

**Supporting Statement B for
Paperwork Reduction Act Submission**

Migratory Bird Harvest Surveys

**Form numbers: 3-2056J, 3-2056K, 3-2056L, 3-2056M, 3-2056N, 3-165, 3-165A, 3-165B, 3-165C, 3-165D, 3-165E
50 CFR 20.20**

OMB Control Number 1018-0023

- 1. Describe (including a numerical estimate) the potential respondent universe and any sampling or other respondent selection method to be used. Data on the number of entities (e.g., establishments, State and local government units, households, or persons) in the universe covered by the collection and in the corresponding sample must be provided in tabular form for the universe as a whole and for each of the strata in the proposed sample. Indicate expected response rates for the collection as a whole. If the collection has been conducted previously, include the actual response rate achieved.**

Migratory Bird Harvest Information Program and Migratory Bird Hunter Survey: The potential respondent universe is all licensed migratory bird hunters in the 49 States that have migratory bird hunting seasons, approximately 3,800,000 individuals. The universe is stratified by: (1) State, and (2) hunters' hunting activity and success the previous season. A systematic sample is selected within each stratum from the names and addresses in the order in which they are received. Stratum-specific universe and sampling data for forms 3-2056J, 3-2056K, 3-2056L, and 3-2056M, are given in Tables 1-4. Sampling rates vary by State, form, and success strata, and range from <1 percent to 100 percent. Because sampling rates vary by State, form, and success strata, weighted and unweighted response rates were calculated to each survey form for 2012. Weighted and unweighted response rates for all five form types average 51 percent nationally. Response rates for the four HIP survey forms in 2012 were as follows:

Survey form	Unweighted response rate	Weighted response rate
Waterfowl (3-2056J)	46%	51%
Dove (3-2056K)	51%	52%
Woodcock (3-2056L)	55%	51%
Snipe/Coot/Rail/Gallinule (3-2056M)	52%	50%

About 4 percent of the nonresponse rate is due to undeliverable mail. We are investigating address hygiene software, to determine if that is an economical way to reduce nonresponse due to undeliverable mail.

Parts Collection Survey: In 2012, approximately 70,000 duck wings and 14,000 goose tails were collected and examined by biologists out of a universe of 15,600,000 ducks and 3,200,000 geese harvested. These parts are obtained from approximately 6,500 successful waterfowl hunters who return form 3-165 out of a universe of 1,115,000 active waterfowl hunters. Sample sizes for waterfowl are given in Table 5.

The sample of hunters who will be sent form 3-165E consists of approximately 4,100 successful mourning dove hunters from a sample universe of about 1 million active dove hunters. We

solicit wings from the first two weekends of the hunting season only, to allow estimation of regional recruitment. We collect and examine about 25,000 wings from the first week of the hunting season out of a universe of about 7,000,000 birds (about half of the total season harvest) that are harvested during the first week of the mourning dove hunting season. Sampling rates vary by State, and range from 55 percent to 100 percent of successful mourning dove hunters responding to Form 3-2056K this previous year. Less than 1 percent of the harvest during the first week is sampled. Sample sizes for mourning doves are listed in Table 6. Appendix A contains a statistical review of the dove Parts Collection Survey. As the result of this work, we reduced sample sizes for this survey for the 2013-14 hunting season.

The sample of hunters who are sent form 3-165B consists of approximately 2,000 successful hunters from a sample universe of approximately 200,000 active hunters of other species of migratory birds (woodcock [≈130,000 hunters], snipe [≈30,000 hunters], rail [≈10,000 hunters], gallinule [≈3,000 hunters], and band-tailed pigeon hunters [≈15,000 hunters]. Approximately 15,000 wings are collected and examined out of a universe of approximately 500,000 birds harvested. The percent of harvest sampled ranges from <1 percent to 5 percent for the species or species groups, with the highest sampling rate applied to woodcock harvest. Sample sizes for the woodcock, snipe, rail species, and band-tailed pigeons are listed in Table 7.

Sandhill Crane Harvest Survey: The universe for sampling is approximately 30,000 individuals who obtain an annual permit to hunt sandhill cranes. Sampling rates are set by State, with 10 percent of the permittees randomly selected to receive questionnaires in Texas, 20 percent of the permittees selected in Colorado and North Dakota, and 50 percent of the permittees contacted in all other States except Wyoming. All permittees in Wyoming are contacted because of the low number of permits issued. Pertinent sampling characteristics by State are listed in Table 8. In 2009, the unweighted response rate for the crane survey was 62 percent, and the weighted response rate was 56 percent.

2. Describe the procedures for the collection of information including:

- * **Statistical methodology for stratification and sample selection,**
- * **Estimation procedure,**
- * **Degree of accuracy needed for the purpose described in the justification,**
- * **Unusual problems requiring specialized sampling procedures, and**
- * **Any use of periodic (less frequent than annual) data collection cycles to reduce burden.**

Migratory Bird Harvest Information Program: Each State requires all migratory bird hunters to identify themselves as such, and to provide their name, address, and date of birth, as a condition for obtaining authorization to hunt migratory game birds in the State. We are seeking permission to collect email addresses from States that already collect this information, so we can send some reminders by email. All of the name, address, email address, and date of birth information collection is done by the State's hunting license vendors (agents) or by a State contractor. State license agents or contractors ask each migratory game bird hunter to answer a series of questions that allows us to stratify our sampling procedure. Each State collects the information in a way that is most appropriate for that State, but all States ask some variation of the following questions:

- 1) Will you hunt migratory birds this year?
- 2) How many ducks did you bag last year?
- 3) How many geese did you bag last year?
- 4) How many doves did you bag last year?
- 5) How many woodcock did you bag last year?

- 6) Did you hunt coots or snipe last year?
- 7) Did you hunt rails or gallinules last year?
- 8) Will you hunt sandhill cranes this year?
- 9) Will you hunt band-tailed pigeons this year?
- 10) Will you hunt brant this year?
- 11) Did you hunt sea ducks last year?

States are responsible for development of adequate control procedures to ensure that agents (1) account for all validated licenses; (2) promptly provide the State with names, addresses, and other information; (3) have a low proportion of incomplete or illegible information; and (4) return information from all migratory game bird hunters. We are continuing to work with States to improve the quality of their sample frame (Appendixes B and C).

Migratory Bird Hunter Survey Procedures: Survey procedures are based on Dillman's Total Design Method (Dillman, 1978, Mail and Telephone Surveys, the Total Design Method, Wiley). This method has been shown to substantially reduce nonresponse in many situations.

- a. States provide us with migratory game bird hunters' names, addresses, birth dates, and their answers to the above questions in an acceptable form (electronic data or machine-scannable paper form). We receive the first list of hunter names and addresses in August prior to the migratory bird hunting seasons in each State. The States then send us updated lists every 2 weeks until the end of the migratory bird hunting seasons within each respective State. We need this information is needed in timely fashion to contact survey participants and ask them to keep records of their migratory game bird hunting throughout the hunting season. This also allows us to get survey forms to selected hunters before the hunting season starts or shortly after the hunter purchased his or her hunting license.
- b. To protect hunters' privacy, it is our policy to use the names and addresses only for conducting hunter surveys and for no other purpose. All records of hunters' names and addresses are deleted after each year's survey results are finalized, and we do not maintain a permanent record of names and addresses.
- c. We use the answers to the above questions to assign each hunter to one of three activity strata for duck, goose, dove, and woodcock hunting; and one of two hunting activity strata for coots and snipe, rails and gallinules, band-tailed pigeons, brant, and sea duck hunting. The three hunting activity strata for hunters of duck, goose, and dove hunters are (1) no harvest; (2) low harvest; and (3) high harvest. Low harvest of ducks and geese is defined as harvest of 1 to 10 birds the previous year; low harvest of doves is defined as harvest of 1 to 30 birds the previous year. The two hunting activity strata for hunters of woodcock, coots or snipe, rails or gallinules, band-tailed pigeons, brant, sea ducks are: (1) will (did) hunt or (2) will (did) not hunt.
- d. We select samples of hunters for receipt of one of four Migratory Bird Harvest Survey forms: waterfowl (duck, goose, sea duck, and brant; form 3-2056J), dove and band-tailed pigeon (form 3-2056K), woodcock (form 3-2056L), and snipe, rail, gallinule, and coot (form 3-2056M). Similar species are grouped together on the same form to control survey costs. Higher sampling rates are needed for successful hunters and for those who hunt less-frequently hunted species. Hunters are not asked to participate in more than one survey per State per year to minimize the burden on individual respondents.

- e. Samples are stratified by survey form, State, and hunting activity. Stratification by State is relevant because: (1) hunters must register for the Migratory Bird Harvest Information Program in each State in which he/she hunts; (2) harvest regulations and species distributions vary by State; and (3) response rates vary by State. Theoretically, there could be up to $(3)(3)(3)(2)(2)(2)(2)(2) = 1,728$ activity strata in each State, defined by (number of duck hunting activity strata) X (number of goose hunting activity strata) X (number of dove hunting activity strata) X (number of woodcock hunting activity strata) X (number of coots/snipe success strata) X (number of rail/gallinule success strata) X (number of band-tailed pigeon success strata) X (number of sea duck hunting success strata) X (number of brant hunting success strata). However, individual States do not allow hunting of all the species listed; therefore most States have fewer strata. For example only 11 States have sea duck seasons, only 14 States have brant seasons, and only 7 States have band-tailed pigeon seasons. We also consider the stratification of each species/species group independently. Thus, there are a total of 705 strata in the 49 States, with the number of activity strata in individual States ranging from 10 to 17.
- f. Samples are selected as the names are received so that migratory bird hunters can be contacted and asked to keep records as soon as possible after the hunting season starts. The first, eligible hunter in a file is selected, and then every n^{th} hunter in each stratum is selected thereafter, with (potentially) different sampling rates for each stratum. Sampling without replacement is used, with high priority strata being sampled before lower priority strata. Stratum priority is determined by: (1) biological need, and (2) desired precision levels for the estimates.
- g. Double sampling estimates (Hansen and Hurwitz, 1958, JASA) are used to account for nonresponse (see Groves, 1989, *Survey Errors and Survey Costs*, Wiley, pages 165-169; and Hansen, Hurwitz and Madow, 1953 *Sample Survey Methods and Theory*, Wiley, vol. 1, pages 468-475). Two response strata are defined by the respondents and nonrespondents to the first wave of reminder letters. A second wave of reminders and survey replacement forms is sent to all nonrespondents to the first wave of reminder letters. Additionally, a third wave of reminder letters and survey replacement forms is sent to all nonrespondents to the second wave of reminder letters.

For each species (e.g., mourning dove) or species-group (e.g., geese), the number of active hunters, number of hunting days, and number of birds harvested are estimated from the questionnaire responses using a ratio estimator with the harvest per hunter and the number of migratory bird hunters reported, by stratum, by State. Species-, age-, and sex-specific harvests are estimated using ratios estimated from the Parts Collection Survey.

Target 95 percent confidence intervals for harvest estimates at the management unit level (e.g., Flyway) are as follows: ducks, ± 5 percent; geese, ± 5 percent; mourning doves, ± 5 percent; brant, woodcock, band-tailed pigeons, and white-winged doves, ± 10 percent; sea ducks, ± 25 percent; snipe, rails, gallinules, and coots, ± 50 percent. These target precision levels were deemed appropriate by the Federal and State biologists who are charged with managing those migratory bird species.

Surveys must be conducted annually because migratory bird harvests can change substantially between years depending on the size of the fall flight and hunting pressure. Estimates are required for annually promulgating hunting regulations.

Parts Collection Survey Procedures: Samples of successful hunters from the previous year's Migratory Bird Hunter Survey are asked to complete and return a postcard (forms 3-165A, C,

and E), volunteering to contribute wings and tails during the following hunting season. The samples are randomly selected in proportion to the estimated harvest in each State, and rates vary from 30 to 100 percent of successful hunters. Because it is difficult to find enough hunters to be in the Parts Collection Survey each year and to mail out packages of survey forms, hunters can remain in the survey for 3 (waterfowl)-10 (all others) years. Those who volunteer are sent a cover letter with instructions and a supply of pre-addressed, postage-paid return envelopes (forms 3-165, 3-165B, and 3-165E) for mailing in the wings and tails. Inner envelopes to protect other mail from stains and seepage are enclosed with the instructions and return envelopes. These packages are sent to survey volunteers before the hunting season opens in their State. Throughout the hunting season, survey participants mail in parts to four collection points (one in each flyway), where they are stored until they are examined. At the end of the hunting season, biologists examine each part to determine species, age, and sex composition of the sample; hunters cannot reliably determine this information. After those data have been compiled, respondents are sent a personalized thank you letter detailing the species, age, and sex of each bird from which they contributed a wing or a tail. The proportions of species, age, and sex in the Parts Collection Survey are then applied to the total harvest estimates from the Migratory Bird Hunter Survey, to allocate harvest estimates among groups. The allocation is proportional to the State, because of different hunting regulations in States and different sampling rates.

Sandhill Crane Harvest Survey: Sampling is stratified according to State of permit issuance; sampling rates vary from 15 percent in States with many crane permittees (Texas, North Dakota) to 100 percent in States with few crane permittees (e.g., Wyoming). No specialized sampling procedures are required, and we use the standard estimation methods for stratified random samples. Stratum-specific (State-specific) estimates of the proportion of permittees that actually hunted cranes, the mean number of days hunted, and the mean number of cranes harvested are derived from the responses. Those estimates are expanded by N (number of permits issued) for each State to obtain State totals, which are then combined to provide estimates of the number of active crane hunters, days of hunting, and cranes harvested for all mid-continent sandhill crane hunting in the U.S. The 95 percent confidence interval for the annual harvest estimate is about ± 5 percent, which is a precision level that is adequate to ensure responsible harvest management (i.e., hunting regulations) decisions.

3. Describe methods to maximize response rates and to deal with issues of nonresponse. The accuracy and reliability of information collected must be shown to be adequate for intended uses. For collections based on sampling, a special justification must be provided for any collection that will not yield "reliable" data that can be generalized to the universe studied.

