

SUMMARY OF EFFORT

The Summary of Mist-Netting Effort is the only information available that allows us to analyze between-year changes in mist-netting data in a constant-effort manner. It is critical that this form be completed exactly as indicated. Please review this section of the manual carefully before filling out the Summary of Mist-Netting Effort forms. The most common problems that we encounter are unspecified net number(s), unspecified timing (to the nearest ten minutes) of the opening and closing of the net(s), and net-hour calculations. Remember, the opening and closing times you should record are those for the first net to be opened or closed and should be recorded in the same format as capture times. Also, please be sure to double-check all net-hour calculations. All effort at MAPS nets from Intended Period 1 through Intended Period 10 [including August data for stations at higher altitudes that were delayed by one (or, in years of exceptionally heavy and late-melting snowpacks, even two) period(s)] must be recorded on the Summary of Mist-Netting Effort forms (Fig. 6), including any effort conducted before the recommended starting period. Banding data submitted for Intended Periods 11(August 9-18) and 12 (August 19-28) must also be accompanied by effort data.

MAPSPROG incorporates a module to enter all effort data; program checks ensure that all MAPS season banding records occurred on days the nets were actually operated.

Instructions for completing the Summary of Mist-Netting Effort form

Location: Record your four-character location code.

Station: Record your four-character station code.

List net numbers of all 12-m nets: Record the net designations of all 12 meter nets.

List net numbers and lengths of all other nets: Record the net designations and lengths of all other nets. If you do not operate other length nets, please indicate by recording "N/A" or "none."

If any nets are stacked, list their net numbers and how stacked: For example, nets 02 and 03 stacked: 02-low and 03-high.

Describe net changes from last year: Indicate any previously operated nets that were not operated in the current year and any new nets added. Please note that any moved nets will require new net numbers.

MAPS season shift due to heavy snow pack at high elevation stations: See page 24 for a complete explanation of when this rare season shift may be necessary.

Intended Period: Record the **intended** period for the date operated. Remember, if it is impossible to put in the effort for a given period within the period itself, it may be done within five days before or after that period. If the date operated falls outside the standard ten-day period, include a note explaining why the operation did not occur in the standard ten-day period.

**2009 MAPS SUMMARY OF MIST-NETTING EFFORT - pg 1**LOCATION CODE: B I P A STATION CODE: U P E DList net numbers of all 12-m nets: 01- 09List net numbers and lengths (in meters) of all other nets: Net 10 = 9 mIf any nets are stacked, list their net numbers and how stacked (i.e., nets 02 and 03 stacked: 02-low, 03-high, etc.): No stacked netsDescribe any changes in your nets or net sites since last year. **Any moved nets require new net numbers!:** No changes

MAPS PERIODS

Period One: May 01 - May 10
 Period Two: May 11 - May 20
 Period Three: May 21 - May 30
 Period Four: May 31 - June 09
 Period Five: June 10 - June 19
 Period Six: June 20 - June 29
 Period Seven: June 30 - July 09
 Period Eight: July 10 - July 19
 Period Nine: July 20 - July 29
 Period Ten: July 30 - August 08

NOTE: Heavy snowpack in some years can cause the breeding season to be delayed in the higher elevations of the western mountains. We allow the entire MAPS season to be shifted later by one or even two periods in these instances. If your station experienced a delay in breeding this year due to heavy snowpack, please indicate the number of periods you shifted this year (1 or 2): _____

Intended Period	Date (mm/dd)	Net number(s)	Open Time		Close Time		Net Hours	Period Net Hours	Note No.*
			(nearest 10 minute) hour	minute	(nearest 10 minute) hour	minute			
<i>e.g. 3</i>	<i>05/21</i>	<i>01-06,08-10</i>	<i>06</i>	<i>0 0</i>	<i>12</i>	<i>0 0</i>	<i>54.00</i>		
<	<	07	06	3 0	12	0 0	5.50	59.50	1
3	05/28	01-09	05	5 0	11	5 0	54.00		
<	<	10	06	2 0	11	5 0	4.13	58.13	1
4	06/05	01-09	05	5 0	07	5 0	18.00		2
<	<	10	05	5 0	07	5 0	1.50		2
4	06/07	01-09	07	5 0	11	5 0	36.00		2
<	<	10	07	5 0	11	5 0	3.00	58.50	2
5	06/14	01-09	05	4 0	11	4 0	54.00		
<	<	10	05	4 0	11	4 0	4.50	58.50	
6	06/24	01-09	05	5 0	07	3 0	15.00		3
<	<	10	05	5 0	07	3 0	1.25		3
<	<	01-09	08	5 0	12	2 0	31.50		3
<	<	10	08	5 0	12	2 0	2.63	50.38	3

* Please write note on reverse side of this page.

FIGURE 6. Completed MAPS Summary of Mist-Netting Effort (page 1).

Date: Record the month and day of the date of operation.

Net Numbers: Record the net designations of the nets operated (not the quantity of nets opened). A single day's effort should be recorded on multiple lines if nets of different sizes are used or if the nets are open for varying periods of time. For example, if all ten nets were opened at 0600 and nets 08 and 09 were closed at 1000 due to sun or wind while the remaining eight were closed as planned at 1200, then the effort should be recorded on at least two lines. See also the example for Intended Period 3 in Figure 6.

Open Time and Close Time: These times should be recorded in the same format as capture times. That is, using the 24-hour clock, record, to the nearest 10 minutes, the opening and closing times of the first net opened or closed. Always enter three digits. Note that the ultimate zero is preprinted on the form; e.g., 6:24 a.m. = 062(0), 1:48 p.m. = 135(0).

Net Hours: Record the net hours accumulated (to the nearest 0.01 net hour) for the nets recorded on each line.

Period Net Hours: Record the total effort for all days in an intended period on the last line for the intended period.

Note No.: Record a note (with a note number) on the reverse (page 2) side of the form indicating why nets were opened or closed at times that deviate from the standard protocol. Record the note numbers for these notes in the Note No. column on the form.

Total net hours for all MAPS periods combined: Carefully sum the Period Net Hours for all MAPS periods operated during the year and enter the sum in the appropriate box on the reverse side (page 2) of the form. Please use a calculator to sum these Period Net Hours and please double-check your sum. A comparison of this sum to the sum obtained from the computerized effort file (in both IBP's verification procedures and MAPSPROG) provides an important check that all effort data have been entered.

COLLECTION AND RECORDING OF BANDING DATA

All birds captured throughout the season, including recaptures, must be identified to species and must be aged and sexed if possible (use “unknown” if necessary). Age and sex birds by the extent of skull pneumaticization and/or other appropriate plumage, breeding, mensural, or molt characters (Bird Banding Offices 1991, Pyle 1997). Incorrectly-identified, -aged, and/or -sexed birds are detrimental to analyses. All birds not already banded and not excluded from the operator’s banding permit (except hummingbirds, which are not included in MAPS analyses because most banders don’t band them) must be banded with a numbered aluminum band issued by your country’s banding office.

We consider Pyle (1997) as the authority for in-hand age, sex, and difficult species determinations of North American passerines and near-passerines. The information in this book is now accepted by the banding offices as well. MAPS banders are expected to be using this book in the field, and the validity of your determinations will be checked using it as well. Please ensure that you understand the concepts presented in Pyle (1997) and apply them appropriately.

General procedures for recording banding data

Primary MAPS data: Primary MAPS data are the data upon which all analyses of productivity indices, survival-rate estimates, and population trends are based. Thus, it is crucial that complete primary MAPS data be taken on all birds captured, including recaptures. Primary MAPS data include the following data fields (see pages 34-53): capture code (e.g., newly banded, recaptured, band changed), band number, species (as given by the species alpha code), age, how aged (if age determined), sex, how sexed (if sex determined), status (as required on banding schedules submitted to the banding office), date, capture time, station, net number, disposition, and feather pull. It is important to note that the primary MAPS data fields are the only ones that may be subject to modification based on other information obtained during the capture or by comparisons with other capture records of the same band number. Date, capture time, and net number will allow us to screen out records that cannot be used for multi-year comparisons. Ageing and sexing criteria will allow us to screen out improperly-aged or -sexed birds and to evaluate the reliability of these criteria.

