWS data figured importantly in Environmental Assessments on "Proposed Hunting Regulations on Black Ducks" in 1976, 1980, and 1983. Also, an Environmental Assessment on "Sport Hunting of Tundra Swans" in 1984 used winter survey data to justify opening a hunting season in all Flyways. MWS data will be of great importance in the development of long-term harvest management strategies that will be developed in the proposed Environment Impact Statement on hunting.

8. Develop Mitigation Proposals - MWS data are the only source of information on the relative abundance and distribution of various waterfowl to assess impacts and negotiate mitigation from major public works projects (e.g. power plants, sewage treatments facilities, highways, water diversion projects, etc.,). Major losses of valuable inland and coastal wintering habitats would have occurred in the past without this source of information on both the local and Flyway levels.

9. Assess Disease Outbreaks - MWS information has been useful in the past to appraise potential effects of disease outbreaks. Waterfowl diseases such as avian cholera, botulism , Newcastle disease, aspergillosis, and duck plague have the potential of causing large scale die-offs in the future. If these situations should occur, winter waterfowl survey data would be invaluable to assess the effects at the species or population level.

10. Provide Public Outreach - MWS information has been helpful in providing information upon requests to the general public, news media, and various State and Federal agency personnel, including law enforcement. Biologists have used this information to explain why waterfowl numbers may have changed or are above or below average, particularly to hunters. Conducting the MWS each year gives biologists an opportunity to stay in touch with changes that may be occurring over time in a particular area and cause them to investigate potential factors responsible for these changes.

Improvements

In recent years, actions have been taken to improve the MWS, including:

1) Standardization of data reporting procedures. A standardized data entry and editing program has been implemented in the Atlantic Flyway. This system should reduce input errors and improve capabilities to retrieve, tabulate, and analyze data. It is proposed that an improved system for the reporting of information will be adapted for use in all Flyways.
2) Evaluation of alternative methods of data analysis, including the use of analytical methods that adjust for effort and differential coverage.
3) Evaluation of standardized long-term alternative survey designs.
    a) Experimental aerial transect, using stratified random sampling, was developed for wintering black ducks in coastal Atlantic Flyway states.
    b) Experimental stratified random samples of aerial transect to estimate mallard numbers in forested areas of the Mississippi Alluvial Valley.
    c) Recently, survey biologists in Texas are using combination of, a) a cruise survey of random Playa lakes, b) a cruise survey of major concentration areas on lakes and reservoirs, and c) transect surveys in Central and Eastern coastal areas.

In recent years, alternatives have been suggested to current survey procedures, and include such approaches as:

1) Restriction of annual coverage to major concentrations of ducks.
2) Design of annual species-oriented winter surveys, while conducting the original MWS at five-year intervals.
3) Improvement and standardization of the current design and conducting the survey annually.
4) Incorporation of photo-correction techniques.

5) Implementation of a training program for observers.
6) Increase coverage on Mexico portions of the survey.
    a. Realignment of MWS zones with NAWMP Joint Venture boundaries or those of Bird Conservation Regions.
7) Design data entry and data retrieval software programs.
8) Coordination with Latin and South American and Caribbean Wildlife Agencies on the potential for winter survey expansions.

Conclusion

In conclusion, the Central Flyway's MWS has provided useful data comparisons largely unavailable from other sources. The Service designated the MWS as a "Core Survey", in accordance with the Fish and Wildlife Conservation Act of 1980 and subsequent amendments in 1988 and 1989, to satisfy its legal monitoring responsibilities under the Migratory Bird Treaty Act of 1918. These statutes are of critical importance to the management of North America's waterfowl resources. If this survey were discontinued, either flyway-wide or in some States, the long-term continuity and application of this database would be compromised and biologists would be unable to respond to future information needs concerning winter status and distributions of many waterfowl species.

Probably the most important consideration regarding continuation of the MWS in the Central Flyway is maintaining our long-term Federal/State partnership. Obviously, some aspects of the survey are in need of operational refinements. The Service along with the Central Flyway Council urges all States in the Central Flyway to participate to the full extent possible. The Service is committed to assisting States wherever possible with training, selecting vendors aircraft and pilots, safety, operating procedures, prioritizing key wintering concentrations, and with updating data entry, storage, and retrieval programs. Hopefully, the Flyway Councils and the Service, working in concert, can effectively improve the operation, efficiency, and utility of the MWS to management North America's waterfowl resources.