Response to the Migratory Bird Harvest Information Program is mandatory. We monitor participation by reviewing trends in data transmission from each State, for which we have direct information from 1999-present and indirect information from 1961-present. We also spot-check compliance by following the registrations of individual hunters (Appendix B). We use standard methods to encourage response to the Migratory Bird Harvest Survey, Parts Collection Survey, and Sandhill Crane Survey. These include a cover letter that is addressed to the individual hunter and signed by the Chief of the Division of Migratory Bird Management or the Chief of the Branch of Harvest Surveys. The letter explains why the information is important and includes a toll-free number to call and ask questions. The cover letters attempt to motivate the respondent and stress the importance of participation. Forms are sent as early in the hunting season as possible, to encourage participation. The forms are one page long and have been designed to be as attractive and as easy to use as possible. All forms are sent to hunters with pre-addressed, postage paid return envelopes. The Migratory Bird Hunter Survey and Sandhill

Crane Survey requests daily diary records, to minimize response bias. The form also includes space to record season totals, for hunters who do not wish to record daily hunting activity. The Migratory Bird Hunter Survey uses three waves of reminder mailings to contact nonrespondents and encourage participation. The first wave includes a postcard and a letter sent by first class mail. Second and third waves of reminders and replacement forms are sent to all nonrespondents, also by first class mail. The Sandhill Crane Survey uses 1 wave of reminders, because most sample frame information are not available until late winter and early spring, and we have a limited time frame in which to analyze data and publish reports. The Parts Collection Survey maximizes response rates by using forms 3-165A, C, and D to solicit volunteer participants from a randomly selected sample of successful hunters. Solicitation forms are mailed out well in advance of the opening of the hunting season, so that survey envelopes can be mailed to them before the start of the hunting season. In these solicitation forms, we tell hunters that we will send a report that contains all of the biological data on the specimens they send in each year, as incentive to participate in the survey for the duration of the hunting season. This report is sent in June of each year. As described in item B. 2.g. above, double sampling estimates are used to detect and, if necessary, account for nonresponse.

We have a full-time administrative assistant to answer calls on the toll-free number that is printed on all survey materials. This staff member can answer questions from the public, clarify instructions, or order additional survey materials. If questions are too technical, the call can be forwarded to a biologist. We also have an email address that is checked daily.

We are working on a contract with our Service's Information Resources and Technology Management to develop an online survey response platform, which we hope will increase participation and save money on printing and mailing

4. Describe any tests of procedures or methods to be undertaken. Testing is encouraged as an effective means of refining collections of information to minimize burden and improve utility. Tests must be approved if they call for answers to identical questions from 10 or more respondents. A proposed test or set of tests may be submitted for approval separately or in combination with the main collection of information.

To test the accuracy of identification of species, age, and sex of duck wings, we ask six to seven biologists each year to send known age- and sex-wings through the survey. These are not identifiable by the biologists processing them. When these hunters receive their reports at the end of the season, they tell us if we made any mistakes. This lets us know if we need to focus attention on improving any particular species or area. To test the timeliness and accuracy of our print contractor, we send a complete set of surveys from every mailing to the Chief of the Branch. These mailings are reviewed for accuracy and timeliness.

5. Provide the name and telephone number of individuals consulted on statistical aspects of the design and the name of the agency unit, contractor(s), grantee(s), or other person(s) who will actually collect and/or analyze the information for the agency.

The individual directly responsible for information collection and analysis is: Dr. Khristi Wilkins, Chief, Branch of Harvest Surveys, Division of Migratory Bird Management, Laurel, MD 20708-4028 (301/497-5557).

The following statisticians have reviewed parts of the statistical design and analysis of these surveys:

Dr. David Otis (retired), Leader, USGS Iowa Cooperative Fish and Wildlife Research Unit, Department of Natural Resource Ecology and Management, Iowa State University, Ames, IA.

Dr. Christine M. Bunck, Deputy Center Director, USGS National Wildlife Health Center, Madison, WI 53711 (608-270-2407).

Mr. Grey W. Pendleton, Statistician (Biology), Alaska Department of Fish and Game, Douglas, AK 99824 (907-465-4353).

Dr. Robert E. Trost (retired), Division of Migratory Bird Management, U.S. Fish and Wildlife Service, 911 N.E. 11th Avenue, Portland, OR 97232-4181.

Dr. Paul H. Geissler (retired), Biometrician, National Ecological Surveys Team, USGS Fort Collins Science Center, Fort Collins, CO 80526.

Table 1. Potential respondent universe (N) and number of waterfowl hunters sampled (n) by stratum for Form 3-2056J, based on 2012 counts. Each hunter is assigned a duck, sea duck, goose, and brant stratum.

State	Duck hunters in stratum (N) and sample (n)						Sea duck hunters in stratum (N) and sample (n)						Goose hunters in stratum (N) and sample (n)						Brant hunters in stratum (N) and sample (n)			
	Bagged none		Bagged 1-10		Bagged >10		Do not hunt		Do hunt		Bagged none		Bagged 1-10		Bagged >10		Do not hunt		Do hunt			
	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n		
AK	5,684	534	2,009	380	1,585	389	6,832	574	2,446	729	7,601	880	1,267	294	410	129	7,084	672	2,194	631		
AL	141,521	1,428	6,337	325	6,548	849	0	0	0	0	149,700	2,004	2,928	304	1,778	294	0	0	0	0		
AR	90,377	745	17,801	480	25,831	1,703	0	0	0	0	112,480	1,680	12,594	494	8,935	754	0	0	0	0		
AZ	52,158	2,280	1,450	153	1,760	362	0	0	0	0	54,521	2,614	634	124	213	57	0	0	0	0		
CA	124,240	687	15,405	808	26,860	1,805	165,966	3,083	539	217	142,115	1,448	15,630	1,016	8,760	836	165,765	2,897	740	403		
CO	44,737	499	6,381	335	3,713	460	0	0	0	0	46,359	604	5,937	318	2,535	372	0	0	0	0		
CT	2,973	104	1,148	207	305	122	2,973	104	1,453	329	3,201	136	973	200	252	97	3,201	136	1,225	297		
DE	5,040	365	1,917	384	1,118	356	7,262	593	813	512	5,278	421	2,069	422	728	262	7,278	689	797	416		
FL	92,499	927	5,483	260	4,847	550	0	0	0	0	102,829	1,737	0	0	0	0	0	0	0	0		
GA	125,287	1,384	12,138	914	4,978	720	0	0	0	0	133,928	1,990	6,764	708	1,711	320	0	0	0	0		
IA	103,597	1,345	4,303	168	4,013	300	0	0	0	0	105,541	1,398	4,171	201	2,201	214	0	0	0	0		
ID	33,022	325	6,177	375	5,870	846	0	0	0	0	38,579	774	5,069	479	1,421	293	0	0	0	0		
IL	71,237	641	12,506	361	9,200	469	0	0	0	0	76,270	739	12,004	447	4,669	285	0	0	0	0		
IN	16,257	139	7,406	271	3,844	287	0	0	0	0	18,368	245	6,986	274	2,153	178	0	0	0	0		
KS	36,368	311	5,498	188	6,895	494	0	0	0	0	38,724	411	5,332	198	4,705	384	0	0	0	0		
KY	136,233	746	793	66	588	81	0	0	0	0	136,887	808	594	60	133	25	0	0	0	0		
LA	169,544	2,891	13,771	982	12,195	1,518	0	0	0	0	152,798	1,611	17,803	803	24,909	2,977	0	0	0	0		
MA	5,184	164	1,817	404	654	258	6,721	389	934	437	5,960	334	1,356	379	339	113	7,217	556	438	270		
MD	24,834	336	11,032	651	5,750	454	41,122	1,340	494	101	38,919	1,121	1,835	197	862	123	38,850	1,159	2,766	282		
ME	37,347	3,340	1,990	1,149	663	535	34,444	1,595	5,556	3,429	38,952	4,121	916	754	132	149	0	0	0	0		
MI	108,702	812	19,309	534	11,381	630	0	0	0	0	114,697	1,037	17,856	551	6,839	388	0	0	0	0		
MN	118,459	399	41,323	597	24,084	513	0	0	0	0	133,621	595	37,478	597	12,767	317	0	0	0	0		
MO	54,179	262	8,138	313	10,058	505	0	0	0	0	61,739	580	6,474	255	4,162	245	0	0	0	0		
MS	37,011	315	7,346	369	7,077	576	0	0	0	0	46,121	851	3,914	245	1,399	164	0	0	0	0		
MT	43,898	425	4,378	360	3,176	372	0	0	0	0	45,489	528	4,039	357	1,924	272	0	0	0	0		
NC	285,760	1,798	20,402	842	12,043	812	0	0	0	0	301,481	2,288	13,110	762	3,613	402	240,081	2,195	78,124	1,257		
ND	30,050	375	12,311	713	13,593	902	0	0	0	0	36,064	682	13,850	799	6,040	509	0	0	0	0		
NE	20,135	160	6,048	261	4,770	360	0	0	0	0	21,882	284	6,427	283	2,644	214	0	0	0	0		
NH	5,570	260	1,188	377	344	216	6,932	716	170	137	6,087	386	873	355	142	112	7,063	818	39	35		
NJ	10,461	517	3,217	361	2,115	391	14,902	1,061	891	208	11,932	718	2,331	289	1,530	262	12,803	715	2,990	554		
NM	52,504	750	1,587	315	934	199	0	0	0	0	53,964	970	870	216	191	78	0	0	0	0		
NV	5,964	101	1,386	168	1,432	312	0	0	0	0	7,641	294	942	234	200	53	0	0	0	0		
NY	23,622	637	9,662	664	4,564	557	31,293	921	6,555	937	24,959	824	8,710	548	4,179	486	30,402	861	7,446	997		
OH	19,867	98	5,933	203	2,516	163	0	0	0	0	20,710	139	6,084	213	1,522	112	0	0	0	0		
OK	29,870	594	3,442	323	5,864	953	0	0	0	0	34,384	1,064	3,167	477	1,625	329	0	0	0	0		
OR	30,000	324	6,899	268	10,101	1,221	46,569	2	431	7	36,499	748	6,011	402	4,490	663	46,816	1,661	184	152		
PA	85,307	441	12,038	681	5,109	548	0	0	0	0	85,482	628	11,662	543	5,310	499	0	0	0	0		
RI	718	95	340	156	169	112	862	135	365	228	775	99	349	201	103	63	650	31	577	332		
SC	106,747	750	5,699	395	4,588	541	0	0	0	0	114,488	1,265	2,171	271	375	150	0	0	0	0		
SD	27,783	272	7,185	310	6,385	424	0	0	0	0	28,512	381	9,107	350	3,734	275	0	0	0	0		
TN	69,338	571	6,328	362	5,937	600	0	0	0	0	74,621	858	4,695	348	2,287	327	0	0	0	0		
TX	578,647	958	20,533	885	23,500	1,388	0	0	0	0	608,890	2,322	9,308	505	4,482	404	0	0	0	0		
UT	19,438	159	6,744	354	5,595	508	0	0	0	0	27,264	553	3,751	354	762	114	0	0	0	0		
VA	31,443	279	6,037	498	3,299	430	39,464	943	1,315	263	33,556	435	5,450	490	1,773	282	38,878	909	1,901	298		
VT	3,046	179	1,246	367	591	245	0	0	0	0	3,678	330	930	325	275	136	0	0	0	0		
WA	24,259	198	6,832	314	8,899	940	24,259	198	15,731	1,254	31,185	639	5,820	459	2,985	354	39,374	1,300	616	152		
WI	94,946	285	27,268	682	13,423	608	0	0	0	0	113,971	697	18,991	692	2,675	166	0	0	0	0		
WV	2,752	219	1,100	110	302	70	0	0	0	0	2,865	229	1,050	119	239	51	0	0	0	0		
WY	6,214	200	1,756	262	1,105	268	0	0	0	0	6,561	269	1,890	295	624	166	0	0	0	0		
Total	3,244,829	3,276,453	391,037	411,922	320,171	348,093	429,601	441,255	37,693	46,481	3,498,128	3,543,897	312,172	331,379	145,737	161,192	645,462	660,061	100,037	106,113		

Table 2. Potential respondent universe (N) and number of mourning dove and band-tailed pigeon hunters sampled (n) by stratum for Form 3-2056K, based on 2012 counts.

State	Mourning dove hunters in stratum (N) and sample (n)						Band-tailed pigeon hunters in stratum (N) and sample (n)			
	Bagged none		Bagged 1-10		Bagged >10		Do not hunt		Do hunt	
	N	n	N	n	N	n	N	n	N	n
AL	120,666	1,633	24,682	498	9,058	450	0	0	0	0
AR	106,495	473	17,768	428	9,746	468	0	0	0	0
AZ	20,837	150	19,419	678	7,755	598	46,723	1,013	1,288	413
CA	111,993	756	42,197	818	12,315	691	163,549	1,667	2,956	598
CO	42,812	208	6,099	157	5,920	468	53,841	725	990	108
DE	6,228	198	1,468	148	379	75	0	0	0	0
FL	89,293	423	10,511	396	3,025	282	0	0	0	0
GA	95,992	707	36,946	803	9,465	406	0	0	0	0
ID	38,719	234	5,761	269	589	96	0	0	0	0
IL	74,631	411	15,541	259	2,771	90	0	0	0	0
IN	17,434	49	7,889	196	2,184	142	0	0	0	0
KS	27,676	83	13,685	28	7,400	26	0	0	0	0
KY	128,385	266	6,526	200	2,703	168	0	0	0	0
LA	190,966	915	4,174	151	370	24	0	0	0	0
MD	27,579	363	12,980	795	1,057	201	0	0	0	0
MN	174,221	303	6,648	240	2,997	278	0	0	0	0
MO	57,620	140	11,069	69	3,686	26	0	0	0	0
MS	32,192	347	14,234	300	5,008	344	0	0	0	0
MT	50,459	296	841	29	152	17	0	0	0	0
NC	253,200	656	55,276	857	9,729	254	0	0	0	0
ND	51,183	453	3,857	362	914	150	0	0	0	0
NE	20,421	122	8,347	414	2,185	170	0	0	0	0
NM	48,349	1,991	5,181	826	1,495	328	52,477	936	2,548	2,209
NV	6,464	69	2,067	161	253	90	0	0	0	0
OH	21,033	137	6,123	146	1,160	92	0	0	0	0
OK	28,230	362	8,232	328	2,714	266	0	0	0	0
OR	41,954	347	3,876	179	1,171	144	46,145	524	855	146
PA	84,259	244	15,518	433	2,677	148	0	0	0	0
RI	1,070	44	134	23	23	1	0	0	0	0
SC	99,480	430	13,052	224	4,502	187	0	0	0	0
SD	36,109	488	4,608	307	636	124	0	0	0	0
TN	59,918	299	14,435	287	7,250	285	0	0	0	0
TX	455,352	559	104,886	1,039	62,442	1,246	0	0	0	0
UT	26,552	140	4,797	361	428	61	30,271	479	1,506	83
VA	25,933	200	9,466	454	5,380	511	0	0	0	0
WA	36,459	360	3,005	391	526		39,872	747	118	4
WI	128,272	540	6,769	315	596	57	0	0	0	0
WV	2,697	147	1,397	115	60	13	0	0	0	0
WY	7,654	81	1,222	103	199	32	0	0	0	0
Total	2,848,787	15,624	530,686	13,787	190,920	9,009	432,878	6,091	10,261	3,561

Table 3. Potential respondent universe (N) and number of woodcock hunters (n) sampled by stratum, for Form 3-2056L, based on 2012 counts.