Supplemental data: MAPS operators are also asked to collect supplemental data on all birds captured, including recaptures: extent of skull pneumaticization, breeding condition (presence or absence of a cloacal protuberance or brood patch), extent of body and flight-feather molt, extent of primary-feather wear, extent of juvenal plumage, existence of molt limits and information on feather generation for selected feather tracts or groups of feather tracts, wing chord, body mass, and fat class. These data are used in verification programs to assure the accuracy of the species, age, and sex determinations. They can also provide invaluable information regarding spatial (geographic) and temporal variation in the timing and extent of breeding and molt and the physiological condition of the bird. Because supplemental data reflect information taken directly from the bird in the hand, supplemental data must never be modified and should mirror precisely what was recorded in the field.

Optional data: Additional data, such as exposed culmen and tail length, may also be taken but are not required, although they sometimes are useful in verifying the primary data.

Codes, scales, and forms: All data should be taken according to the standardized guidelines and utilizing the standardized codes described in these instructions and should be recorded on copies of the standardized 8 ½" by 14" MAPS banding-data sheets (Figs. 7 and 8) included in your spring MAPS package.

We realize that some contributors to the MAPS Program have long been recording many of these data according to slightly different codes and scales. The codes suggested in these guidelines are the result of thousands of hours of field work and subsequent analysis by researchers at the U.S.D.A. Forest Service, the U.S. Fish and Wildlife Service, the Point Reyes Bird Observatory, and The Institute for Bird Populations and are summarized in Ralph *et al.* 1993. In an effort to aid in the standardization of the capture and banding data now being collected in North America, we suggest that you adopt the scales and codes presented here. If you find it impossible to adopt these scales and codes, you must provide us with an explanation of how your codes correspond to MAPS codes so that they can be converted to MAPS codes. Note that codes other than MAPS codes are not accepted by the MAPS entry/verification program, MAPSPROG.

Please use the MAPS banding-data sheets for recording all MAPS banding data. We have examined well over 70 different banding-data sheets and have designed these sheets to increase the ease, logic, and accuracy of recording banding data in the field, as well as the efficiency and accuracy of entering those data into a computer for analysis and the production of banding schedules.

There are three types of MAPS banding-data sheets: the **MAPS Banding Sheet** for recording the use of new bands; the **MAPS Recaptures Sheet** for recording recaptures; and the **MAPS Unbanded Sheet** for recording birds that are captured but left unbanded.

Multiple-station locations: If more than one station is operated at a location, band strings are shared among stations, and banding is not conducted simultaneously at multiple stations, then the data from these stations should be combined on a single set of banding-data sheets to avoid gaps in the band sequences on the forms. If more than one set of banding-data sheets must be used, please use a different page-numbering sequence for each set (A1, A2,...; B1, B2...) so that each location/year/band-size/page combination is unique.

Non-MAPS data: No banding data from non-MAPS sites (e.g., nestlings, traps, feeder stations) or collected before or after the MAPS season (April 26-August 13, or through September 2 if effort for periods 9 and 10 is being made up) should be submitted to the MAPS Program. All non-MAPS data should be recorded on separate forms and, if possible, with separate band strings so as to avoid breaks in the band sequences on the MAPS Banding Sheets. However, occasionally, individual records that technically cannot be considered MAPS data are included on MAPS banding-data sheets. These records might include birds found dead on a trail or they might consist of a bird captured accidentally not in a MAPS net or at your MAPS station. These records must be identified as non-MAPS in order to avoid including them in constant-effort analyses. **Mark these records by recording "NM" in the NOTE NUMBER field.**

Page headings and other notations: Be sure to fill out the headings - **Location, Year, Band Size (for new bands), and Page #** - on each banding-data sheet. Use the four-character location code determined during station registration. Number the pages sequentially for each band size, starting with page 1 every year; in other words, there will be a page 1 for each band size used each year. This is very important, as it will allow us (and you) to see at a glance that all data are submitted. Please write “End of year” at the bottom of the last page of each band size each season.

New bands: To ensure that band numbers are recorded and computerized correctly and to facilitate band inventory and scheduling, it is of the utmost importance that original banding data for only a SINGLE STRING OF BANDS be included on any single MAPS Banding Sheet and that the bands be recorded (and, as much as possible, used) in sequence. Please write “End of string” below the last record for each band string.

Lost and destroyed bands: Lost and destroyed bands should be recorded in sequence on the MAPS Banding Sheets. Record only code, band number, species name as “Band Lost” or “Band Destroyed,” date, and station.

Recaptures: Every capture of a banded bird is a “recapture”. Recaptures thus include returns (first captures in the current year of birds banded previously in the same place on the same permit), repeats (subsequent captures, even on the same day, of birds banded or recaptured in the same place earlier in the current year), and recoveries (first captures of birds banded in a different place or on a different permit). Birds banded outside of MAPS operation and recaptured during MAPS operation are considered recaptures. Previously-banded birds that escape or are inadvertently released before the band number is read should also be recorded as recaptures. Complete data should be taken for all recaptures and should be recorded only on MAPS Recaptures Sheets. It is crucial that new and recapture banding data NOT be entered on the same sheets. Do NOT separate recaptures by band size.

Changed bands: If a band is replaced, record the capture on both the MAPS Banding Sheet (new band) and MAPS Recaptures Sheet (recapture record). Record the old band number on the Recapture Sheet, with the new number as a note on the back. Record the new band number on the Banding Sheet, with the old number as a note on the back. The old band should be sent to the banding office with the schedule on which the new band is reported. Both records should be given capture code “C.” NEVER re-use a band you have taken off a bird; it makes tracking individuals exceedingly difficult and, because the structural integrity of the band is compromised, increases the risk of injury to the bird. Importantly, a changed band should be counted only as a single recapture on the Summary of Mist-netting Results (see below), because it involves only one bird.

Added bands: Occasionally, birds wind up with a band on each leg. Usually, this is the result of a bander not realizing that the bird is a recapture and applying a band to the other leg. This can be avoided by ensuring that all banders at your location are banding on the same leg. If both bands are readable and neither is endangering the bird’s welfare, it is best, because of the risk of injury to the bird, not to attempt to remove one of the bands. If the bird was captured with two bands, enter a record for each band, both with code “A” (for “Added Band”), on the Recapture Sheet. If you have applied the second band, record it (again as

code “A”) on the Banding Sheet, with the original band number in a note, and record the original band on the Recapture Sheet (also with code “A”) with the added band number in a note (analogous to changing a band, except that no band was removed). As with changed bands, added bands should be counted only as single recaptures on the Summary of Mist-netting Results (see below).

Unbanded birds: As much information as possible (including all primary MAPS data) must be recorded on the MAPS Unbanded Sheets for all birds that are captured but not banded (escapes, releases, and mortalities) regardless of the size of band they would have received had they been banded. Data on these birds is essential for calculating capture rates, and mortalities can be used in productivity analyses. A bird is considered an “escape” if it was touched prior to escape; a bird that bounces out of or escapes from a net before it is touched should not be recorded. “Releases” might include species that a bander is not authorized to band (gallinaceous species or hummingbirds) and birds for which the recommended band size is unavailable. See Table 2 for species alpha codes for gallinaceous birds.