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Appendix 1. Central Flyway Waterfowl Technical Committee and Central Flyway Council Recommendation on Continuation of the MWS.

Recommendation 22: March 2000

The Central Flyway Council recommends:

4. That the MWS be continued annually in the traditional surveyed areas in the Central Flyway and throughout North America.
5. That winter surveys conducted by the Fish and Wildlife Service (Service) continue in Mexico.
6. That a review of the MWS be conducted by the Service and the Flyways, with the objective of improving or refining the survey. Included should be a review of objectives and design, inconsistencies in the collecting and reporting of data, and concerns related to safety or logistical problems.

Justification:
Some states and one flyway have proposed or considered proposing the elimination of the MWS. The current MWS, with some modification, has been operational since the early 1930's. The principal objective of the MWS is to obtain an annual estimate of the relative numbers of waterfowl and their distribution on the wintering grounds. Data from the surveys have provided the only population status information for many species. In addition to providing annual population status information, temporal and spatial distribution aspects of the data have been used for many important management activities that impact waterfowl habitat, including implementation of the North American Waterfowl Management Plan, land acquisition programs, integration of the management programs with other wildlife, assessing the impact of construction, water development projects, and other public projects that impact waterfowl habitat, aviation, and a multitude of other uses.

MWS needs to be continued for several reasons:

1. It provides the only annual population data on several species of ducks such as buffleheads, goldeneyes, and ruddy ducks, and many other species.
2. The MWS is the current official survey used in the management plans for some Canada goose populations and for eastern population tundra swans. In the Central Flyway alone, 10 species plans depend on the MWS.
3. The MWS is the official population survey used for Mid-Continent Light Goose Populations. The survey needs to be maintained to monitor the success or failure of population reduction techniques now in use or being contemplated for use in the future.

While the MWS, including Mexican portions, has been and remains very useful, there are some aspects of the survey that may need improvement, at least in some parts of the surveyed area. A comprehensive review of areas such as objectives of the survey, design, consistent and correct species identification, and safety while conducting the survey would be appropriate. This review should be done jointly by the Service and the Flyways.

Appendix 2. Indigenous North American Migratory Bird Species For Which U.S. Hunting Seasons Are Established

Family Anatidae

1. Trumpeter Swan
2. Tundra Swan
3. Ross's Goose
4. Snow Goose
5. Canada Goose
6. Greater White-fronted Goose
7. Brant
8. King Eider
9. Common Eider
10. Fulvous Whistling Duck
11. Black-bellied Whistling Duck
12. Wood Duck
13. American Wigeon
14. Gadwall
15. American Green-winged Teal
16. Mallard
17. Mottled Duck
18. American Black Duck
19. Northern Pintail
20. Blue-winged Teal
21. Cinnamon Teal
22. Northern Shoveler
23. Canvasback
24. Redhead
25. Ring-necked Duck
26. Greater Scaup
27. Lesser Scaup
28. Harlequin
29. Long-tailed Duck
30. Black Scoter
31. Surf Scoter
32. White-winged Scoter
33. Bufflehead
34. Barrow's Goldeneye
35. Common Goldeneye
36. Hooded Merganser
37. Common Merganser
38. Ruddy Duck
39. Muscovy [1]
40. Masked Duck [1]

Family Columbidae

41. Mourning Dove
42. White-winged Dove
43. White-tipped Dove
44. Band-tailed Pigeon
45. Zenaida Dove [2,3]
46. Scaly-naped Dove [2]

Family Corvidae

47. Common Crow
48. Fish Crow

Family Gruidae

49. Sandhill Crane

Family Rallidae

50. American Coot
51. Purple Gallinule
52. Common Moorhen
53. King Rail
54. Clapper Rail
55. Sora
56. Virginia Rail

Family Scolopacidae

57. American Woodcock
58. Common Snipe

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[1] Mexico
[2] Puerto Rico
[3] Virgin Islands