State	Woodcock hunters in stratum (N) and sample (n)			
	Do not hunt		Do hunt	
	N	n	N	n
AL	153,502	391	904	205
AR	127,726	291	6,283	383
CT	3,984	315	442	159
DE	7,965	218	110	45
FL	100,937	148	1,892	197
GA	138,770	307	3,633	247
IA	109,227	278	2,686	46
IL	91,705	198	1,238	126
IN	27,086	179	421	115
KS	48,444	320	317	90
KY	137,540	352	74	15
LA	182,280	729	13,230	652
MA	7,059	429	596	221
MD	41,581	270	35	17
ME	38,745	409	1,255	752
MI	123,019	628	16,373	533
MN	174,376	505	9,490	575
MO	71,423	111	952	98
MS	49,646	214	1,788	482
NC	311,775	487	6,430	102
NE	30,758	85	195	13
NH	6,055	116	1,047	211
NJ	15,139	202	654	115
NY	36,217	263	1,631	230
OH	27,815	131	501	52
OK	39,051	144	125	51
PA	97,922	537	4,532	386
RI	1,157	45	70	22
SC	116,468	253	566	122
TN	79,616	150	1,987	185
TX	622,436	294	244	14
VA	40,125	261	654	200
VT	4,335	61	548	51
WI	126,933	434	8,704	484
WV	3,273	126	881	93
Total	3,194,090	9,881	90,488	7,289

Table 4. Potential respondent universe (N) and number of snipe/coot and rail/gallinule hunters sampled (n) by stratum for Form 3-2056M, based on 2012 counts. Each hunter is assigned to both a coot/snipe and rail/gallinule stratum.

State	Coot/snipe hunters in stratum (N) and sample (n)				Rail/gallinule hunters in stratum (N) and sample (n)			
	Do not hunt		Do hunt		Do not hunt		Do hunt	
	N	n	N	n	N	n	N	n
AK	7,172	30	2,106	310	9,278	340	0	0
AL	153,186	396	1,220	187	153,740	455	666	128
AR	128,070	278	5,939	98	130,009	281	4,000	95
AZ	39,994	58	8,017	1,061	39,935	61	8,076	1,058
CA	163,216	726	3,289	453	165,736	991	769	188
CO	53,003	310	1,828	50	54,554	344	277	16
CT	4,362	235	64	55	4,362	232	64	58
DE	6,467	260	1,608	770	7,255	653	820	377
FL	96,366	411	6,463	363	99,006	479	3,823	295
GA	130,792	322	11,611	1,813	131,250	332	11,153	1,803
IA	109,110	211	2,803	275	109,293	230	2,620	256
ID	44,738	204	331	21	45,069	225	0	0
IL	90,264	209	2,679	118	91,100	210	1,843	117
IN	26,787	83	720	250	27,350	269	157	64
KS	48,476	255	285	156	48,516	257	245	154
KY	130,924	291	6,690	51	126,799	271	10,815	71
LA	187,842	958	7,668	307	190,681	1,039	4,829	226
MA	7,467	484	188	125	7,551	538	104	71
MD	19,773	93	21,843	2,301	41,156	2,255	460	139
ME	34,684	213	5,316	994	34,684	208	5,316	999
MI	134,450	272	4,942	100	134,450	272	4,942	100
MN	170,779	513	13,087	315	171,989	511	11,877	317
MO	70,707	178	1,668	20	71,653	182	722	16
MS	26,592	121	24,842	112	26,835	125	24,599	108
MT	51,150	207	302	63	51,452	270	0	0
NC	259,200	415	59,005	448	262,003	425	56,202	438
ND	54,990	243	964	540	55,954	783	0	0
NE	28,781	123	2,172	63	29,305	129	1,648	57
NH	7,021	197	81	21	7,102	218	0	0
NJ	15,481	393	312	67	15,488	360	305	100
NM	53,267	519	1,758	10	53,359	525	1,666	4
NV	8,577	175	206	108	8,701	226	82	57
NY	33,290	281	4,558	475	33,588	285	4,260	471
OH	27,363	68	953	38	28,053	90	263	16
OK	38,904	166	272	72	39,118	212	58	26
OR	43,793	185	3,207	133	47,000	318	0	0
PA	100,107	182	2,347	170	100,725	233	1,729	119
RI	1,070	58	157	22	1,083	59	144	21
SC	116,362	536	672	80	116,455	548	579	68
SD	40,970	280	383	196	41,353	476	0	0
TN	79,975	70	1,628	70	80,332	83	1,271	57
TX	622,110	592	570	48	622,482	620	198	20
UT	25,080	252	6,697	260	31,777	512	0	0
VA	39,941	488	838	230	40,133	489	646	229
VT	4,843	114	40	25	4,883	139	0	0
WA	39,990	145	0	3,660	39,990	3,805	0	0
WI	128,977	207	6,660	380	130,240	250	5,397	337
WV	3,853	239	301	132	3,889	248	265	123
WY	8,918	352	157	92	8,775	276	300	168
Total	3,719,234	13,598	229,447	17,708	3,775,491	22,339	173,190	8,967

Table 5. Potential sample universe for the Waterfowl Parts Survey Form 3-165, based on 2012 data.

State	Ducks		Geese	
	Harvest	Number of wings	Harvest	Number of wings
AK	55,900	527	9,400	106
AL	210,900	313	19,700	6
AR	1,328,700	2,888	116,000	184
AZ	51,000	823	1,600	21
CA	1,586,800	6,513	150,100	826
CO	87,900	880	98,100	438
CT	13,400	446	7,900	233
DE	45,700	297	21,500	176
FL	257,900	2,469	1,500	2
GA	162,600	461	15,900	96
IA	117,700	652	39,300	286
ID	277,700	1,817	73,900	228
IL	401,200	1,062	100,300	264
IN	131,600	607	60,400	165
KS	174,600	1,097	93,000	300
KY	42,300	270	7,300	43
LA	2,762,700	5,894	54,200	95
MA	17,800	639	10,800	337
MD	112,200	620	190,400	681
ME	31,400	450	9,600	163
MI	320,200	1,574	144,700	652
MN	749,300	1,276	236,700	272
MO	445,000	1,936	56,900	160
MS	306,700	727	12,300	7
MT	120,100	858	79,700	458
NC	394,400	1,529	73,700	87
ND	459,300	2,544	184,900	491
NE	155,500	1,119	113,800	433
NH	14,200	212	4,900	76
NJ	70,600	721	40,800	340
NM	29,800	388	11,200	85
NV	51,000	767	5,700	54
NY	192,800	2,142	137,900	1,243
OH	106,800	573	59,400	356
OK	342,100	2,113	50,000	202
OR	389,000	4,342	55,100	408
PA	91,800	987	115,700	958
RI	4,800	174	1,500	140
SC	235,500	893	39,700	34
SD	220,300	1,038	140,900	452
TN	249,000	282	29,600	16
TX	1,491,600	5,272	208,400	273
UT	274,500	2,060	23,500	112
VA	134,000	844	52,000	409
VT	20,500	688	8,800	259
WA	490,900	2,758	74,300	432
WI	350,700	2,018	83,800	495
WV	10,300	116	5,800	65
WY	41,700	429	29,400	356
Total	15,632,400	69,105	3,162,000	13,975

Table 6. Potential sample universe for the Mourning Dove Parts Collection Survey for Form 3-165D, based on 2012 data.

State	Doves harvested	Dove wings collected
AL	687,100	805
AZ	494,200	433
AR	601,200	810
CA	900,000	1,475
CO	204,300	462
DE	39,900	332
FL	175,100	317
GA	735,700	784
ID	127,600	413
IL	372,700	473
IN	263,300	741
KS	244,800	887
KY	511,800	735
LA	354,100	731
MD	94,300	179
MN	65,400	759
MS	296,600	642
MO	286,900	1,018
MT	2,600	255
NE	1,020,600	273
NV	78,900	1,084
NM	223,400	465
NC	160,100	793
ND	26,900	528
OH	136,000	422
OK	349,700	347
OR	64,100	551
PA	203,200	277
RI	500	365
SC	554,600	974
SD	65,500	593
TN	464,400	451
TX	4,150,800	2,347
UT	78,000	225
VA	295,900	1,573
WA	51,500	597
WV	73,200	281
WI	10,300	178
WY	25,300	309
Total	14,490,500	24,884

Table 7. Potential sample universe for the Other Migratory Game Bird Survey for Form 3-165B, based on 2012 data.

State	Woodcock		Snipe		Rail species ¹		Band-tailed pigeon	
	Harvest ²	Number of wings	Harvest	Number of wings	Harvest	Number of wings	Harvest	Number of wings
AK	.	.	600	0	.	.	.	.
AL	3,500	10	1,800	0	200	0	.	.
AR	4,200	4	0	17	0	95	.	.
AZ	.	.	0	0	.	.	1,300	66
CA	.	.	6,300	0	.	.	9,100	22
CO	.	.	400	0	0	0	1,100	0
CT	1,700	262	200	5	0	1	.	.
DE	800	11	0	0	0	0	.	.
FL	12,600	0	10,600	14	600	0	.	.
GA	800	23	300	5	1,400	0	.	.
IA	0	10	1,100	0	0	22	.	.
ID	.	.	900	0	.	.	.	.
IL	1,900	2	100	0	100	0	.	.
IN	600	71	3,700	3	300	8	.	.
KS	1,300	0	100	0	0	0	.	.
KY	200	7	0	0	0	0	.	.
LA	20,000	189	7,400	3	700	27	.	.
MA	1,900	437	0	0	0	0	.	.
MD	2,400	131	1,300	0	100	0	.	.
ME	9,600	1,296	100	2	0	0	.	.
MI	74,100	3,631	500	11	0	0	.	.
MN	31,000	1,404	2,800	5	100	119	.	.
MO	900	143	800	0	0	32	.	.
MS	200	54	0	0	0	0	.	.
MT	.	.	100	0	.	.	.	.
NC	13,400	198	800	32	0	67	.	.
ND	.	.	200	0	.	.	.	.
NE	1,300	0	0	0	0	0	.	.
NH	3,800	906	600	1	.	.	.	.
NJ	3,100	195	700	0	3,500	379	.	.
NM	.	.	0	0	0	0	300	3
NV	.	.	100	0	.	.	.	.
NY	8,400	1,035	200	1	0	0	.	.
OH	1,500	65	0	0	0	2	.	.
OK	600	0	4,000	1	700	32	.	.
OR	.	.	3,400	9	.	.	1,500	68
PA	13,500	518	100	6	0	0	.	.
RI	300	7	0	0	0	0	.	.
SC	7,900	94	9,500	0	5,400	142	.	.
SD	.	.	100	0	.	.	.	.
TN	1,500	49	0	0	0	0	.	.
TX	.	.	800	0	0	0	.	.
UT	.	.	200	0	.	.	100	0
VA	1,200	172	1,000	0	3,700	554	.	.
VT	3,000	683	400	0	.	.	.	.
WA	.	.	2,200	0	.	.	200	24
WI	40,400	3,092	1,100	5	100	0	.	.
WV	2,000	40	0	1	0	19	.	.
WY	.	.	600	0	0	0	.	.
Total	269,600	14,739	65,100	121	16,900	1,499	13,600	183

¹ Number of parts for rails is calculated as 3-year pooled total.

² "." indicates no season available in the state.

Table 8. Potential respondent universe, number of sandhill crane hunters, and response rates for Form 3-2056N, based on 2012 counts.

state	Number of hunters	Number sampled	Number of responses	Response rate
AK	3,599	745	459	62%
CO	801	684	321	47%
KS	571	336	191	57%
MN	1,032	518	343	66%
MT	186	93	72	77%
ND	8,519	4,232	3,065	72%
NM	859	859	486	57%
OK	451	1,306	683	52%
SD	343	347	271	78%
TX	14,083	2,812	1,514	54%
WY	102	102	70	69%
Total	30,546	12,034	7,475	62%

Appendix A. Alternative Sample Size Allocation Schemes for the Mourning Dove Parts Collection (Wing) Survey

Addendum to Progress Report I

Dave Otis

February 27, 2013

I presented methods and results in Progress Report I for sample size and allocation when the statistical objective was the precision of predicted Management Unit recruitment from a 5-year moving average. This design was also discussed at the 2012 MODO Task Force meeting, and it was agreed that Task Force representatives would take the information back to their respective Technical Committees for discussion at their February/March meetings. In this Addendum, I provide more specific details about this sampling design, the current design, and a third alternative in an effort to provide the Management Unit technical committees with information that can be used to make recommendations on a preferred alternative to the USFWS Harvest Survey Branch. This effort does not necessarily preclude consideration of other alternatives, but the designs described here do represent reasonably distinct choices.

Design 1. There would be no change in the sample allocations and total sample size that are currently used. Expected state sample sizes are given in Table 1 in the “2007-2011 Average” column.

Design 2. This is the design that was described in Progress Report I. Significant changes from the original design were 1) evaluating sample size and the relative importance of recruitment estimate precision in the context of a precision criterion for a predicted Management Unit population growth rate (or abundance) from a demographic model, 2) state allocations based on an index to breeding population size, and 3) Management Units analyzed separately. Expected state sample sizes are given in Table 1 in the “Management Unit Optimum Allocation” column. Total wing survey sample size is expected to be ~ 50% less than Design 1.

Design 3. This design was motivated from comments received from the 2013 EMU meeting. They expressed interest in knowing a bit more about what the consequences would be for recruitment estimates at a scale intermediate between the Management Unit and the individual state. The thought was that development of harvest strategies based on population balance equations might be impaired by decreased resolution in recruitment estimates at regional (subunit) scales, since we know from data collected to date that biologically important differences do occur within Management Units.

In response to this request, I evaluated the precision of predicted recruitment estimates for regional subunits that I had suggested at the 2010 Task Force meeting. I began with the sample sizes from Design II, and computed expected standard errors for each subunit (see Table 1 for state assignments to subunits). The initial results informed me about the level of precision that would be reasonably achievable for each of the subunits in each Management Unit, and I made the somewhat arbitrary decision that a standard error of < 0.3 for predicted subunit recruitment would be adequate to identify biologically important changes in recruitment over time. These criteria together suggested target standard errors of 0.30, 0.25, and 0.25 for each subunit in the EMU, CMU, and WMU, respectively. To achieve these target values, I made relatively small additions to sample sizes in 1 WMU subunit and 2 CMU subunits (Table 1). (Note: for the ME subunit in the CMU I could only reach a precision of 0.35). Achievement of desired precision in the EMU required much more significant increases in sample size. I first increased the optimum sample sizes for all EMU states by increasing the total Management Unit sample size from 5000 (Design II) to 8200. One EMU subunit then received an additional increase in sample size. (Note: reasonable precision was not achievable in the FL subunit.) Expected state sample sizes are given in Table 1 in the "Management Unit Optimum Allocation + Subunit Supplement)" column. Total wing survey sample size for this design is expected to be ~ 30% less than Design 1.

Table 1. Three alternative sample size allocation schemes for the Mourning Dove Parts Collection Survey. Highlighted cells indicate states that receive additional wings to achieve the subunit precision objective. In the EMU, this supplement is in addition to the overall increase in Management Unit sample size.