Mortalities: Even if all reasonable precautions are taken, mortalities do occur occasionally in the course of mist netting. If a bird dies before it is banded, it should be recorded on the MAPS Unbanded Sheet. If a bird dies just after it is banded, remove and destroy the band. Record the bird on the Unbanded Sheet and the band on the Banding Sheet as destroyed (code “D”). In either case, the bird should receive “000” in the “STATUS” field and a “D” or “P” in the “DISP” field for “death due to cause other than predation” or “predator-caused mortality,” respectively. If the mortality is a recapture, remove and destroy the band (unless it is a recovery, in which case you should send the band number to the banding office on form 3-1807, submit the information electronically at <http://www.reportband.gov>, or call the toll free band reporting number, 1-800-327-BAND). As before, enter “000” in the STATUS field and “D” or “P” in the DISP field.

Banding-data fields

The front of the banding-data sheet is broken into 35 fields each containing one or more columns. Each of these fields is described separately below. Please write out completely the first record on each sheet each day. After that, use a “greater than” (>) or “less than” (<) in the BANDER’S INITIALS, SPECIES NAME, STATUS, DATE, CAPTURE TIME, and STATION fields if the entry is repeated (on the same day only) on the next line; do not use ditto marks or vertical lines that can be mistaken for ‘1’s and do not use these symbols in any other fields. If data for a given field are not collected, leave the field blank; do not use zeroes, nines, hyphens, slashes, or any other symbols to designate data not taken.

Please record all data taken, even if the values are “0,” and don’t make assumptions. For example, if you have what you believe is a female with a brood patch, please verify that there is no cloacal protuberance. Once you have done so, enter “0” in the CP field; if you leave it blank, we cannot assume that you checked to make sure there wasn’t a CP. Furthermore, there is a much greater likelihood of data being entered in the wrong fields when the adjacent fields are left blank.

BANDER'S INITIALS -- Place the initials of the bander or person taking the data in this field. Write the initials and full names of all the banders on the page in the spaces provided at the bottom of the form.

CODE -- Capture Code. Use the codes shown at the top of the banding-data sheet. Use "N" for all newly-banded birds; "L" for lost bands; "D" for destroyed bands; "U" for unbanded birds; "C" for changed bands (refer to the section on changed bands [above] for instructions on code- "C" captures); "A" for added bands (refer to the section on added bands [above]); and "R" for all other recaptures, regardless of whether they are repeats, returns, or recoveries. Please note that the only capture codes acceptable on a given sheet are those presented at the top of the sheet (e.g., "N" does not appear on the Recapture Sheet). The code for unbanded birds, "U," is already filled in on the Unbanded Sheet for these birds.

BAND NUMBER -- For new, lost, and destroyed bands, enter the complete band number for the first band on the first line of each page. Do not use a hyphen to separate the prefix from the rest of the band number. Please double-check to be sure that this first band number is completely correct. Thereafter, for all other band numbers on the page, enter only the last three digits right-justified. For all recaptures, however, be sure to enter the full band number each time. Furthermore, please double-check the band numbers on all recaptured birds before releasing them. Incorrect band numbers on recaptures are the most serious errors of all because correct band numbers on recaptured birds are the basis for all mark-recapture analyses. We strongly recommend the use of some form of optical magnification, preferably a magnification visor, to read the band numbers of recaptured birds and to examine skull pneumaticization of all birds. The best one we have found is the OptiVISOR, an optical glass binocular magnifier that fits over your head, tilts up when not in use, and leaves both hands free to band and examine the bird. We recommend the DA-5 model (2.5 power at a focal length of 8"; price about \$29) coupled with a 2.5 power OptiLoupe attachment (price about \$5) that can be swung down in front of one of the eyepieces. It is distributed by lapidary and jewelers'-supply houses. Call the manufacturer, Donegan Optical, Lenexa, Kansas, (913) 492-2500, for a distributor near you.

It is extremely important that **all band numbers be nine characters long**. Three-digit prefixes must be recorded prefaced with a "0" (e.g., 972 becomes 0972). Two-digit prefixes must be recorded prefaced and followed by '0's (e.g., 81 becomes 0810). For unbanded birds, leave BAND NUMBER blank.

SPECIES NAME -- Enter at least an abbreviation of the species name (e.g., "Bl-cap Chick" for Black-capped Chickadee). This abbreviation will not be entered in the MAPS database but will serve as a check against the error-prone SPECIES ALPHA CODE (below), such as Barn Swallow ("BARS") and Bank Swallow ("BANS"), both of which are often written incorrectly as "BASW". Write "Band Lost" or "Band Destroyed" in this space where appropriate.

SPECIES ALPHA CODE -- Enter the four-letter code for the species (e.g., "BCCH" for Black-capped Chickadee) from *Four-letter and six-letter alpha codes for birds recorded from the American Ornithologists' Union check-list area* (Pyle and DeSante 2003). This list (further updated in Pyle and DeSante [2005, 2006]) can be downloaded from The Institute for

Bird Populations' website at <http://www.birdpop.org/AlphaCodes.htm>. Very few discrepancies that are likely to be encountered by banders exist between this list and the current BBL codes; the most notable is the use of "TUTI" by Pyle and DeSante (2003) instead of "ETTI" by the BBL for Tufted Titmouse (formerly Eastern Tufted Titmouse). All discrepancies are listed in Appendix 1 of Pyle and DeSante (2003, 2005, 2006). In the very few cases where the species codes differ, and until the BBL is able to update their codes, MAPSPROG will convert the alpha codes provided by Pyle and DeSante (2003, 2005, 2006) to current BBL codes when producing the export file for Band Manager. Species codes for gallinaceous birds are given in Table 2; these species do not fall under the jurisdiction of the federal banding offices, which consequently do not provide alpha codes for them.

Table 2. Species alpha codes for gallinaceous birds.

<u>Species</u>	<u>Alpha codes</u>	<u>Species</u>	<u>Alpha Codes</u>
Plain Chachalaca	PLCH	Dusky Grouse	DUGR
Chukar	CHUK	Sooty Grouse	SOGR
Himalayan Snowcock	HISN	Sharp-tailed Grouse	STGR
Gray Partridge	GRAP	Greater Prairie-Chicken	GRPC
Ring-necked Pheasant	RNEP	Lesser Prairie-Chicken	LEPC
Common Peafowl	CPEA	Wild Turkey	WITU
Ruffed Grouse	RUGR	Mountain Quail	MOUQ
Greater Sage-Grouse	GRSG	Scaled Quail	SCQU
Gunnison Sage-Grouse	GUSG	California Quail	CAQU
Spruce Grouse	SPGR	Gambel's Quail	GAQU
Willow Ptarmigan	WIPT	Northern Bobwhite	NOBO
Rock Ptarmigan	ROPT	Montezuma Quail	MONQ
White-tailed Ptarmigan	WTPT		

Occasionally, notes associated with a record indicate that the species determination for a recapture or an unbanded bird was uncertain. **Mark these records by recording "QS" in the NOTE NUMBER field.**

AGE -- Enter a single-digit numeric code for the age class of the bird, as shown at the top of the banding-data sheets. Alternate, single-character, alpha codes for each age class also are presented below. We strongly recommend using the numeric codes, however, because of the difficulty we have experienced in distinguishing between a printed 'H' and a printed 'A', which together comprise the vast majority of the age classes. These codes are:

- 4 - Local (L): A young bird incapable of sustained flight. (These birds always should be banded, processed, and released near the capture net as quickly as possible.)
- 2 - Hatching Year (H): A bird capable of sustained flight and known to have hatched during the calendar year in which it is captured.

NOTE NO.	NOTE
1	<i>band changed, original band number = 122045678</i>
2	<i>molt limit within lesser and med covs</i>
3	<i>aged by adult plumage; escaped before fully processed</i>
4	<i>Unable to fly on release but couldn't recapture</i>
5	<i>couldn't see molt limit betw/ tert's and middle ss (but Pyle says can be hard to see)</i>
6	<i>pox on legs: pp 1-2 growing; swab vial # 000013107</i>
7	<i>male seen near net during extraction. Rects looked ~truncate but pp covs looked ~tapered - unsure of SY/ASY, aged AHY; swab vial # 000013062</i>
8	<i>molting pp 3-4. unreplaced outer pp covs & rect's truncate; swab vial # 000010679</i>
9	<i>gr covs w/ 3 feather gens - 3 alternate coverts; rect's with limited yellow (like Fig. 263 B); swab vial # 000013104</i>
10	<i>molting pp 2-3, ss 8-9, & pp covs; L & R r 1, unsure of brood patch 5</i>
11	<i>preformative nearly complete; head & upper breast feathers black w/ yellow edging; swab vial # 000016111</i>

Figure 8: Completed MAPS banding sheet (back). These notes refer to captures in figure 7.