State	Subunit	Management Unit	2007-2011 Average	Management Unit Optimum Allocation	Management Unit Optimum Allocation + Subunit Supplement
AZ	AZ	WMU	1579	759	759
CA	CA		1292	718	718
ID	NW		304	218	318
OR	NW		169	237	337
WA	NW		715	122	222
NV	MC		370	204	204
UT	MC		278	241	241
Total			4707	2500	2800
AR	ME	CMU	518	218	418
MO	ME		796	229	429
IA	NE		58	339	339
MN	NE		102	209	209
ND	NE		264	362	362
SD	NE		523	470	470
KS	MW		994	777	777
NE	MW		830	375	375
OK	MW		817	345	345
TX	TX		1859	807	807
CO	W		1164	322	522
MT	W		273	325	525
WY	W		356	101	301
NM	NM		552	123	123
Total			9106	5000	6000
AL	S	EMU	662	568	932
GA	S		327	490	804
LA	S		254	208	341
MS	S		573	279	457
NC	S		967	545	893
SC	S		1157	266	436
TN	S		370	210	345
FL	FL		372	466	765
DE	MC		225	13	21
KY	MC		566	353	578
MD	MC		449	54	88
PA	MC		374	86	140
VA	MC		1238	157	257
WV	MC		190	55	92
IL	N		948	410	673
IN	N		1298	330	541
OH	N		507	315	517
WI	WI		243	195	620
Total			10720	5000	8500
Grand Total			24533	12500	17300

Sample Size Derivation for the Mourning Dove Parts Collection (Wing) Survey

Progress Report I

Dave Otis

September, 2012

This report describes an approach for determining the total sample size necessary to achieve a desired level of precision of the harvest age ratio at the Management Unit (MU) scale, and the optimum allocation of the sample to individual states within the MU.

Notation

Let

HY = number of sampled juvenile birds in a state,

AHY = number of sampled adult birds in a state,

$n = HY + AHY$.

Then the proportion of juveniles in the sample = $p = HY/n$, and the age ratio $R = HY/AHY = p/(1-p)$.

Prediction Variance of \hat{R}

Let \hat{R} be a sample age ratio in a given year and state. Then

$$\begin{aligned} Var(\hat{R}) &= E[Var(\hat{R}|R)] + Var[E(\hat{R}|R)] \\ &= s^2 + \sigma^2, \end{aligned}$$

where s^2 is the average sampling error of \hat{R} and σ^2 is the temporal process error, i.e., true natural variation) of R .

Define the predicted value of the age ratio (\hat{R}_0) in year T+1 as the running average (\bar{R}) of the previous T years. The variance of this individual predicted value is

$$\begin{aligned} \text{Var}(\bar{R} - \hat{R}_0) &= \text{Var}(\bar{R}) + \text{Var}(\hat{R}_0) \\ &= \frac{s^2 + \sigma^2}{T} + (s^2 + \sigma^2). \end{aligned}$$

Prediction variance at the Management Unit scale

Let \hat{R}_{it} be the age ratio estimate in the i th state in the t th year. The states are treated as strata with weights $\{w_i\}$ that are proportional to population abundance. The index to abundance is the same as used in the current harvest management assessment, i.e., the product of the area of dove habitat and the running average mourning dove Call Count Survey index. So,

$$\bar{R} = \frac{1}{T} \sum_{t=1}^T \sum_{i=1}^Z w_i \hat{R}_{it} = \frac{1}{T} \sum_{t=1}^T \hat{R}_t, \quad \text{where } Z = \text{number of states.}$$

Now the prediction variance of \bar{R} is

$$\text{Var}(\bar{R}) = \sum_{i=1}^Z w_i^2 (\sigma_i^2 + s_i^2) \left(\frac{T+1}{T} \right). \quad (1)$$

Now, for the sample size exercise we assume a true long-term average proportion of HY birds in the i th state = p_i and let n_i = number of (known age) wings sampled. We then have

$$s_i^2 = \frac{f(p_i)}{n_i}, \text{ where} \quad (2)$$

$$f(p_i) = \left(\frac{p_i}{1-p_i} \right) \left(1 + \left(\frac{p_i}{1-p_i} \right)^2 + \frac{2p_i}{1-p_i} \right).$$

(See Appendix for derivation.)

From finite sampling theory (Cochran 1977), the optimum allocation of N wings to the Z states in a Management Unit is then

$$n_i = N \frac{w_i \sqrt{f(p_i)}}{\sum_{i=1}^Z w_i \sqrt{f(p_i)}} . \quad (3)$$

Sample Size for a Desired Precision of the Harvest Age Ratio

Data

All subsequent calculations are based on SAS codes and datasets of the 2007 – 2011 mourning dove wingbee provided by B. Raftovich (USFWS, 4/25/12).

Calculations

As an initial exercise, I used the above equations to calculate expected variance of R as a function of N = total MU sample size for $T = 5$. I used the average value of p for each state to substitute into $f(p)$. Because this effectively assumes that sampling variance is constant, I used the naïve estimates of process error (Burnham et al. 1987):

$$\sigma^2 = \frac{1}{T-1} \sum_{t=1}^T (\hat{R}_t - \bar{R})^2 - \frac{1}{T} \sum_{i=1}^T s_i^2 .$$

For CMU states that are geographically split between the Central and Pacific Flyways (MT, WY, CO NM), I used only the CMU wing data. If $\sigma^2 < 0$, then I set $\sigma^2 = 0.00001$. I used IL values of (R , σ^2) for IA, and the Burnham et al. (1987) unequal sampling variance process error calculation for MN because of the extreme range in sampling variation in that state.

The above exercise assumed that all wings were of known age. But we know that a significant proportion of sample wings are classified as ‘unknown’ based on the standard age key, and this was the motivation for development of a technique for assigning ‘unknown’ wings to an age class (Miller and Otis 2010). So how do we adjust variance calculations for this adjustment? The only available information is contained in Miller (2008, p.27), which reports results of a simulation exercise that suggests that the variance of the adjusted estimate is ~ 2.5 times

greater than a corresponding estimate that assumes all wing ages are known. (Note that even though the sample size is greater when unknown wings are included, the variance also increases substantially. This is the ‘cost’ of the adjusting the naïve age ratio estimator for bias.) Therefore, I inflated all of the $f(p)$ values by 2.5. I also calculated the average proportion of unknown wings in each state and adjusted each calculated state sample size by $1/(1-\text{proportion unknown})$. The result represents the number of total wings (known + unknown) needed.

Results

Required sample size began to reach asymptotic values for $N \approx 3000$ for the EMU and $N \approx 2000$ for the CMU and WMU (Fig. 1). Minimum achievable SE values were approximately 0.20 for the EMU and 0.10 for the CMU and WMU. Proportional allocations of total sample size to the individual states are given in Table 1.

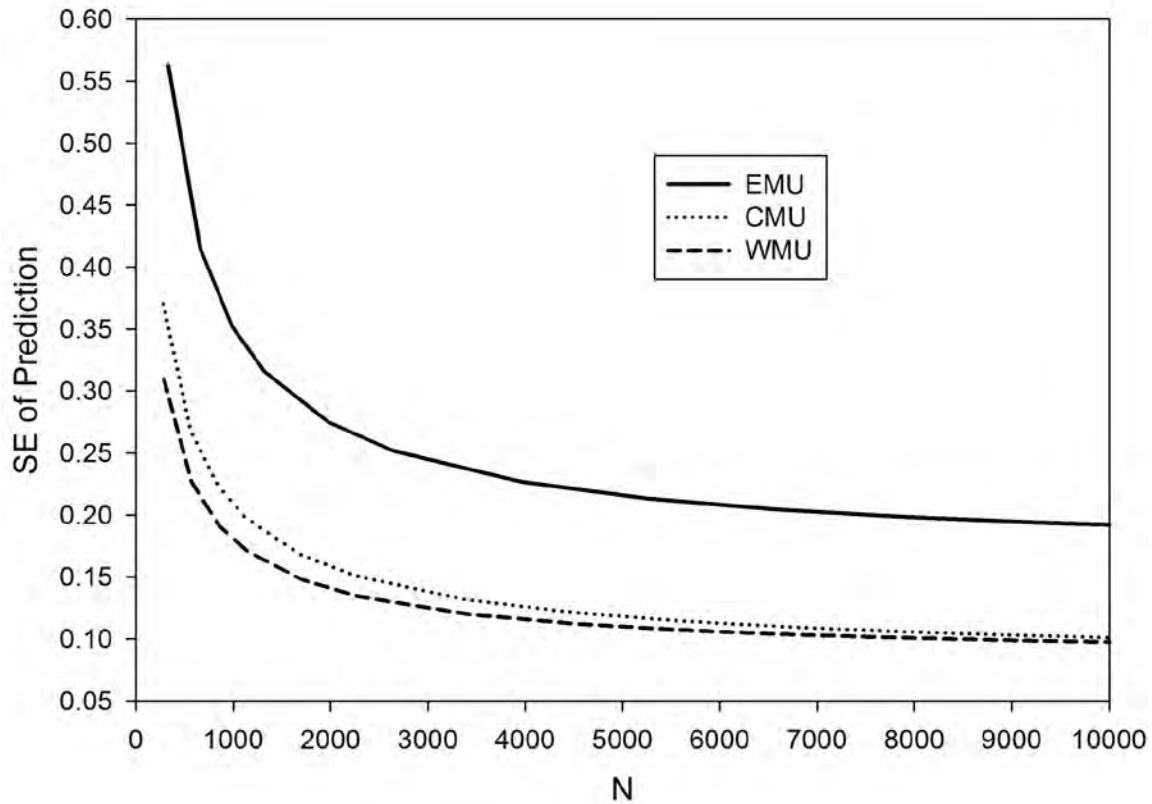


Figure 1. Total Management Unit sample size (N) required to achieve a desired level of precision of the predicted harvest age ratio.

Wing Survey Sample Size in the Context of a Population Balance Equation

The primary rationale for the dove PCS is to provide annual estimates of recruitment that are used in a more informed harvest management strategy (Anonymous 2005). Thus, it makes sense to consider the sample size problem in the context of a desired precision of a prediction from a simple population balance equation. This approach is similar to that used in the Mourning Dove Banding Needs Assessment (Otis 2009), which used the basic population model described in the Mourning Dove National Strategic Harvest Management Plan (Anonymous 2005):

$$\lambda = S_{AHY} + S_{HY} * R',$$

where λ = the relative change in population abundance in the subsequent year, S_{AHY} and S_{HY} are annual survival rates, and R' is the annual per capita recruitment rate, which is estimated by adjusting the harvest age ratio for the relative harvest vulnerability (V) of the HY to AHY age class, i.e., $R' = R/V$. This adjustment factor is typically calculated from age- class recovery rates produced by standard band recovery models (Brownie et al. 1985). Based on previous band recovery analyses (Otis, unpubl. data) I chose to use a grand average value of $V = 1.3$ for present calculations. I also assume that the relative contribution of the sampling variance of V in the population balance equation will be negligible, i.e., V is treated as a constant.

The variance of a prediction from this equation is given as

$$\begin{aligned} VAR(\hat{\lambda}) = & VAR(\hat{S}_{AHY}) + \hat{R}'^2 VAR(\hat{S}_{HY}) + \hat{S}_{HY}^2 VAR(\hat{R}') + VAR(\hat{S}_{HY}) VAR(\hat{R}') \\ & + 2 \hat{R}' COV(\hat{S}_{AHY}, \hat{S}_{HY}). \end{aligned} \quad (4)$$

For current purposes, I assumed that a harvest strategy that used a population balance equation with this basic structure for making annual regulation decisions would use estimated average survival rates and associated variances derived from a standard band recovery analysis. (These survival rates could be interpreted as survival in the absence of harvest, which would then be adjusted for a predicted harvest rate in the balance equation). Thus, a desired level of precision for the predicted λ becomes strictly a function of \hat{R}' and $VAR(\hat{R}')$.

Survival rate calculations and results

I used 2003 – 2011 band recovery data provided by M. Seamans (USFWS, 5/16/12) and Program MARK to calculate state specific survival rate estimates. For each state, I fit only 3 models using the Brownie et al. dead-recovery model: 1) the standard age and time-specific global model, 2) constant age, age and time-specific recovery rates, 3) constant age, age and time-additive recovery rates. I used the estimated \hat{c} from the global model to adjust for binomial over-dispersion, but considered only Models 2 and 3 for estimation of survival rates.

Based on comparison of AIC values, Model 3 was best for nearly all states. Precision of survival rate estimates was generally inflated significantly by \hat{c} values ($\bar{x} = 5.0$, range = 2.3 – 8.2). In several states band recovery data was insufficient to produce reliable estimates, so I made the following substitutions: DE = MD; NM, MT, WY = CO; OR = WA.

Sample size calculations

We now have all of the empirical estimates necessary for using Eq. (4) to calculate the expected variance of the predicted population growth rate as a function of N.

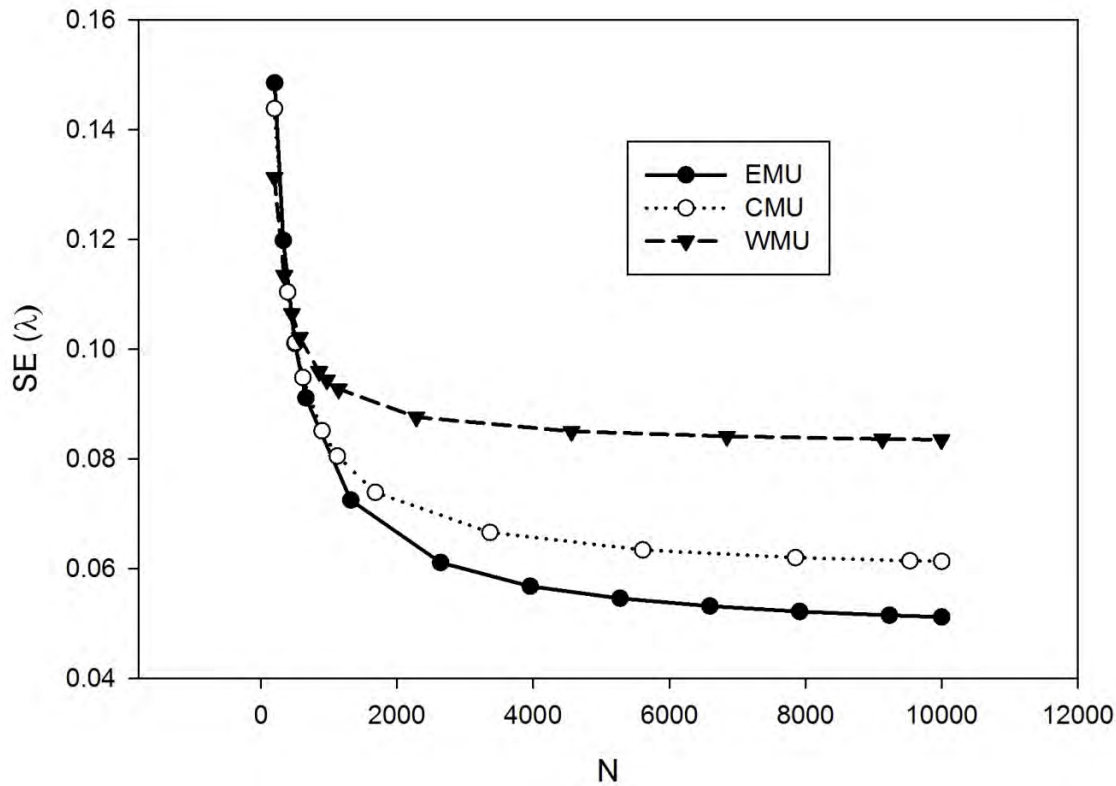


Figure 2. Total Management Unit sample size (N) required to achieve a desired level of precision of the predicted population growth rate (λ).