- 1 - After Hatching Year (A): A bird known to have hatched before the calendar year in which it is captured; year of hatching otherwise unknown.
- 5 - Second Year (S): A bird known to have hatched in the calendar year preceding the year in which it is captured (known to be in its second calendar year of life).
- 6 - After Second Year (O): A bird known to have hatched earlier than the calendar year preceding the year in which it is captured (known to be at least in its third calendar year); year of hatching otherwise unknown.
- 7 - Third Year (T): A bird known to have hatched two calendar years prior to the year in which it is captured (known to be in its third calendar year).
- 8 - After Third Year (Z): A bird known to have hatched more than two calendar years prior to the year in which it is captured (known to be at least in its fourth calendar year); year of hatching otherwise unknown.
- 0 - Indeterminable (U): Age unknown because age indeterminable; i.e., age determination attempted but not possible with confidence.
- 9 - Not attempted (X): Age unknown because age determination not attempted.

Please attempt (without relying on previous capture data) to age adult birds as second year (SY) or after second year (ASY). It should be possible to reach this level of precision with at least some individuals of roughly 95% of North American passerine and near-passerine species. In addition, many near-passerines (including woodpeckers) and a few passerines may be aged to third year (TY) and after third year (ATY). Our ability to index juvenile survival rates and estimate recruitment rates of young and immigration rates of adults hinges on your ability to discriminate between SY and ASY age classes. Since the presence of juvenal or first-alternate feathers indicates SY, whereas the lack of such feathers often is not definitive, it is likely that more SYs than ASYs will be identified. The proportion of birds assigned to each age class generally should reflect the proportion suggested in the species' bar graph in Pyle (1997).

HOW AGED -- The how-aged codes indicate the criteria that you used to determine the age of the bird. Use only the appropriate code(s) shown at the top of the banding-data sheets. Use two codes if possible and enter them from left to right in order of importance for your age determination. If you use only one code, enter it left-justified. You must record at least one criterion unless the age is unknown (i.e., unless AGE = 0 or 9). The how-aged codes are as follows:

- S - Skull: The degree of skull pneumaticization.
- C - Cloacal Protuberance: The presence of a cloacal protuberance on adults.
- B - Brood Patch: The presence of a brood patch on adults.
- J - Juvenal Plumage: The presence of juvenal body plumage on juveniles.
- L - Molt Limit: The presence of two generations of feathers **within** a feather tract (e.g., within the greater coverts) **or between** two adjacent feather tracts (e.g., between the primary coverts and greater coverts). If the Molt Limit code is used, at least one of the first seven MOLT LIMITS & PLUMAGE fields (see below) must be filled in.
- P - Plumage: The appearance, if reliable for ageing, of plumages other than juvenal body plumage. Feather color, shape, quality, and wear are plumage characteristics; measurements are not. Contrasts in color, shape, quality, or wear between two

generations of feathers or groups of feathers should generally be treated as a molt limit characteristic (L), not a plumage characteristic (P). If the Plumage code is used, at least one of the first seven MOLT LIMITS & PLUMAGE fields (see below) must be filled in.

- M - Molt: The presence and characteristics, if reliable, of active molt, indicated by pinfeathers and/or missing flight feathers in a symmetric pattern.
- F - Feather Wear: The degree, if reliable, of flight-feather wear.
- I - Mouth/Bill: The external and/or internal appearance, if reliable, of the bill or the presence of a fleshy gape on very young birds.
- E - Eye color: The color of the iris, if reliable. This does not include the eye ring.
- O - Other: Any criterion not listed above (e.g., date, orbital apterium, talon-flange serration, tail fork, etc.). If you use this code, you must explain how the bird was aged in a note on the back of the sheet.

Note that W (Wing Length) and T (Tail Length) are not valid how-aged codes. If tail length (or tail fork) are used to age Barn Swallows or Great-tailed Grackles use "O" and provide a note to that effect.

Please do not age recaptures based on previous captures. Each capture should be treated in the field as if it were a new bird in order to avoid perpetuating previous errors and to enable us to see what is possible at that time of year.

Please remember that you must record at least one ageing criterion unless the age is unknown (indeterminable or unattempted). In many cases, especially with adults, more than one criterion is available; RECORD TWO! Try to look at and indicate features such as plumage, eye color, and bill/mouth that are not recorded elsewhere on the form. Don't forget that CPs and BPs can be used for ageing adults, since HY birds don't get them. Please study the sample banding sheet (Fig. 7) to better understand how this field should be used.

Please remember also that **you must record data in at least one of the first seven MOLT LIMITS & PLUMAGE fields whenever "L" or "P" is used as a how-aged code.** You also must record data in at least one of the MOLT LIMITS & PLUMAGE fields whenever you age an adult bird more specifically than AHY (i.e., SY, ASY, TY, or ATY). Remember, however, that when you age an adult bird as SY by Molt Limit, you must also indicate, with an additional how-aged code, what you used to determine that it was **not** a HY bird (e.g., skull, cloacal protuberance, brood patch, plumage, molt, feather wear, mouth/bill, eye color, or other). This additional how-aged code should generally be recorded as the left-justified one.

SEX -- Enter "M" for male, "F" for female, "U" for indeterminable (sex unknown because sex indeterminable, i.e., sex determination attempted but not possible with certainty), or "X" for not attempted (sex unknown because sex determination not attempted). If you must use numeric codes (we strongly recommend against them), use "4" for male, "5" for female, "0" for indeterminable, and "9" for not attempted.

HOW SEXED -- Use the codes below as in HOW AGED above. As with age, do not sex recaptures in the field based on previous captures. Note that S (skull), L (molt limit), M (molt), and F (feather wear) are not valid how-sexed codes.

- C - Cloacal Protuberance: The presence of a cloacal protuberance, if reliable, on adult males.
- B - Brood Patch: The presence or degree of a brood patch, if reliable, on adult females.
- J - Juvenal Plumage: The appearance of juvenal body plumage, if reliable, on juveniles.
- P - Plumage: The appearance, if reliable, of all plumages other than juvenal plumage. Does not include measurements.
- I - Mouth/Bill: The appearance, if reliable, of the bill.
- E - Eye Color: The color, if reliable, of the iris.
- W - Wing Length: The wing chord, if reliable.
- T - Tail Length: The length, if reliable, of the tail.
- O - Other: Any criterion not listed above (e.g., singing, tail fork, etc.). Use of this code requires an explanatory note.

We commonly see data for species that cannot be sexed by plumage with “CP” or “BP” in the HOW SEXED field. This invariably is the result of a bander instructing a recorder to enter “male by CP” or “female by BP” and the recorder not realizing that “P” in this case stands for plumage. It’s much safer (and faster) to say the codes (e.g., “M by C”) rather than the words.

SKULL -- Skull Pneumaticization. In order to determine the degree of skull pneumaticization, it is necessary to part the feathers of the head to get them out of the way (wetting them slightly may help), then gently rock the skin back and forth over the skull while looking through the skin to the skull. The best procedure is to start at the back of the skull and proceed toward the front looking for the pattern of the line that separates the pneumaticized area from the area that is not pneumaticized. A pneumaticized skull consists of two layers of bone connected by tiny “struts” and filled with air, much like the wing of a plane. A pneumaticized skull appears opaque and grayish with tiny whitish dots. In contrast, an un-pneumaticized skull, consisting of a single, thin layer of bone, appears pinkish and somewhat translucent and never shows the minute dots characteristic of a pneumaticized skull. We very strongly recommend the use of a binocular magnifier such as the OptiVISOR for determining the degree of skull pneumaticization (see above under BAND NUMBER). See Yunick 1979, Ralph *et al.* 1993, and Pyle 1997 for more complete information (including diagrams) on the determination of age by skull pneumaticization.