Achievable precision asymptotes occur at approximately $N = 2500$ (WMU) and $N = 5000$ (EMU, CMU). Values of $SE(\lambda)$ at these values are approximately 0.087 (WMU), 0.065 (CMU) and .055 (EMU).

Discussion

Results suggest that significant reductions in the current survey sampling effort ($\bar{x}_{EMU} = 10,800$; $\bar{x}_{CMU} = 9,100$; $\bar{x}_{WMU} = 4,500$) could be made with negligible loss of precision in population balance equation prediction. The relative importance of reducing the sampling variance of the harvest age ratio is determined by both the magnitude of the true natural

variation in annual recruitment ($\sigma_{R'}^2$) and the relative magnitude of the variance components associated with survival rates. Survival rate estimates in the EMU are estimated much more precisely than in the CMU and WMU, but natural variation in recruitment is nearly an order of magnitude larger in the EMU than in the CMU and WMU (Fig. 1). The end result is that population balance equation predictions can be estimated most precisely in the EMU, but not by a huge margin (Fig. 2). Conversely, natural variation in annual WMU recruitment is relatively small and therefore WMU recruitment can be predicted relatively precisely with appropriate sample sizes (Fig. 1). However, WMU survival rates are estimated with much less precision, which to a large degree swamps the small variation in predicted recruitment, and results in the least precise balance equation predictions (Fig. 2). Relationships between variance components in the CMU are intermediate between the EMU and WMU.

I envision that the next steps in the project will be 1) discussions with FWS Harvest Survey Section staff and the Mourning Dove Task Force about the acceptability of and/or modifications in the approach outlined in this report, and 2) initial discussions about various attributes of the sampling design used to achieve the desired sample sizes.

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Table 1. Optimum state sample size allocation proportions (from Eq. 3).

State	Management Unit	
	WMU	
AZ		0.280
CA		0.280
ID		0.094
NV		0.085
OR		0.103
UT		0.106
WA		0.052
	CMU	
AR		0.039
CO		0.069
IA		0.073
KS		0.155
MN		0.044
MO		0.044
MT		0.072
NE		0.079
NM		0.025
ND		0.077
OK		0.065
SD		0.098
TX		0.139
WY		0.022
	EMU	
AL		0.102
DE		0.003
FL		0.057
GA		0.098
IL		0.091
IN		0.071
KY		0.074
LA		0.042
MD		0.011
MS		0.059
NC		0.114
OH		0.069
PA		0.019
SC		0.055
TN		0.044
VA		0.033
WI		0.045
WV		0.012

APPENDIX. Derivation of sampling variance of $R = \text{juvenile to adult age ratio}$.

Let $HY = \text{number of juvenile birds in the sample}$,

$AHY = \text{number of adult birds in the sample}$,

$n = HY + AHY$.

Then the proportion of juveniles in the sample = $p = HY/n$, and $R = HY/AHY = p/(1-p)$.

Using the delta method we have

$$\begin{aligned} \text{Var}(R) &= \text{Var}\left(\frac{p}{1-p}\right) \\ &= \frac{1}{(1-p)^2} \text{Var}(p) + \frac{p^2}{(1-p)^4} \text{Var}(1-p) - 2 \frac{p}{(1-p)^3} \text{Cov}(p, 1-p) \\ &= \frac{1}{n} \left[\frac{p}{1-p} \right] \left[1 + \frac{p^2}{(1-p)^2} - 2 \frac{1}{(1-p)^2} (-p(1-p)) \right] \\ &= \frac{R}{n} (1 + R^2 + 2R) \\ &= \frac{R}{n} (R + 1)^2. \end{aligned}$$

Participation Rates and Envelope Issue Allocation for the Mourning Dove Parts Collection (Wing) Survey

Progress Report II

Dave Otis

April, 2013

Progress Report I focused on the problem of optimum allocation of wing sample size to Management Units (MUs) and states, using a statistical criterion based on the variance of a predicted population growth rate from a demographic balance equation. This progress report is concerned with the next logical step in the survey protocol, i.e., the amount of total effort (in terms of the number of wing envelopes issued to hunters) necessary to achieve a given desired number of total wings from a MU, and the efficient allocation of this effort to the states within the MU.

The allocation process depends on 3 parameters:

1. Volunteer rate: the proportion of hunters that are contacted who indicate they would be willing to participate in the wing survey.
2. Participation rate: the proportion of volunteers that actually contribute wings to the survey.
3. Average number of wings contributed by a participant (Parts per hunter [PPH]).

In late spring of each year, USFWS Branch of Harvest Surveys (BHS) staff creates a list of potential participants from successful hunters who reported hunting on their HIP diary survey the previous year. Letters are sent to a random sample of these hunters to ask if they would be willing to participate in the dove Parts Collection Survey (PCS). Sampling rates are set to achieve minimum state sample sizes. Contacted hunters that respond positively are then sent 2 envelopes and asked to return wings from their first 2 hunts during the first 2 weeks of the season.

Values for volunteer and participation rates used in the design of the first dove wing survey in 2007 were taken from the long-standing waterfowl Parts Collection Survey. These values remain essentially unchanged in the current survey protocol. The original expected number of wings submitted by hunters was calculated from 2005 HIP data diaries and values are now updated annually. The specific objectives in this report are to 1) update the state-specific participation rate and average wings submitted by actual participants using 2007 – 2011 dove wing survey (data are not available for updating volunteer rates), 2) use these estimates together with optimum wing sample size allocations derived in Progress Report I to calculate

the most cost-efficient allocation of envelopes issued to volunteers, 3) compare the cost-efficiency of asking participants to return separate envelopes from 2 hunts with asking a larger sample of participants to return only a single envelope from their first hunt.

DATA

Analyses were based on the 2007 – 2011 ‘Wingbee’ Access database, which includes state, year, hunter number, issued envelope numbers, location, and wing data, and a 2007-2011 ‘Issue’ Excel database, which contains state, year, hunter number, and year of participation of volunteers that were issued envelopes. Databases were provided by B. Raftovich (FWS Harvest Survey Branch).

RESULTS

Participation rates

Average state participation rates exhibited substantial variation, ranging from 0.284 to 0.648 (Table 1). The annual averages over all states were consistent, with a grand average = 0.483, which is somewhat less than the value of 0.55 taken from the waterfowl parts collection survey. However, intra-state annual variation in participation rates was substantial, with an average range = 0.17.

Expected wings per envelope issue

The annual operational cost of the survey is primarily determined by the cost of mailing (issuing) envelopes to volunteers. Therefore, a logical parameter of interest is the number of wings that we can expect to receive from each hunter (PPH). This expectation is estimated by the product of the participation rate and the average total number of wings submitted to the wingbee by participants. Average state PPH exhibited substantial variation, ranging from 2.379 to 10.374 (Table 2). The annual averages over all states were consistent, with a grand average = 6.804. Intra-state PPH annual variation was modest, with an average range = 3.039.

Participation rates of volunteer holdovers

To increase sample sizes, in 2010 the PCS protocol for selecting volunteers was altered by automatically including all hunters that had submitted wings the previous year. Comparison of the grand average participation rate of randomly selected first year volunteers ($\bar{X}_{2010} = 0.452$, $n = 2738$; $\bar{X}_{2011} = 0.461$, $n = 2533$) to holdover participants ($\bar{X}_{2010} = 0.517$, $n = 1361$; $\bar{X}_{2011} = 0.483$, $n = 1286$) revealed rate increase of ~ 0.04 .

Optimum issue allocation

Given the set of state-specific optimum proportional allocation for wing sample sizes presented in Progress Report I and the corresponding PPH values in Table 2, it becomes straightforward to calculate the optimum number of envelope issues for each state for any desired MU total wing sample size. For example, Table 3 presents the results using the current MU total sample sizes.

Cost comparison of one versus two requested wing samples

The premise of this exercise is that it would be less expensive, in terms of mailing costs, to achieve a desired number of wings by sending one return envelope to 2X willing participants instead of sending 2 return envelopes to X willing participants (the current protocol), if the expected number of wings received from the second hunt envelope is sufficiently smaller. Note that the current protocol engenders cost of 3 mailed envelopes per hunter (the envelope sent by the BHS + 2 return envelopes) while the alternative protocol engenders cost of 2 envelopes.

Let

X = expected number of wings received from the first hunt,

Y = “ “ “ “ “ second “,

C = 1 unit of envelope mailing cost,

W = cost/wing of current protocol,

W'' = cost/wing of alternative protocol,

N = number of envelopes sent in the current protocol.

Then

$$W = \frac{N(3C)}{N(X+Y)} = \frac{3C}{X+Y}$$

$$W'' = \frac{2N(2C)}{2NX} = \frac{2C}{X}$$

$$\frac{W''}{W} = \frac{2C}{X} * \frac{X+Y}{3C} = \frac{2}{3} * (1 + Y/X).$$

Therefore, if $Y/X < 0.33$, then the alternative protocol is cheaper. However, wingbee data revealed that the overall average proportion of wings submitted for the second hunt compared to the first hunt number ($= Y/X$) was 0.56, with very little variation among years. Thus, the conclusion is that the current protocol is more cost efficient.

DISCUSSION

Methods and results presented in Progress Reports I (and Addendums) and II can be used to increase cost and efficiency of the Mourning Dove Parts Collection Survey. The next important step will be to continue work with the FWS Branch of Harvest Surveys and the Flyway/Management Unit Technical Committees to reach consensus on modification of survey protocols in time for implementation in the 2013 survey.

Table 1. Annual state participation rates.

STATE	2007	2008	2009	2010	2011	AVERAGE	RANGE	STD
AL	0.461	0.259	0.260	0.533	0.393	0.381	0.274	0.121
AR	0.477	0.439	0.576	0.418	0.479	0.478	0.159	0.061
AZ	0.667	0.726	0.653	0.568	0.626	0.648	0.157	0.058
CA	0.481	0.500	0.520	0.517	0.516	0.507	0.039	0.016
CO	0.589	0.517	0.559	0.444	0.580	0.538	0.145	0.059
DE	0.615	0.625	0.333	0.560	0.486	0.524	0.292	0.120
FL	0.383	0.339	0.374	0.417	0.435	0.390	0.096	0.038
GA	0.424	0.468	0.455	0.537	0.277	0.432	0.260	0.096
ID	0.605	0.500	0.529	0.390	0.394	0.484	0.215	0.092
IL	0.490	0.591	0.541	0.508	0.475	0.521	0.116	0.046
IN	0.623	0.528	0.564	0.569	0.630	0.583	0.102	0.043
KS	0.579	0.542	0.554	0.573	0.524	0.554	0.055	0.023
KY	0.536	0.647	0.556	0.446	0.545	0.546	0.201	0.071
LA	0.338	0.222	0.375	0.339	0.357	0.326	0.153	0.060
MD	0.569	0.408	0.419	0.477	0.416	0.458	0.161	0.068
MN	0.154	0.250	0.412	0.235	0.368	0.284	0.258	0.105
MO	0.470	0.524	0.642	0.397	0.485	0.503	0.245	0.090
MS	0.486	0.441	0.508	0.620	0.380	0.487	0.240	0.089
MT	0.455	0.533	0.471	0.474	0.512	0.489	0.079	0.033
NC	0.625	0.391	0.549	0.552	0.468	0.517	0.234	0.090
ND	0.378	0.551	0.438	0.362	0.456	0.437	0.189	0.075
NE	0.578	0.592	0.564	0.468	0.486	0.538	0.125	0.057
NM	0.441	0.360	0.512	0.526	0.459	0.460	0.166	0.066
NV	0.508	0.321	0.500	0.608	0.439	0.475	0.287	0.105
OH	0.621	0.462	0.571	0.511	0.556	0.544	0.159	0.061
OK	0.348	0.570	0.514	0.477	0.506	0.483	0.221	0.082
OR	0.359	0.214	0.372	0.470	0.378	0.359	0.255	0.092
PA	0.439	0.481	0.423	0.387	0.417	0.429	0.094	0.034
SC	0.506	0.461	0.531	0.553	0.531	0.516	0.092	0.035
SD	0.425	0.645	0.536	0.375	0.413	0.479	0.270	0.111
TN	0.326	0.356	0.475	0.376	0.446	0.396	0.149	0.063
TX	0.386	0.469	0.506	0.457	0.489	0.461	0.120	0.046
UT	0.415	0.415	0.520	0.405	0.593	0.470	0.188	0.083
VA	0.583	0.528	0.618	0.509	0.401	0.528	0.217	0.083
WA	0.588	0.651	0.472	0.610	0.526	0.570	0.179	0.071
WI	0.317	0.432	0.442	0.397	0.436	0.405	0.126	0.052
WV	0.625	0.357	0.700	0.607	0.760	0.610	0.403	0.154
WY	0.680	0.523	0.472	0.526	0.531	0.547	0.208	0.078
Average	0.488	0.469	0.500	0.479	0.478	0.483	0.182	0.072

Table 2. Annual average number of wings submitted per participating hunter (PPH).