Skull pneumaticization should be recorded by means of the scale shown below. We strongly recommend using the numeric codes, although corresponding alpha codes that were developed by Ralph *et al.* (1993) also are shown below; these alpha codes may be used in the field if necessary, but we request that they be converted to numeric codes prior to submission.

- 0 - (N = none): Skull not pneumaticized; that is, only a single thin layer of bone covers the entire brain, which shows through the thin covering of bone and appears as an unmarked, pinkish color. Beware of thick-skinned species such as corvids and parids, whose skull can be very difficult to see because the skin itself tends to be rather opaque; and heavily-muscled species such as grosbeaks and cardinals, whose jaw muscles can obscure the rear of the skull.
- 1 - (T = trace): A trace of skull pneumaticization can be seen at the very back of the skull, usually appearing as an opaque, grayish crescent or a very-small, triangular

- area. Somewhere from 1 to 5% of the skull is pneumaticized.
- 2 - (L = less than 1/3): Skull less than 1/3 pneumaticized but some pneumaticization is obvious. Thus, somewhere from 6 to 33% of the skull is pneumaticized. Generally, the posterior part of the cranium has an inverted 'u'- or 'v'-shaped area of pneumaticization that is usually distinctly grayish and contrasts with the unpneumaticized area. The grayish area typically shows the characteristic, small, whitish dots of a pneumaticized skull.
 - 3 - (H = half): Skull greater than 1/3 but less than 2/3 pneumaticized. In typical birds, most of the rear half of the skull is pneumaticized, as is a small portion of the front part extending back around the eyes. This front part of the skull is usually very difficult to see because the feathers of the forehead are dense and short and difficult to move out of the way. In most cases, a bird given a "3" skull will show a pneumaticized area extending up the midline or sides of the skull.
 - 4 - (G = greater than 2/3): Skull at least 2/3 pneumaticized but at least small areas of skull not pneumaticized. Thus, somewhere from 67 to 94% of the skull is pneumaticized. The un-pneumaticized areas generally show either as two oval, pinkish spots on either side of the cranium or (rarely) as a single spot in the center of the skull.
 - 5 - (A = almost complete): Somewhere from 95 to 99% of the skull is pneumaticized. These birds have virtually a fully-pneumaticized skull that shows one or two tiny, dull-pinkish areas where the pneumaticization is incomplete. It should be noted that some birds, including many flycatchers, thrushes, and vireos, never develop a fully pneumaticized skull, even when adult, but retain a "5" skull throughout life. Thus, a "5"-skull bird cannot necessarily be called a HY/SY bird because it could be an AHY/ASY bird whose skull never completely pneumaticized.
 - 6 - (F = fully complete): Skull fully pneumaticized.
 - 8 - (I = invisible): Skull examined but extent of pneumaticization not visible. Do not use this code if you have determined that pneumaticization is incomplete but are unsure of the appropriate score; in this case, make your best guess!

CL. PROT. -- Cloacal Protuberance. As the breeding season approaches, the cloaca of most male birds (and female Wrentits) begins to enlarge and forms an obvious protuberance which serves a role in sperm storage. The development of the cloacal protuberance is recorded according to the system shown below. Again, we strongly recommend using the numeric codes, although corresponding alpha codes are also given.

- 0 - (N= none): Cloaca not enlarged.
- 1 - (S= small): Cloaca somewhat enlarged and noticeably swollen. The shape of the protuberance is generally such that it is widest at the base and narrowest near the tip (conical). Since small cloacal protuberances (CPs) can be hard to discern, caution should be used in ageing or sexing birds on the basis of a CP of 1 alone. A CP of 1 can **not** be used to age or sex the thrushes of the genera *Catharus*, *Hylocichla*, *Turdus*, or *Ixoreus*. We have found that unenlarged cloacas in these species have often been designated CP = 1, which regularly has led to incorrect age or sex determinations.

- 2 - (M = medium): Cloacal protuberance large, with a diameter fully as large near the tip as at the base (cylindrical).
- 3 - (L = large): Cloacal protuberance very large and with a diameter considerably larger in the middle than at the base (bulbous).

Unlike a brood patch (see below), a regressing CP simply goes back down the scale: 3-2-1-0. CPs vary greatly in size and shape among species, being largest and most prominent in sparrows and thrushes and much less prominent in jays and Wrentits. It may be possible to sex species that rarely show prominent CPs by examining the angle of the CP with respect to the body axis. In males, the CP seems to point straight out, more or less perpendicular to the body axis. In females, the cloaca seems to point toward the rear of the bird, somewhat more parallel to the axis of the body. This same tendency can be used with caution to distinguish the occasionally slightly enlarged cloacal region of a female from a true class- 1 CP of a male. Class- 2 and - 3 CPs of males, of course, cannot be confused with those of females in any species except, possibly, in Wrentits.

Please note that all cloacas, whether enlarged or not, stick out. A true CP is characterized by firmness and lateral swelling. Note also that immature birds DO NOT get CPs.

BR. PATCH -- Brood Patch. Just prior to and during the time that the female (and in some species, the male as well) is incubating eggs in a nest, the feathers of the lower breast and abdomen are lost, vascularization increases just below the skin, and considerable fluid collects below the skin. The purpose of these changes is, of course, to facilitate the transfer of heat from the incubating bird's body to the eggs. The scale shown below should be used to record the sequence of events in the development and regression of a brood patch. Again, we strongly recommend using the numeric codes, although corresponding alpha codes are also given.

NOTE: In hummingbirds and in juveniles of most species, the lower breast and abdomen are normally unfeathered. This can cause it to look like a brood patch of 1 or 4, but the area is darker red and unwrinkled and usually has a less distinct margin.

- 0 - (N = none): No brood patch is present. The lower breast and abdomen are more-or-less feathered. Unfeathered areas of the breast and abdomen are smooth, without evident vascularization.
- 1 - (S = smooth): The lower breast and abdomen feathers are dropped and some vascularization can be seen, but most of the area is still rather smooth and dark red.
- 2 - (V= vascularized): Vascularization is evident, some wrinkles are present, and some fluid is present under the skin, giving the area a pale, opaque, pinkish color as opposed to the normal, dark-red muscle color.
- 3 - (H = heavy): The vascularization is extreme, the brood patch becomes thickly wrinkled, and much fluid is present under the skin. This is the maximum extent of the brood patch and corresponds closely to the time during which the bird is incubating eggs.
- 4 - (W = wrinkled): The vascularization mostly has disappeared and the fluid under the skin is mostly gone. The skin, however, retains many thin, dry-looking, contracted wrinkles.

- 5 - (M = molting): The vascularization and fluid and most of the wrinkles are gone. New pinfeathers are present as the area begins to become re-feathered. Most birds do not reach class 5 BPs until the nesting season is over and the prebasic molt has begun.

The sequence of 0 to 5 is rather symmetric. Classes 1 and 5 resemble each other, class 5 being distinguished most easily by the growth of new feathers. Similarly, classes 2 and 4 resemble each other but class 4 can be distinguished by its dry, thin wrinkles, as opposed to the thick, fluid-filled wrinkles of class 2.

FAT -- Fat Content. Subcutaneous fat is a yellow or orange substance that is stored just under the skin and is used as fuel for migratory flights and for maintenance during the colder winter months. Fat generally is stored in three discrete areas that usually begin filling in the following order: (1) the hollow in the furculum (wishbone) just below the throat at the top of the breast muscles; (2) the hollow directly under the wing, essentially in the "wingpit"; and (3) the lower abdomen just anterior to the vent area. The stored fat can be seen clearly through the nearly-transparent skin and contrasts with the dull, dark-reddish color of the breast muscles. It is seen most easily by holding the bird on its back while placing the index and middle fingers on the front and back of the bird's neck, stretching the head slightly forward along a line parallel to the body, and gently blowing the feathers away from the upper breast to expose the furculum. Then check under the wing and on the abdomen, again by blowing the feathers gently out of the way. Fat content generally can be assessed quite easily while checking for breeding condition and body molt. The placement of the field on the banding-data sheets reflects this fact. The codes shown below should be used to record fat content. Again, the use of the numeric codes is strongly recommended.

- 0 - (N = none): No fat in the furculum or anywhere on the body.
- 1 - (T = trace): A very small amount of fat in the furcular hollow (< 5% filled) but not enough to cover the bottom of the furculum, and no fat or just a trace of fat is present under the wing, on the abdomen, or anywhere else on the body; **or**, if there is no fat in the furcular hollow, at least a trace of fat is present under the wing, on the abdomen, or both.
- 2 - (L = light): The bottom of the furculum is completely covered but the furcular hollow is less than $\frac{1}{3}$ filled, and a small amount of fat may be present under the wing, on the abdomen, or both; **or**, if there is no fat in the furcular hollow, a covering pad of fat is definitely present under the wingpit and, usually, on the abdomen.
- 3 - (H = half): The furcular hollow is about half full (actually anywhere from $\frac{1}{3}$ to $\frac{2}{3}$ filled), and a covering pad of fat is definitely present under the wingpit and, usually, on the abdomen; **or**, if there is no fat in the furcular hollow, a thick layer of fat occurs under the wing and on the abdomen.
- 4 - (F = filled): The furcular hollow is full (actually anywhere from $\frac{2}{3}$ full to level with the clavicles) and a thick layer of fat also occurs under the wing and on the abdomen; **or**, if the fat in the furcular hollow is not full, the fat under the wing as well as on the abdomen is well mounded.

- 5 - (B = bulging): The furcular hollow is more than full; that is, the fat is bulging slightly above the furculum. The fat under the wing as well as that on the abdomen is also well mounded.
- 6 - (G = greatly bulging): Fat is bulging greatly above the furculum. Large mounds of fat occur under the wings and on the abdomen.
- 7 - (V = very excessive): The fat pads of the furculum, "wingpit," and abdomen are bulging to such an extent that they join. Nearly the entire ventral surface of the body is thus covered with fat, and fat even extends onto the neck and head. Such birds are nicknamed "butterballs."

NOTE: The upper fat classes (5-7) are seen most often just prior to and during migration.

BODY MLT -- Body Molt. Body molt should be determined by examining the bases of all the contour feathers on the bird's body, including all the body feathers as well as the upper- and underwing coverts (both secondary coverts and primary coverts) and the upper- and undertail coverts. The bases of the feathers can be exposed by blowing lightly but continuously over the body. The presence of pinfeathers is a sure sign of the early stages of molt. Later stages can be recognized by a remnant, scaly sheath at the base of each growing feather. These sheaths persist until the feathers are fully grown. You should integrate several factors in making your rating, including the number of feather tracts in molt and the proportion of feathers in molt in each feather tract. Body molt should be rated according to the scale shown below. Again, numeric codes are preferred.

- 0 - (N = none): No body molt. No feathers in sheath or growing.
- 1 - (T = trace): Only a very few feathers molting anywhere on the bird's body, usually in no discernible pattern.
- 2 - (L = light): A few feathers are molting from a few feather tracts, or some feathers (fewer than $\frac{1}{2}$) are molting from only one tract. In general, fewer than $\frac{1}{3}$ of the contour feathers on the bird are molting.
- 3 - (M = medium): Some feathers (generally fewer than $\frac{1}{2}$) are molting from most tracts, or many feathers (generally more than $\frac{1}{2}$) are molting from one tract or a few tracts. In general, from $\frac{1}{3}$ to $\frac{2}{3}$ of a bird's contour feathers are in molt. This class also should be used for a bird in spring whose pre-alternate molt normally includes only the head but that has nearly all head feathers in molt. Such a bird would be given a class "3" even though fewer than $\frac{1}{3}$ of all its contour feathers are molting.
- 4 - (H = heavy): Many feathers (generally more than $\frac{1}{2}$) are molting from many or most tracts. In general, more than $\frac{2}{3}$ of the contour feathers on the bird are in molt.

FF MOLT -- Flight-feather Molt. Flight feathers are collective for primaries, secondaries, and Rectrices.

Most adult passerines in North America undergo a complete molt following the breeding season. This molt usually occurs from July to September and most often occurs on the breeding grounds, although there are some notable exceptions (see Pyle 1997). We refer to this complete molt in adults as the "**prebasic molt**" (= "adult prebasic molt" in Pyle 1997). At the same time of year (July to September), juvenile birds also undergo a molt which,

following the new terminology of Howell *et al.* (2003), we refer to as the “**preformative molt**” (= “first prebasic molt” in Pyle 1997). In contrast to the complete prebasic molt of adults, the preformative molt in juveniles of most passerine species is “partial”; that is, it includes the body feathers but not the flight feathers, except sometimes the innermost rectrices (the “decks”) and the innermost secondaries (the “tertials”). Thus, the presence or absence of symmetric flight-feather replacement in a bird undergoing molt in the late summer and early fall often provides another good indicator of the age of the bird. First, be sure to check Pyle (1997) to make sure that the species does not replace flight-feathers during the preformative molt (termed “first prebasic molt” in Pyle). Then, examine all the primaries, secondaries, and rectrices for the presence or absence of flight-feather molt; and examine both the left and right sides to be sure that the replacement is symmetric and not adventitious (the accidental, generally asymmetric, loss of flight feathers or body feathers anywhere on a bird). Record flight-feather molt with the codes shown below. In this case, we recommend using alpha codes since the codes are categorical and do not represent a sequence that can be expressed numerically.

- N - (0 = none): No flight-feather molt.
- A - (1 = adventitious): Accidental, adventitious, usually asymmetric flight-feather molt.
- S - (2 = symmetric): Normal, essentially symmetric flight-feather molt, indicative of prebasic molt in adult birds and preformative molt in some young birds. A few species also exhibit prealternate flight-feather molt (see Pyle 1997).
- J - (3 = juvenal growth): Growth of juvenal flight feathers in fledgling birds (only to be used for very young birds, just out of the nest, growing their first flight feathers).

IMPORTANT NOTE: If a bird is exhibiting flight-feather molt, record, as a note, the particular group(s) of feathers (primaries, secondaries, and/or rectrices) in which molt is occurring. If possible, record the highest-numbered growing feather in each molting group. This information will aid greatly in the verification of age data.

FF WEAR -- Flight-feather Wear. The juvenal generation of flight feathers (primaries, secondaries, and rectrices) is structurally weaker than later (adult) generations of feathers and thus may wear and fade at a faster rate. Furthermore, because young birds grow their juvenal flight feathers considerably before adults molt their flight feathers, at any given time during the following 12 months juvenal flight feathers are older than the new generation of adult flight feathers. The result is that juvenal feathers in the following spring are likely to show greater degrees of feather wear than do adult feathers at that time. If so, these data may help to determine the age of birds first captured in the spring. In addition, hatching year birds in the summer have very fresh, new flight feathers, while adult flight feathers, before they are molted, are very old and worn. This also helps facilitate the determination of age in mid-summer birds. Examine only the outer 4-5 primaries to determine wear. Flight-feather wear should be classified according to the scale shown below. Again, numeric codes are preferred.

- 0 - (N = none): No wear at all. The feather edges are perfect. A light-colored edge exists all the way around the feathers, including the tips.