STATE	2007	2008	2009	2010	2011	AVERAGE	RANGE	STD
AL	5.803	3.843	3.542	8.697	5.903	5.557	5.155	2.064
AR	8.200	6.333	8.932	6.714	7.644	7.565	2.599	1.063
AZ	8.726	9.531	9.645	7.496	8.577	8.795	2.149	0.866
CA	6.278	5.866	5.576	5.830	6.567	6.024	0.991	0.395
CO	10.054	7.117	8.794	7.396	8.770	8.426	2.937	1.192
DE	8.538	9.469	6.667	8.320	8.343	8.267	2.802	1.011
FL	5.340	3.786	4.011	5.463	5.188	4.758	1.677	0.794
GA	6.305	5.489	6.886	7.111	4.877	6.134	2.234	0.942
IA					5.800	5.800		
ID	7.355	4.231	5.691	5.390	4.364	5.406	3.124	1.260
IL	7.848	9.400	8.976	8.238	7.119	8.316	2.281	0.904
IN	10.673	9.444	9.475	10.083	10.039	9.943	1.229	0.507
KS	10.038	7.483	8.649	9.615	9.248	9.007	2.554	0.992
KY	11.429	12.059	10.278	9.743	10.159	10.734	2.316	0.969
LA	4.070	4.244	5.583	6.356	5.214	5.094	2.285	0.951
MD	7.621	5.918	5.905	7.233	5.909	6.517	1.715	0.841
MN	0.615	2.000	3.647	1.412	4.221	2.379	3.606	1.516
MO	6.224	5.540	8.400	4.686	6.500	6.270	3.714	1.382
MS	6.071	7.085	8.574	10.815	6.405	7.790	4.744	1.945
MT	8.576	5.844	10.412	8.631	5.930	7.879	4.567	1.962
NC	7.875	5.313	8.406	8.655	6.815	7.413	3.342	1.370
ND	4.844	6.306	4.406	5.340	7.018	5.583	2.611	1.069
NE	8.931	8.796	8.487	6.180	6.872	7.853	2.751	1.247
NM	6.412	4.400	8.878	9.215	5.326	6.846	4.815	2.134
NV	6.794	3.821	5.614	7.743	6.085	6.011	3.922	1.464
OH	9.931	7.282	7.714	7.426	7.395	7.950	2.649	1.119
OK	4.515	10.177	9.215	7.163	8.607	7.935	5.662	2.203
OR	4.128	1.643	3.488	5.394	4.216	3.774	3.751	1.376
PA	5.122	4.779	4.103	3.453	3.762	4.244	1.669	0.696
SC	7.242	6.644	8.500	9.470	9.492	8.270	2.848	1.293
SD	7.247	10.403	7.750	6.087	6.513	7.600	4.316	1.694
TN	4.326	4.889	7.557	5.765	6.473	5.802	3.231	1.279
TX	4.197	6.324	7.124	5.624	7.073	6.068	2.928	1.213
UT	3.600	4.138	4.320	3.976	5.506	4.308	1.906	0.720
VA	7.815	7.654	8.912	8.275	5.705	7.672	3.207	1.203
WA	7.507	7.881	5.393	7.317	6.495	6.919	2.488	0.992
WI	1.967	4.716	3.788	5.698	4.897	4.213	3.732	1.428
WV	8.688	7.286	8.100	7.143	8.360	7.915	1.545	0.675
WY	11.840	7.477	6.417	8.193	7.578	8.301	5.423	2.079
Average	6.914	6.437	7.048	7.035	6.691	6.804	3.039	1.232

Appendix B. Overview of HIP Sample Frame Problems

Background. The Harvest Information Program (HIP) was initiated to provide reliable estimates of hunter activity and harvest for all migratory game birds. Under this program, the states annually collect the names and addresses of individuals who specify they intend to hunt migratory game birds that year, and send that name and address information to the USFWS. The states' databases of migratory game bird hunters are then used as the sample frames for surveys that generate annual hunter activity and harvest estimates. The HIP was initially implemented in a few states in 1992, and has been fully operational in the 48 contiguous states and Alaska since 1999.

So far, HIP survey results have been used primarily to provide the public and migratory bird managers with state, regional, and national estimates of hunting activity and harvest. However, the migratory bird management community believes more appropriate harvest regulations can be developed by using harvest estimates and banding data to index or estimate abundance of species for which we do not have surveys designed to estimate population size. For example, the Mourning Dove Task Force has recommended the use of such methods, rather than the Call Count Survey or the Breeding Bird Survey (which estimate only trends in birds observed), as the basis for harvest strategies that may be implemented in all 3 dove management units as early as 2014. Similarly, goose managers have begun using harvest and band-recovery data to estimate the abundance of mid-continent light geese.

The Problem. If the management community uses HIP harvest estimates explicitly as part of an informed decision-making process, we need to ensure that the estimates are unbiased and precise. The key to reliable results from any survey is the sample frame. A complete list of migratory bird hunters from each state is essential to the success of the HIP because it enables the USFWS to select and survey *representative* samples of hunters in each state. If a state's HIP sample frame excludes certain groups of hunters (e.g., lifetime license holders or nonresident hunters) and the success (harvest) of excluded groups is different than that of hunters included in the sample frame, the survey sample will not be representative and the survey results will likely be biased. More important is the fact that the sample frame is also the source of expansion factors. A harvest survey estimates the average number of birds shot per hunter and that average is then multiplied by the number of hunters in the sample frame (the expansion factor) to obtain an estimate of total harvest. Obviously, if a state's sample frame only includes 75% (or some unknown percentage) of the migratory bird hunters in the state, the resulting harvest estimates will only be 75% (or some unknown percentage) of the actual harvest.

Conversely, a state also can identify too many hunters for HIP. That is, if hunters who do not intend to hunt migratory birds are included in a state's list, it is much harder to "find" specifically migratory bird hunters to send surveys. These inflated sample frames are also common, and can result from several practices. The problem is particularly acute in states that have electronic licensing systems but do not charge a fee for a separate migratory bird (i.e., HIP) permit. In some of those states, many license vendors HIP-certify license purchasers without asking them the required HIP questions that are used to identify the migratory bird hunters. Hunters who purchase "sportsmen's" or "combo" licenses that give them all of the hunting and fishing privileges the state offers, including migratory bird hunting, are often automatically HIP-certified even though they have no intention to hunt migratory birds. In both cases the consequence is that the USFWS receives name and address data for hundreds of thousands of "migratory bird hunters" who are really only anglers, or only deer

hunters, etc. Because they have been erroneously identified as migratory bird hunters by the states' HIP certification processes, many of these people are sampled and asked to participate in HIP surveys. This dramatically increases the costs of the HIP to obtain desired levels of precision (i.e., many more hunters from states' lists need to be sampled to ensure an adequate number of migratory bird hunters receive surveys), and ultimately undermines public confidence in the HIP and the agencies (state and USFWS) that manage the program (e.g., a deer hunter, non-hunter, or angler receives a survey and wonders why, and sees the effort as a waste of tax dollars).

Often sample frame problems stem from a change in contractor, changes in the state's licensing system, and/or changes in the automated methods used to extract the HIP data for submission to the USFWS. When such changes result in inflated or incomplete sample frames, it usually takes a few years and considerable effort to identify the cause of the problem and correct it, but it can be done with cooperation from contractors and/or licensing and IT personnel. Sample frames that are inconsistent for no apparent reason are much more difficult to "fix," but must be addressed if we expect the results of surveys using those sample frames to be the basis for promulgating management regulations.

In addition to problems associated with identifying the correct hunters to survey, we also have experienced problems in getting accurate information from sampled hunters due to delays in receiving lists of names from the states. HIP survey forms are in diary format; they ask the sampled hunter to report the date, location, and number of birds shot for every hunt. The diary design is an attempt to reduce response bias (both memory and prestige bias), but its effectiveness depends on our collective ability to get the forms in the hands of selected hunters before or as soon as possible after they begin hunting. The operational agreement between the Service and the states when the HIP was implemented was that each year the state agencies would send their first batch (i.e., those hunters who purchased a migratory bird hunting license prior to the opening of migratory bird hunting seasons in September) of HIP name and address data to the USFWS in August before the first hunting seasons start. Once seasons commence, they would send additional data twice each month (on the first and third Wednesday of every month) as they HIP-certify additional hunters, until hunting seasons end in the state. This schedule enables the USFWS to send sampled hunters survey forms that they receive no later than four weeks after being HIP-certified. However, in any given year only about half of the states send HIP sample frame data to the USFWS twice a month, and some don't send data in August or prior to the opening of their state's hunting seasons. Some send the data monthly; others send only two files, the first in the middle or near the end of the hunting season and the second after the season closes. This limits the effectiveness of the diary format and likely results in response bias that compromises survey results.

In summary, by using the data gathered from HIP to estimate abundance of doves, the management community is increasing the efficiency of that data collection program to improve management decisions and the benefit:cost ratio of the survey. Over time doing so should reduce federal and state costs of monitoring efforts needed to promulgate hunting regulations. However, we must strive to ensure the data collected from these efforts are reliable. Although some of the needed changes to HIP may take some time and resources to resolve (e.g., ensuring representative samples of hunters are surveyed), others can occur quickly and likely with minimal costs (e.g., sending name lists to the USFWS twice each month as was initially agreed upon).

Appendix C. HIP sample frame reports – summary of requests and recommendations

Alabama: (1) We request that you work with us to determine whether we are missing some of your sample frame data for 2005, 2007, 2008, and 2009. (2) We recommend that you take steps to minimize the number of unnecessary HIP registrations issued through your electronic licensing system. This can usually be accomplished by charging a small fee for HIP registration, as recommended by AFWA in 2002, or by providing more explicit instructions to your license vendors. (3) We request that you take steps to ensure that Alabama HIP data are sent to us on schedule, starting with the data for 2012.

Alaska: (1) We request that you work with us to determine whether you are sending us complete sample frames. An incomplete sample frame could be caused by any of several factors, such as poor compliance by hunters, poor compliance by license vendors (failure to send ADFG the completed HIP forms), or omission of incomplete or very late (but valid) HIP forms. If you have state survey estimates of waterfowl harvest that we could compare with HIP estimates, or information from law enforcement on hunter compliance rates, it would help us assess this together. (2) We request that you ensure more timely transmission of the HIP sample frame data by (a) increasing the frequency at which license vendors are required to send in HIP forms, particularly early in the year (prior to October), and (b) elevating the priority of HIP form data entry by your staff and/or contractors.

Arizona: (1) We request that you send us counts of the number of migratory bird permits and waterfowl permits sold each license year from 2005-2011. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years. (2) We request that you ensure more complete and timely transmission of the HIP sample frame data by (a) increasing the frequency at which license vendors are required to send in HIP forms, particularly early in the year (prior to October), and (b) elevating the priority of HIP form data entry by your staff and/or contractors.

Arkansas: (1) We request that you work with us to determine whether we are missing some of your sample frame data for 2007. (2) We request that you work with us to determine whether you are sending us complete sample frames. An incomplete sample frame could be caused by any of several factors, such as poor compliance by hunters or omission of some type(s) of HIP-registered hunters from the HIP data you send us. If you have state survey estimates of migratory bird harvest that we could compare with HIP estimates, or information from law enforcement on hunter compliance rates, it would help us assess this together. (3) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2).

California: (1) We request that you work with us to determine how much of your sample frame data for 2003 we are missing, and whether we are missing any of the 2010 data. (2) We recommend that you take steps to minimize the number of unnecessary HIP registrations that are issued. This can usually be accomplished by charging a small fee for HIP registration, as recommended by AFWA in 2002, or by providing explicit instructions to your license vendors about which hunters need HIP registration and which ones don't. (3) We request that you take steps to ensure that you include HIP registration data from all sources, including internet license sales and HIP registrations of lifetime license holders who

hunt migratory birds, and send us the electronic data twice a month, in accordance with the established schedule.

Colorado: (1) We request that you work with us to determine the actual number of HIP registrations that your contractor issued for the 2009 hunting season. (2) We request that you take steps to ensure that your contractor sends us all of the Colorado HIP data on schedule, starting with the data for 2012.

Connecticut: We request that you work with us to determine whether we are missing some of your sample frame data from 2005-2011. Please check your accounting records and if possible, send us the number of migratory bird (HIP) permits you sold each month from January 1, 2005 through February 28, 2011.

Delaware: (1) We request that you work with us to determine the actual number of HIP registrations that your contractor issued for the 2008 and 2010 hunting seasons. (2) "timely data transfers" (see Colorado #2).

Florida: (1) "take steps to minimize the number of unnecessary HIP registrations" (see Alabama #2). (2) "determine whether you are sending us complete sample frames" (see Arkansas #2).

Georgia: (1) We request that you work with us to determine the correct number of HIP registrations Georgia issued for the 2003, 2009, and 2010 hunting seasons. (2) "take steps to minimize the number of unnecessary HIP registrations" (see Alabama #2). (3) "determine whether you are sending us complete sample frames" (see Arkansas #2).

Idaho: We request that you work with us to determine the correct number of HIP registrations Idaho issued for the 2007 hunting season.

Illinois: (1) We request that you work with us to determine the correct number of HIP registrations your telephone contractor issued for the 2003 hunting season. (2) "take steps to minimize the number of unnecessary HIP registrations" (see Alabama #2).

Indiana: "determine whether you are sending us complete sample frames" (see Arkansas #2).

Iowa: (1) "take steps to minimize the number of unnecessary HIP registrations" (see Alabama #2). (2) "determine whether you are sending us complete sample frames" (see Arkansas #2).

Kansas: We request that you work with us to determine the correct number of HIP registrations Kansas issued for the 2004 and 2005 hunting seasons. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years.

Kentucky: (1) We request that you work with us to determine the correct number of HIP registrations/permits that Kentucky issued for the 2005, 2006, 2007, and 2008 hunting seasons. (2) We recommend that you take steps to minimize the number of unnecessary HIP registrations issued through your electronic licensing system. This can perhaps be accomplished by providing more explicit

instructions to your license vendors about which hunters need to be HIP-registered and which ones do not. (3) “timely data transfers” (see Alabama #3).

Louisiana: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (2) “determine whether you are sending us complete sample frames” (see Arkansas #2).

Maine: We appreciate the cooperation we have enjoyed with Maine in examining sample frame issues, and we request that you continue to work with us to determine whether you are sending us complete sample frames. We also recommend that you take steps to minimize the number of unnecessary HIP registrations issued through your electronic licensing system. This can perhaps be accomplished by providing more explicit instructions to your license vendors.

Maryland: “timely data transfers” (see Alabama #3).

Massachusetts: (1) We request that you work with us to determine the correct number of HIP registrations Massachusetts issued for the 2007 hunting season. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2).

Michigan: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2).

Minnesota: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2).

Mississippi: (1) We request that you work with us to determine whether we are missing some of your sample frame data for 2003, 2005, 2007, 2008, 2009, and 2010. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (4) “timely data transfers” (see Alabama #3).

Missouri: None. Missouri’s execution of the state’s HIP responsibility is an outstanding example of how this program can and should be conducted. Please just keep doing what you’re doing.

Montana: (1) We request that you work with us to determine whether we are missing some of your sample frame data for 2008. (2) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (3) “timely data transfers” (see Alabama #3).

Nebraska: (1) We request that you work with us to determine the actual number of HIP registrations that your contractor issued for the 2009 hunting season. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Colorado #2).

Nevada: (1) We request that you work with us to determine whether we are missing some of your sample frame data that your contractor collected for 2007 and 2008. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2).

New Hampshire: (1) We request that you work with us to determine whether we are missing some of your sample frame data from 2003, 2004, and 2006. (2) “timely data transfers” (see Alabama #3).

New Jersey: We request that you take steps to ensure that you and/or your contractors send us the data for all New Jersey HIP registrations and that the data are sent to us on schedule, starting with the 2012-13 season.

New Mexico: We request that you work with us to determine whether we are receiving complete sample frames for New Mexico. An incomplete sample frame could be caused by any of several factors, such as poor compliance by hunters, poor compliance by license vendors (failure to send in the completed HIP forms), or, if you provide hunters the opportunity to get their HIP registration on-line, failure to transfer electronic HIP data to us. If you have state survey estimates of migratory bird harvest that we could compare with HIP estimates, or information from law enforcement on hunter compliance rates, it would help us assess this together.

New York: (1) “determine whether you are sending us complete sample frames” (see Arkansas #2). (2) We request that you take steps to ensure that you and/or your contractors send us the data for all New York HIP registrations and that the data are sent to us on schedule, starting with the 2012-13 season.