- 1 - (S = slight): Very little wear. Feather edges are only slightly worn and no actual fraying or nicks have occurred. Often, a light-colored edge exists around the sides of the feathers but not at the tips.
- 2 - (L = light): Relatively light wear. The feathers are definitely worn but with very little fraying and very few actual nicks.
- 3 - (M = moderate): The feathers show considerable wear and some very definite fraying. Nicks and chips are obvious along the vanes.
- 4 - (H = heavy): The feathers are very heavily worn and frayed. The tips are often worn completely off.
- 5 - (X = excessive): The feathers are extremely ragged and torn up, and the shafts are usually exposed well beyond the vanes. All the tips are usually completely worn or broken off.

JUV. PL. -- Extent of Juvenal Body Plumage. Most fledgling birds wear a juvenal plumage that is distinct, at least in texture, from any other plumage of the species. Juvenal plumage is generally distinguished from adult plumages by loosely-textured (“fluffy”) contour feathers, often with streaks or spots not found on corresponding adult feathers. It is important to examine individual feathers in assessing the extent of juvenal plumage. This plumage may be worn from only a few days to several months, depending on species and fledging date, until the **preformative molt**, at which time it is molted into “**formative plumage**” (= “first prebasic plumage” in Pyle 1997, which see for descriptions and timing of juvenal plumage and an extensive discussion of molt). The extent of juvenal body plumage on a young bird, therefore, is often a good indicator of how long the individual has been out of its nest. Note that flight feathers (primaries, secondaries, and rectrices) are generally not replaced during the preformative molt and should not be considered when assessing the extent of juvenal plumage. The extent of juvenal body plumage should be recorded according to the scale shown below. Again, we recommend using the numeric codes rather than the alpha codes. For the purpose of this field, only juvenile birds have juvenal body plumage! Most birds do retain some juvenal wing coverts through the first breeding season, but these second-year birds are considered to have no juvenal body plumage because they have completed the preformative (and in some cases prealternate) body molt.

- 3 - (F = full): Full juvenal body plumage. The bird has not yet begun its preformative (= “first prebasic”) molt.
- 2 - (G = greater): More than half of the juvenal body plumage remains, although the bird already has begun its preformative molt. The individual looks mostly like a juvenile, but some formative (= “first basic”) body plumage is evident.
- 1 - (L = less): Less than half of the juvenal body plumage remains. The bird has molted primarily into formative body plumage, but some juvenal body plumage remains.
- 0 - (N = none): No juvenal body plumage. The individual has molted already into full formative body plumage. All adult birds, including SYs, therefore, have “0” juvenal plumage, even if they have some retained juvenal coverts or flight feathers.

In summary, a bird is in full (3) juvenal plumage from fledging until the onset of the preformative (= “first basic” in Pyle 1977) molt. During this molt, juvenal plumage is replaced by formative (= “first basic” in Pyle 1977) body plumage. Thus, birds in partial (2 or 1)

juvenal plumage must be in molt. Recently-fledged birds still may be growing their juvenal feathers but should be classed as “3” juvenal plumage. Similarly, birds in the final stages of the preformative molt may have shed all of their juvenal body feathers but still be growing their formative feathers; such birds have “0” juvenal plumage.

MOLT LIMITS & PLUMAGE – These fields are to be used for adult birds aged more specifically than AHY (i.e., SY, ASY, TY, or ATY), as well as for any birds (including those aged HY or AHY) aged by molt limit or plumage (i.e., any time “L” or “P” is used as a how-aged code). Up to eight fields, which describe individual (or multiple) feather tracts or non-feathered body parts, may be considered for any individual bird. At least one of the first seven fields must be filled in if the bird is aged by molt limit or plumage, and at least one of the fields must be filled in if the bird is aged SY, ASY, TY, or ATY. Refer to Pyle (1997), Froehlich (2003), and Saracco (2004) for additional discussion and examples of the use of molt limits and plumage criteria for ageing landbirds. Note that in Saracco (2004) and in the material that follows, we use the new molt terminology of Howell *et al.* (2003) as discussed by Pyle (2004). In particular, as compared to molt terminology in Pyle (1997), we use “**formative feathers**” instead of “first basic feathers,” “**preformative molt**” instead of “first prebasic molt,” “**basic feathers**” to mean “adult basic feathers,” and “**prebasic molt**” to mean “adult prebasic molt.” The eight MOLT LIMITS & PLUMAGE fields are:

PRI. COVS – Primary coverts.

SEC. COVS – Secondary coverts (i.e., greater, median, lesser, carpal, and alula coverts and alula).

PRIMARIES – Primaries.

SECONDS – Secondaries, not including the tertials.

TERTIALS – Tertials.

RECTRICES – Rectrices.

BODY PLUM. – Includes all feather tracts of the head, upperparts and underparts.

NON-FEATH – Includes all non-feather parts including bill, mouth, eye, legs, and feet. A note is required if this field is used.

The codes entered in these fields should reflect the *feather generation(s)* present within the particular feather tract (or multiple feather tracts in the case of body plumage). Adventitiously (accidentally) replaced feathers should be ignored (except to provide context to the other feathers in the tract) because recognizing them as a separate feather generation will lead to mis-aging birds. Similarly, brand new or actively molting feathers should be ignored when coding tracts containing actively molting feathers.

The use of any of the following three codes during the MAPS season on an adult bird prior to completion of its prebasic molt indicates that it is a SY bird; the use of any of these codes on a young bird after its preformative molt (= “first prebasic molt” in Pyle 1997) confirms that it is a HY bird.

- J – Juvenal: Feather tract comprised entirely of retained juvenal (or a mix of juvenal and alternate) feathers, but no formative (= “first basic” in Pyle 1997) feathers. This code should also be used for NON-FEATH if non-feathered body parts show characteristics indicative of a young bird.

- L – Molt limit: Molt limit between juvenal and formative feathers exists **within** the feather tract, regardless of whether or not alternate feathers are also present in the tract.
- F – Formative: Feather tract comprised entirely of formative (or a mix of formative and alternate) feathers, but no juvenal feathers.

The use of any of the following three codes during the MAPS season indicates that the bird is not a SY or HY bird:

- B – Basic: Feather tract comprised entirely of basic (or a mix of basic and alternate) feathers (note that basic feathers = “adult basic feathers” in Pyle 1997), but no juvenal or formative feathers. The use of this code during the MAPS season on an adult bird prior to its prebasic molt indicates that it is an ASY bird; the use of this code during the MAPS season to describe feather tracts on an adult bird after its prebasic molt indicates only that it is an AHY bird.

Individuals of some near-passerine species (e.g., woodpeckers) can be aged to TY or ATY during the MAPS season (see discussion in Pyle 1997, pp. 39-40) due to incomplete molts, which result in feathers that are retained through the next prebasic (not preformative) molt. Such individuals can have up to three generations of juvenal and basic feathers present within the same feather tract (these species do not acquire alternate feathers). Two codes are to be used to distinguish cases in which juvenal and basic (rather than juvenal and formative) feathers are present, from situations in which two generations of basic (rather than formative and basic) feathers are present:

- R – Retained: Both juvenal and basic (rather than juvenal and formative) feathers are present within the tract (e.g., see Figs. 25 and 26 in Froehlich 2003). The use of this code during the MAPS season on an adult bird prior to its prebasic molt indicates that it is a TY bird; the use of this code during the MAPS season to describe feather tracts on an adult bird after its prebasic molt indicates that it is a SY bird.
- M – Mixed: Multiple generations of basic feathers are present in the tract (e.g., see Fig. 27 in Froehlich 2003). The use of this code during the MAPS season on an adult bird prior to its prebasic molt indicates that it is an ATY bird; the use of this code during the MAPS season to describe feather tracts on an adult bird after its prebasic molt indicates only that it is an ASY bird.