North Carolina: (1) We request that you continue to work with us to determine whether you are sending us complete sample frames. (2) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (3) “timely data transfers” (see Alabama #3).

North Dakota: “timely data transfers” (see Alabama #3).

Ohio: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (2) “timely data transfers” (see Alabama #3).

Oklahoma: (1) “determine whether you are sending us complete sample frames” (see Arkansas #2). (2) “timely data transfers” (see Alabama #3).

Oregon: “timely data transfers” (see Alabama #3).

Pennsylvania: “timely data transfers” (see Alabama #3).

Rhode Island: (1) We request that you send us counts of the number of HIP registrations issued in Rhode Island in each of the following license years: 2003, 2005, and 2007-2011. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years. (2) We request that you ensure more complete and timely transmission of the HIP sample frame data by (a) increasing the frequency at which license vendors are required to send in HIP forms, particularly early in the year (prior to October), and (b) elevating the priority of HIP form data entry by your staff and/or contractors.

South Carolina: (1) We request that you work with us to determine the correct number of HIP registrations South Carolina issued for the 2003 hunting season. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for that year. (2) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2).

South Dakota: We request that you work with us to determine whether we received the data from all of the HIP registrations South Dakota issued for the 2006 and 2007 hunting seasons.

Tennessee: (1) We request that you work with us to determine the correct number of HIP registrations/permits that Tennessee issued for each year from 2003-2010. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Alabama #3).

Texas: (1) We request that you take steps to minimize the number of unnecessary HIP registrations issued through your electronic licensing system. This could perhaps be accomplished by requiring super combo license purchasers to “activate” their migratory bird hunting privilege by registering for HIP, and/or by providing more explicit instructions to your license vendors about which hunters need to be HIP-registered and which do not. (2) “timely data transfers” (see Alabama #3).

Utah: (1) We request that you work with us to determine the actual number of HIP registrations that your contractor issued for the 2009 hunting season. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Colorado #2).

Vermont: (1) We request that you work with us to determine whether we are missing some of the HIP registration data that you collected for 2003, 2005, 2006, and 2010. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Rhode Island #2)

Virginia: (1) “determine whether you are sending us complete sample frames” (see Arkansas #2). (2) “timely data transfers” (see Colorado #2).

Washington: (1) We request that you work with us to determine the correct number of HIP registrations/migratory bird permits that Washington issued for each year from 2006-2010. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Alabama #3).

West Virginia: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (2) We request that you take steps to ensure that all of West Virginia’s HIP data are sent to us on schedule, particularly after September 1 when hunting seasons are underway.

Wisconsin: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (2) We request that you send us the first file of your annual HIP data on schedule in late August, starting in 2012.

Wyoming: (1) “determine whether you are sending us complete sample frames” (see Arkansas #2). (2) “timely data transfers” (see Alabama #3).

Harvest Information Program (HIP) Review
Report to the Migratory Shore & Upland Game Bird Working Group
August 22, 2013
Khristi Wilkins (USFWS), Dave Morrison (TXPWD), and Brad Bortner (USFWS)

Background

The Harvest Information Program (HIP) was implemented nation-wide in 1998 to provide a sample frame for estimating harvest of waterfowl, doves, band-tailed pigeons, woodcock, snipe, coots, rails, gallinules, and sandhill cranes. Prior to 1998, purchasers of the Migratory Bird Hunting and Conservation Stamp (a.k.a. Duck Stamp) provided the sample frame for estimating harvest of these species/species groups (except sandhill cranes). The wildlife management community had long recognized that not all migratory bird hunters purchase Duck Stamps (e.g., dove hunters who do not hunt waterfowl). The cooperative State-Federal HIP was developed to obtain unbiased estimates of harvest of all migratory game birds nationwide. Under this program, hunters are required to register for HIP every year in each State in which they hunt migratory birds. State agencies are responsible for collecting the hunter information and forwarding it to the United States Fish and Wildlife Service (USFWS), and the USFWS is responsible for implementing the survey, analyzing data, and making results available to States and the public.

In 2000, the Migratory Shore and Upland Game Bird Working Group (MSUGBWG) struck an ad hoc committee and charged it with conducting a complete review of all aspects of HIP to determine whether the program was functioning as intended, and to make recommendations for improvements where necessary. This committee of State and Federal biologists, State licensing administrators, and biometricians reviewed and evaluated:

- (1) the purpose and history of HIP,
- (2) the efficacy of the screening (i.e., registration) questions,
- (3) types, impacts, and scope of vendor non-compliance,
- (4) the scope and impact of hunter non-compliance,
- (5) the role and impact of large chain stores in the overall success of HIP,
- (6) the statistical reliability of HIP surveys,
- (7) the impacts of HIP on State harvest surveys,
- (8) the impacts of State license systems, and
- (9) the cost of implementation.

The committee issued a report of its findings and recommendations in 2002 (Ver Steeg and Elden, 2002). The committee determined that the Harvest Information Program was necessary to improve the reliability of annual harvest estimates for all migratory game birds, especially for doves, woodcock, and marsh birds (snipe, coot, rails, and gallinules). However, the committee recommended several actions to improve the quality of the sample frame and increase compliance by hunters and license vendors. They also recommended that the USFWS investigate using reduced stratification (i.e. reducing the number of screening questions [up to 10 depending on species hunted in the State] and answers [2-4/question]). Recommendations and follow-up actions are summarized in Table 1.

Table 1. Summary of results from HIP evaluation 2002 (Versteeg and Elden, 2002).

Area	Recommendation	To	Action taken since 2002
Future	Continue HIP with significant improvements	USFWS	Developing ways to better to manage data and assess quality
Information & Education	Improve hunter education about HIP	USFWS & States	USFWS – info on HIP on FWS website; States – most have info on their websites and/or in their hunting regulations booklets
Communication with States	Work closely with States collectively to improve agency acceptance of HIP	USFWS	States have accepted HIP as necessary and routine, but some States would like to see progress on efforts to streamline
Communication with States	Work with States individually to determine any special needs related to implementing HIP	USFWS	This has been an ongoing process
Screening questions	Investigate the feasibility of a reduced level of stratification, primarily by examining an additional year of survey data	USFWS	Minimal
Screening questions	Pilot a shorter series of screening questions	USFWS	None
Enforcement of Hunter Compliance	Stricter enforcement of the HIP registration requirement in States where such enforcement has been minimal or nonexistent	States	Varies by State
Enforcement of Hunter Compliance	Provide a more consistent level of enforcement throughout the country	USFWS	New agents receive training on HIP, including examples of what to look for on licenses of several States, and fines for non-compliance are standard across most federal enforcement districts
Enforcement of Hunter Compliance	Law Enforcement Committee of the IAFWA to develop uniform enforcement guidelines as soon as possible for adoption by the Service and the States	States & AFWA	?
Vendor Compliance	Employ better techniques to monitor vendor compliance	States	Minimal
Vendor Compliance	Examine, and possibly adopt, HIP-certification systems that eliminate or minimize the service of license vendors	States	Many have implemented on-line licensing and HIP registration, and usage by hunters is growing
Vendor Compliance	Consider a standardized, multi-State system for HIP data collection and possibly other permits	States	None

HIP registration fees	Each State with the authority to require a fee for HIP registration should do so	States	In 2009, 15/49 States were charging for HIP (although some States charge for point of sale permits and offer online permits for free)
Exempted Hunters	Minimize the number of hunters exempted from HIP	States	Minimal change
Mechanics	Investigate potential sources of bias and evaluate the impact of such biases on the harvest estimates	USFWS	Minimal
Mechanics	Develop and maintain data to determine trends and variations in bias over time	USFWS	None
Mechanics	Conduct additional research over a number of years to determine if the bias is consistent and to ensure that current harvest estimates are correlated with reality	USFWS	None
Mechanics	Determine the impact on harvest survey results when changes are made to the survey design	USFWS	Not applicable (no changes made to design)
Funding	Support an increase in the Service's budget of \$300,000 annually to assist the Division of Migratory Bird Management (MBM) with research and outreach efforts related to many of these recommendations	AFWA & USFWS	That funding was eliminated by the time the report was released in 2002
Funding	\$150,000 of the \$300,000 for at least the next 10 years to support efforts directed specifically at improving the HIP survey design methodology	USFWS	That funding was eliminated by the time the report was released in 2002

Requested actions

At this time, we do not feel that the USFWS and States need to repeat an intensive review of the HIP, because we expect that the outcome and recommendations would be similar. We recommend focus on four areas. Recommendation #1 would provide a long-term fix; recommendations 2-4 are needed to improve HIP as it currently is implemented.

- (1) **Long-term: Consider making HIP a Federal permit.** When HIP was initially proposed by IAFWA in 1990, it was envisioned as a national permit that would be required by the USFWS but administered by the States. However, some State agencies and the Office of Management and Budget (OMB) were concerned about the Federal government getting involved in State licensing, and OMB would not approve what it perceived to be a Federal permit. Thus, when phased-in implementation began in 1994, HIP had evolved into its current form: HIP permits (or the equivalent) issued by State natural resources agencies and forwarded to the USFWS. If HIP registration was accomplished through a Federal permit issued by the USFWS, the quality of the sample frame would be improved and States would be relieved of the burden of collecting these data. However, some States charge a fee for their HIP permit and might not want to lose that revenue. Also, we do not know how OMB would react to a proposal to create a Federal permit, or if the USFWS would be able to secure the necessary funding to operate the HIP program.
- (2) **Ensure game bird managers are involved with the HIP data collection, coding, and transfer processes in each State.** The quality of the HIP sample frame is dependent upon receipt of correct, complete data in a timely manner. Incomplete or late sample frames have limited the utility of the harvest estimates for management, especially the harvest estimates of mourning doves (see Appendix A for description of sample frame problems and Appendix B for summary of requested actions for each state). Inaccurate coding of hunters' responses to the HIP screening questions has also been a problem (e.g., many hunters assigned to the wrong strata regardless of their answers to the screening questions, because of a programming error). The latter problem is nearly impossible to detect until after the bulk of the hunting registrations have been received. At that point it is too late to make corrections even if the problem is recognized because most hunters have already been surveyed. State agency biologists have limited ability to prevent and correct problems when licensing or IT personnel or contractors have sole responsibility for HIP registration systems and for compiling and transferring the HIP data to the USFWS. In our experience, the quality of the data is improved when people with a vested interest in the survey results (i.e., game bird managers) are closely involved with the HIP process within each State agency. Therefore, we request that each State agency make the quality of its HIP sample frame data a high priority, and **appoint a migratory game bird manager to be responsible for the quality of HIP data from his/her agency.** This person would work with the USFWS's Branch of Harvest Surveys to ensure that HIP data are coded correctly, compiled from all license types and sources (e.g., online, telephone, point of sale), and transferred to the USFWS in a timely fashion.
- (3) **Review efficacy of stratification questions.** The HIP registration process takes several minutes (see Appendix C for list of screening questions). Reducing the number of questions and answers would make the process quicker and would likely increase hunter and license vendor compliance. This change would also have the added benefit of clearing up the misconception that the screening questions *are* the harvest survey. In our conversations with hunters, we have found that many

hunters believe this to be the case, and when they see non-compliance, they think that the survey is not providing useful information. Analyses of data from 1999 showed that the screening questions reduced necessary sample size somewhat (VerSteeg and Elden, 2002), but current data need to be analyzed in a cost-benefit context, keeping in mind that a slight loss of efficiency might be beneficial to the overall success of the HIP.

- (4) **Get permission from State agencies to include email addresses with HIP registrations.** The design of the HIP survey is based on the Dillman Total Design Method (Dillman 1978, Dillman 1991). Hunters are mailed a complete survey packet (diary form and cover letter) within 1-3 weeks of receipt of name and address. A hunter who does not return his/her survey form shortly after the close of the season is sent a reminder post card. About 3 weeks after this mailing, a complete follow-up packet is sent to non-respondents. Finally, 3-4 weeks, later an additional survey packet is sent to remaining non-respondents. Because some States collect email addresses as part of the licensing process, the USFWS would like to investigate the feasibility of sending some reminder mailings by email. This would allow us to reduce printing and mailing costs, as well as reduce our carbon footprint in support of the USFWS Sustainability Initiative. Postage costs are the largest part of the HIP survey program, and anything we can do to lessen these costs will protect the long-term viability of the survey. However, before the USFWS can investigate including email addresses with HIP registrations, approval is needed from State agencies and the Office of Management and Budget. Approval from the States is the first step.

Citations

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Appendix A. Overview of HIP Sample Frame Problems

(Note: This document was given to each state agency's Flyway Technical Representative in June 2012).

Background. The Harvest Information Program (HIP) was initiated to provide reliable estimates of hunter activity and harvest for all migratory game birds. Under this program, the states annually collect the names and addresses of individuals who specify they intend to hunt migratory game birds that year, and send that name and address information to the USFWS. The states' databases of migratory game bird hunters are then used as the sample frames for surveys that generate annual hunter activity and harvest estimates. The HIP was initially implemented in a few states in 1992, and has been fully operational in the 48 contiguous states and Alaska since 1999.

So far, HIP survey results have been used primarily to provide the public and migratory bird managers with state, regional, and national estimates of hunting activity and harvest. However, the migratory bird management community believes more appropriate harvest regulations can be developed by using harvest estimates and banding data to index or estimate abundance of species for which we do not have surveys designed to estimate population size. For example, the Mourning Dove Task Force has recommended the use of such methods, rather than the Call Count Survey or the Breeding Bird Survey (which estimate only trends in birds observed), as the basis for harvest strategies that may be implemented in all 3 dove management units as early as 2014. Similarly, goose managers have begun using harvest and band-recovery data to estimate the abundance of mid-continent light geese.

The Problem. If the management community uses HIP harvest estimates explicitly as part of an informed decision-making process, we need to ensure that the estimates are unbiased and precise. The key to reliable results from any survey is the sample frame. A complete list of migratory bird hunters from each state is essential to the success of the HIP because it enables the USFWS to select and survey *representative* samples of hunters in each state. If a state's HIP sample frame excludes certain groups of hunters (e.g., lifetime license holders or nonresident hunters) and the success (harvest) of excluded groups is different than that of hunters included in the sample frame, the survey sample will not be representative and the survey results will likely be biased. More important is the fact that the sample frame is also the source of expansion factors. A harvest survey estimates the average number of birds shot per hunter and that average is then multiplied by the number of hunters in the sample frame (the expansion factor) to obtain an estimate of total harvest. Obviously, if a state's sample frame only includes 75% (or some unknown percentage) of the migratory bird hunters in the state, the resulting harvest estimates will only be 75% (or some unknown percentage) of the actual harvest.

Conversely, a state also can identify too many hunters for HIP. That is, if hunters who do not intend to hunt migratory birds are included in a state's list, it is much harder to "find" specifically migratory bird hunters to send surveys. These inflated sample frames are also common, and can result from several practices. The problem is particularly acute in states that have electronic licensing systems but do not charge a fee for a separate migratory bird (i.e., HIP) permit. In some of those states, many license vendors HIP-certify license purchasers without asking them the required HIP questions that are used to identify the migratory bird hunters. Hunters who purchase "sportsmen's" or "combo" licenses that give them all of the hunting and fishing privileges the state offers, including migratory bird hunting, are often automatically HIP-certified even though they have no intention to hunt migratory birds. In both cases the consequence is that the USFWS

receives name and address data for hundreds of thousands of “migratory bird hunters” who are really only anglers, or only deer hunters, etc. Because they have been erroneously identified as migratory bird hunters by the states’ HIP certification processes, many of these people are sampled and asked to participate in HIP surveys. This dramatically increases the costs of the HIP to obtain desired levels of precision (i.e., many more hunters from states’ lists need to be sampled to ensure an adequate number of migratory bird hunters receive surveys), and ultimately undermines public confidence in the HIP and the agencies (state and USFWS) that manage the program (e.g., a deer hunter, non-hunter, or angler receives a survey and wonders why, and sees the effort as a waste of tax dollars).

Often sample frame problems stem from a change in contractor, changes in the state’s licensing system, and/or changes in the automated methods used to extract the HIP data for submission to the USFWS. When such changes result in inflated or incomplete sample frames, it usually takes a few years and considerable effort to identify the cause of the problem and correct it, but it can be done with cooperation from contractors and/or licensing and IT personnel. Sample frames that are inconsistent for no apparent reason are much more difficult to “fix,” but must be addressed if we expect the results of surveys using those samples frames to be the basis for promulgating management regulations.

In addition to problems associated with identifying the correct hunters to survey, we also have experienced problems in getting accurate information from sampled hunters due to delays in receiving lists of names from the states. HIP survey forms are in diary format; they ask the sampled hunter to report the date, location, and number of birds shot for every hunt. The diary design is an attempt to reduce response bias (both memory and prestige bias), but its effectiveness depends on our collective ability to get the forms in the hands of selected hunters before or as soon as possible after they begin hunting. The operational agreement between the Service and the states when the HIP was implemented was that each year the state agencies would send their first batch (i.e., those hunters who purchased a migratory bird hunting license prior to the opening of migratory bird hunting seasons in September) of HIP name and address data to the USFWS in August before the first hunting seasons start. Once seasons commence, they would send additional data twice each month (on the first and third Wednesday of every month) as they HIP-certify additional hunters, until hunting seasons end in the state. This schedule enables the USFWS to send sampled hunters survey forms that they receive no later than four weeks after being HIP-certified. However, in any given year only about half of the states send HIP sample frame data to the USFWS twice a month, and some don’t send data in August or prior to the opening of their state’s hunting seasons. Some send the data monthly; others send only two files, the first in the middle or near the end of the hunting season and the second after the season closes. This limits the effectiveness of the diary format and likely results in response bias that compromises survey results.

In summary, by using the data gathered from HIP to estimate abundance of doves, the management community is increasing the efficiency of that data collection program to improve management decisions and the benefit:cost ratio of the survey. Over time doing so should reduce federal and state costs of monitoring efforts needed to promulgate hunting regulations. However, we must strive to ensure the data collected from these efforts are reliable. Although some of the needed changes to HIP may take some time and resources to resolve (e.g., ensuring representative samples of hunters are surveyed), others can occur quickly and likely with minimal costs (e.g., sending name lists to the USFWS twice each month as was initially agreed upon).

Appendix B. HIP sample frame reports – summary of requests and recommendations

(Note: This document was given to each state agency’s Flyway Technical Representative in June 2012, along with a detailed report for each state.)

Alabama: (1) We request that you work with us to determine whether we are missing some of your sample frame data for 2005, 2007, 2008, and 2009. (2) We recommend that you take steps to minimize the number of unnecessary HIP registrations issued through your electronic licensing system. This can usually be accomplished by charging a small fee for HIP registration, as recommended by AFWA in 2002, or by providing more explicit instructions to your license vendors. (3) We request that you take steps to ensure that Alabama HIP data are sent to us on schedule, starting with the data for 2012.

Alaska: (1) We request that you work with us to determine whether you are sending us complete sample frames. An incomplete sample frame could be caused by any of several factors, such as poor compliance by hunters, poor compliance by license vendors (failure to send ADFG the completed HIP forms), or omission of incomplete or very late (but valid) HIP forms. If you have state survey estimates of waterfowl harvest that we could compare with HIP estimates, or information from law enforcement on hunter compliance rates, it would help us assess this together. (2) We request that you ensure more timely transmission of the HIP sample frame data by (a) increasing the frequency at which license vendors are required to send in HIP forms, particularly early in the year (prior to October), and (b) elevating the priority of HIP form data entry by your staff and/or contractors.

Arizona: (1) We request that you send us counts of the number of migratory bird permits and waterfowl permits sold each license year from 2005-2011. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years. (2) We request that you ensure more complete and timely transmission of the HIP sample frame data by (a) increasing the frequency at which license vendors are required to send in HIP forms, particularly early in the year (prior to October), and (b) elevating the priority of HIP form data entry by your staff and/or contractors.

Arkansas: (1) We request that you work with us to determine whether we are missing some of your sample frame data for 2007. (2) We request that you work with us to determine whether you are sending us complete sample frames. An incomplete sample frame could be caused by any of several factors, such as poor compliance by hunters or omission of some type(s) of HIP-registered hunters from the HIP data you send us. If you have state survey estimates of migratory bird harvest that we could compare with HIP estimates, or information from law enforcement on hunter compliance rates, it would help us assess this together. (3) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2).

California: (1) We request that you work with us to determine how much of your sample frame data for 2003 we are missing, and whether we are missing any of the 2010 data. (2) We recommend that you take steps to minimize the number of unnecessary HIP registrations that are issued. This can usually be accomplished by charging a small fee for HIP registration, as recommended by AFWA in 2002, or by providing explicit instructions to your license vendors about which hunters need HIP registration and which ones don’t. (3) We request that you take steps to ensure that you include HIP registration data from all sources, including internet license sales and HIP registrations of lifetime license holders who hunt migratory birds, and send us the electronic data twice a month, in accordance with the established schedule.

Colorado: (1) We request that you work with us to determine the actual number of HIP registrations that your contractor issued for the 2009 hunting season. (2) We request that you take steps to ensure that your contractor sends us all of the Colorado HIP data on schedule, starting with the data for 2012.

Connecticut: We request that you work with us to determine whether we are missing some of your sample frame data from 2005-2011. Please check your accounting records and if possible, send us the number of migratory bird (HIP) permits you sold each month from January 1, 2005 through February 28, 2011.

Delaware: (1) We request that you work with us to determine the actual number of HIP registrations that your contractor issued for the 2008 and 2010 hunting seasons. (2) "timely data transfers" (see Colorado #2).

Florida: (1) "take steps to minimize the number of unnecessary HIP registrations" (see Alabama #2). (2) "determine whether you are sending us complete sample frames" (see Arkansas #2).

Georgia: (1) We request that you work with us to determine the correct number of HIP registrations Georgia issued for the 2003, 2009, and 2010 hunting seasons. (2) "take steps to minimize the number of unnecessary HIP registrations" (see Alabama #2). (3) "determine whether you are sending us complete sample frames" (see Arkansas #2).

Idaho: We request that you work with us to determine the correct number of HIP registrations Idaho issued for the 2007 hunting season.

Illinois: (1) We request that you work with us to determine the correct number of HIP registrations your telephone contractor issued for the 2003 hunting season. (2) "take steps to minimize the number of unnecessary HIP registrations" (see Alabama #2).

Indiana: "determine whether you are sending us complete sample frames" (see Arkansas #2).

Iowa: (1) "take steps to minimize the number of unnecessary HIP registrations" (see Alabama #2). (2) "determine whether you are sending us complete sample frames" (see Arkansas #2).

Kansas: We request that you work with us to determine the correct number of HIP registrations Kansas issued for the 2004 and 2005 hunting seasons. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years.

Kentucky: (1) We request that you work with us to determine the correct number of HIP registrations/permits that Kentucky issued for the 2005, 2006, 2007, and 2008 hunting seasons. (2) We recommend that you take steps to minimize the number of unnecessary HIP registrations issued through your electronic licensing system. This can perhaps be accomplished by providing more explicit instructions to your license vendors about which hunters need to be HIP-registered and which ones do not. (3) "timely data transfers" (see Alabama #3).

Louisiana: (1) "take steps to minimize the number of unnecessary HIP registrations" (see Alabama #2). (2) "determine whether you are sending us complete sample frames" (see Arkansas #2).

Maine: We appreciate the cooperation we have enjoyed with Maine in examining sample frame issues, and we request that you continue to work with us to determine whether you are sending us complete sample

frames. We also recommend that you take steps to minimize the number of unnecessary HIP registrations issued through your electronic licensing system. This can perhaps be accomplished by providing more explicit instructions to your license vendors.

Maryland: “timely data transfers” (see Alabama #3).

Massachusetts: (1) We request that you work with us to determine the correct number of HIP registrations Massachusetts issued for the 2007 hunting season. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2).

Michigan: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2).

Minnesota: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2).

Mississippi: (1) We request that you work with us to determine whether we are missing some of your sample frame data for 2003, 2005, 2007, 2008, 2009, and 2010. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (4) “timely data transfers” (see Alabama #3).

Missouri: None. Missouri’s execution of the state’s HIP responsibility is an outstanding example of how this program can and should be conducted. Please just keep doing what you’re doing.

Montana: (1) We request that you work with us to determine whether we are missing some of your sample frame data for 2008. (2) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (3) “timely data transfers” (see Alabama #3).

Nebraska: (1) We request that you work with us to determine the actual number of HIP registrations that your contractor issued for the 2009 hunting season. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Colorado #2).

Nevada: (1) We request that you work with us to determine whether we are missing some of your sample frame data that your contractor collected for 2007 and 2008. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2).

New Hampshire: (1) We request that you work with us to determine whether we are missing some of your sample frame data from 2003, 2004, and 2006. (2) “timely data transfers” (see Alabama #3).

New Jersey: We request that you take steps to ensure that you and/or your contractors send us the data for all New Jersey HIP registrations and that the data are sent to us on schedule, starting with the 2012-13 season.

New Mexico: We request that you work with us to determine whether we are receiving complete sample frames for New Mexico. An incomplete sample frame could be caused by any of several factors, such as poor compliance by hunters, poor compliance by license vendors (failure to send in the completed HIP forms), or, if you provide hunters the opportunity to get their HIP registration on-line, failure to transfer electronic HIP data to us. If you have state survey estimates of migratory bird harvest that we could compare with HIP

estimates, or information from law enforcement on hunter compliance rates, it would help us assess this together.

New York: (1) “determine whether you are sending us complete sample frames” (see Arkansas #2). (2) We request that you take steps to ensure that you and/or your contractors send us the data for all New York HIP registrations and that the data are sent to us on schedule, starting with the 2012-13 season.

North Carolina: (1) We request that you continue to work with us to determine whether you are sending us complete sample frames. (2) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (3) “timely data transfers” (see Alabama #3).

North Dakota: “timely data transfers” (see Alabama #3).

Ohio: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (2) “timely data transfers” (see Alabama #3).

Oklahoma: (1) “determine whether you are sending us complete sample frames” (see Arkansas #2). (2) “timely data transfers” (see Alabama #3).

Oregon: “timely data transfers” (see Alabama #3).

Pennsylvania: “timely data transfers” (see Alabama #3).

Rhode Island: (1) We request that you send us counts of the number of HIP registrations issued in Rhode Island in each of the following license years: 2003, 2005, and 2007-2011. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years. (2) We request that you ensure more complete and timely transmission of the HIP sample frame data by (a) increasing the frequency at which license vendors are required to send in HIP forms, particularly early in the year (prior to October), and (b) elevating the priority of HIP form data entry by your staff and/or contractors.

South Carolina: (1) We request that you work with us to determine the correct number of HIP registrations South Carolina issued for the 2003 hunting season. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for that year. (2) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2).

South Dakota: We request that you work with us to determine whether we received the data from all of the HIP registrations South Dakota issued for the 2006 and 2007 hunting seasons.

Tennessee: (1) We request that you work with us to determine the correct number of HIP registrations/permits that Tennessee issued for each year from 2003-2010. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Alabama #3).

Texas: (1) We request that you take steps to minimize the number of unnecessary HIP registrations issued through your electronic licensing system. This could perhaps be accomplished by requiring super combo

license purchasers to “activate” their migratory bird hunting privilege by registering for HIP, and/or by providing more explicit instructions to your license vendors about which hunters need to be HIP-registered and which do not. (2) “timely data transfers” (see Alabama #3).

Utah: (1) We request that you work with us to determine the actual number of HIP registrations that your contractor issued for the 2009 hunting season. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Colorado #2).

Vermont: (1) We request that you work with us to determine whether we are missing some of the HIP registration data that you collected for 2003, 2005, 2006, and 2010. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Rhode Island #2)

Virginia: (1) “determine whether you are sending us complete sample frames” (see Arkansas #2). (2) “timely data transfers” (see Colorado #2).

Washington: (1) We request that you work with us to determine the correct number of HIP registrations/migratory bird permits that Washington issued for each year from 2006-2010. This will enable us to use legitimate expansion factors when we generate the final hunter activity and harvest estimates for those years. (2) “determine whether you are sending us complete sample frames” (see Arkansas #2). (3) “timely data transfers” (see Alabama #3).

West Virginia: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (2) We request that you take steps to ensure that all of West Virginia’s HIP data are sent to us on schedule, particularly after September 1 when hunting seasons are underway.

Wisconsin: (1) “take steps to minimize the number of unnecessary HIP registrations” (see Alabama #2). (2) We request that you send us the first file of your annual HIP data on schedule in late August, starting in 2012.

Wyoming: (1) “determine whether you are sending us complete sample frames” (see Arkansas #2). (2) “timely data transfers” (see Alabama #3).

Appendix C. Standard HIP registration questions. States can omit questions that are not relevant to seasons in their States (e.g., cranes, brant, sea ducks).

Q1. Will you hunt migratory birds this year?

A. Yes or no.

Q2. How many ducks did you harvest last year?

A. Did not hunt, 0, 1-10, or more than 10.

Q3. How many geese did you harvest last year?

A. Did not hunt, 0, 1-10, or more than 10.

Q4. How many doves did you harvest last year?

A. Did not hunt, 0, 1-30, or more than 30.

Q5a. How many woodcock did you harvest last year?

A. Did not hunt, 0, 1-30, or more than 30.

or

Q5b. Did you hunt woodcock last year?

A. Yes or no.

Q6. Did you hunt coots or snipe last year?

A. Yes or no.

Q7. Did you hunt rails or gallinules last year?

A. Yes or no.

Q8. Will you hunt cranes this year?

A. Yes or no.

Q9. Will you hunt band-tailed pigeons this year?

A. Yes or no.

Q10. Will you hunt brant this year?

A. Yes or no.

Q11. Did you hunt sea ducks last year? (NOTE: Some States have changed this to "Will you hunt sea ducks this year?" to identify out-of-state sea duck hunters.)

A. Yes or no.