The following two codes, which can be used during the MAPS season (prior to the prebasic molt) to distinguish adult (AHY) from young (HY) birds, are generally not useful for ageing adult birds to more specific age classes (i.e., SY, ASY, TY, ATY):

- A – Alternate: **ALL** feathers in the feather tract are of alternate plumage; if **ANY** juvenal, formative, or basic feathers are present, the alternate feathers should be ignored and the code for the feather tract should be based on the other feathers, that is “J”, “L”, “F”, or “B”.
- N – Non-juvenal: Feathers in this tract are definitely not juvenal feathers (or the non-feathered body part is not characteristic of a young bird), but whether or not they are formative or basic feathers cannot be determined with confidence. Note that if

primary coverts are coded “J” and a molt limit exists between the primary coverts and the secondary coverts, the secondary coverts must be formative feathers and, thus, must be coded “F”, not “N”, even though formative and basic secondary coverts might be indistinguishable from each other. The code “N” should only be used as a last resort; every effort should be made to identify appropriate feather tracts to formative or basic. Often, this is best accomplished by considering the tract in the context of other tracts which, for example, have perhaps been reliably aged juvenal. This code should also be used for NON-FEATH if non-feathered body parts show characteristics indicative of an adult bird.

The following code should be used for feather tracts examined, but not meeting any of the above criteria:

- U – Unknown: This code should be used for any feather tract or non-feathered body part that is examined, but that shows ambiguous characteristics or that cannot be coded with confidence.

Finally, LEAVE BLANK any field representing a feather tract or non-feathered body part that was not examined for any reason, including cases where that feather tract provides no useful information for ageing the bird.

As an example of the use of these fields, consider the age determination of a SY bird (i.e., AGE = 5) prior to its prebasic molt. The age of SY birds can be determined by the retention of juvenal feathers, which will be evident in some feather tracts but not others (depending on the extent of the preformative molt). Any feather tract for which retained juvenal feathers are evident will have either a “J” or “L” entered in its field, depending on whether molt limits are between or within feather tracts, respectively. If the molt limit is between feather tracts, the tract with juvenal feathers would be coded “J” and the tract with formative feathers would be coded “F.” If the molt limit is within the feather tract, the tract would be coded “L.” In each of these cases where a molt limit between juvenal and formative feathers can be discerned, the bird should be aged by molt limit (HOW AGED = L). If, however, a molt limit can not be discerned, but the juvenal feathers present can be distinguished as juvenal (as opposed to basic) feathers by their appearance alone (i.e., color, shape, quality, or wear), the bird would be aged by plumage (HOW AGED = P). Remember, any feather tract or non-feathered body part that was examined, but for which a code could not be determined, should have a “U” entered in its field.

As another example, consider an ASY bird (i.e., AGE = 6) prior to its prebasic molt. Birds of this age are typically distinguished by having undergone a complete prebasic molt – adjacent feather tracts generally show little if any contrast in quality or wear. Such birds should have a “B” entered in all fields for which the basic feathers present can be distinguished as basic (as opposed to juvenal) feathers by their appearance alone (i.e., color, shape, quality, or wear), and should be aged by plumage (HOW AGED = P). They should not be aged by molt limit (HOW AGED = L) because there is no molt limit. Note that any alternate feathers present provide no information as to whether the individual is a SY or ASY bird.

As a third example, consider a species that can undergo a complete preformative molt (e.g., a Northern Cardinal). When examining an adult of these species during the breeding season, you may find that all of the feathers are of a single generation (i.e., no molt limits).

Because formative and basic feathers appear identical in this species, you will not be able to age the bird specifically to SY or ASY and so the bird must be aged AHY (i.e., AGE = 1). Such birds should have "N" entered in all fields for which the formative or basic feathers present can be distinguished as non-juvinal feathers by their appearance alone (i.e., color, shape, quality, or wear), and should be aged by plumage (HOW AGED = P). If a molt limit is present in these species, the limit must be between juvinal and formative feathers and "N" should not be used in any field because evidence for the existence of formative feathers is provided in context by the presence of juvinal feathers. Therefore, the bird must be aged SY (AGE = 5). Birds of these species can never be aged ASY (AGE = 6) in the field.

Finally, it is possible that various feather tracts in an individual bird will show conflicting characteristics (i.e., characteristics that indicate different age classes). When making an age determination for such a bird, give more weight to tracts that are more reliable or have the most obvious reliable features. Although it is not necessary that all tracts in a record agree, you should be confident in your ultimate age designation. During the MAPS season, a bird with no reliable feather tracts or a bird for which conflicting characteristics make age determination difficult should be aged as AHY (AGE = 1) prior to the prebasic molt and as indeterminable (AGE = 0) after the prebasic (or preformative) molt.

WING -- Wing Chord. Record wing chord (the length of the unflattened wing) to the nearest mm. See Pyle (1997) or Ralph *et al.* (1993) for an explanation of the technique. Unless there is little or no overlap in wing lengths between sexes (e.g., icterids), DO NOT sex birds by wing length alone in the absence of population-specific wing-chord data.

BODY MASS -- Using an electronic balance, record the mass of the bird to the nearest tenth of a gram. If an electronic balance is not available, record the weight of the bird to the nearest 0.5 gram using a Pesola (or other spring-operated) scale.

STATUS -- Record status as a single, three-digit code as shown in Bird Banding Offices 1991 (revised 1992). The most-frequent codes are "300" - normal wild bird captured, banded, and released; "301" - normal wild bird captured, banded and color-banded, and released; and "500" - injured bird (see DISP). In addition to these standard status codes, please use code "000" for all birds that were not banded or that died prior to release. Please note that status "000" birds are not included in schedules submitted to the banding offices, and that this status code is not recognized by the banding offices.

DATE (MO/DAY) -- Month/day. Record the date of capture as month and day, all in numbers. The year is entered once on the top of the form. Record all months and days as two-digit numbers (i.e., June is written "06"). The first entry on a page for each date must be written out completely; subsequent entries for that date may be entered as ">."

CAPTURE TIME -- Using the 24-hour clock, record, to the nearest 10 minutes, the starting time of the net run on which the bird was extracted. Thus, all birds extracted (or escaping) on a given net run will have the same capture time. This is necessary for standardizing effort between years. Do not enter the time at which the bird was extracted, processed, or released. Always enter three digits. Note that the ultimate zero is preprinted on the form; e.g., 6:24 a.m. = 062(0), 1:48 p.m. = 135(0).

STATION -- Record the four-character code for the MAPS station as determined during station registration.

NET -- Enter a two-digit, numeric code (e.g., "06") for the net site at which the bird was captured. It is important that net codes not include alpha characters nor be more than two characters long. Please enter "?" into this field if the net number is unknown.

DISP -- Disposition. Enter a code from the list below indicating the final disposition of any injured or dead bird. A bird is considered "injured" if its survival probability is thought to be compromised, or for healed injuries, could previously been compromised; thus, a minor flesh wound or loss of a few feathers is generally not worthy of note. Any injured or dead bird also should have a status code of "500" or "000," respectively.

- M - Malformed (deformity such as crossed mandibles)
- O - Old (healed) injury.
- I - Ill or diseased.
- S - Stress or shock.
- E - Eye injury.
- T - Tongue injury.
- W - Wing injury (unable to fly).
- B - Body injury.
- L - Leg injury.
- P - Predator-caused mortality.
- D - Death due to a cause other than predation.

NOTE NUMBER -- Enter a number (starting with "1" on each page) if additional information needs to be recorded, and record this information with the corresponding note number in the NOTE field on the back of the banding-data sheet. Occasionally, individual records that technically cannot be considered MAPS data are included on MAPS banding-data sheets. These records must be identified as non-MAPS in order to avoid including them in constant-effort analyses. **Mark these records by recording "NM" in the NOTE NUMBER field.** Occasionally notes associated with a record indicate that the species determination for a recapture or an unbanded bird was uncertain. **Mark these records by recording "QS" in the NOTE NUMBER field.**

FTHR. PULL -- Enter a code from the list below indicating which feathers were pulled during this capture event. Only record this information when the feathers are actually pulled, not on a recaptured bird that has previously had feathers pulled. If no feathers were pulled, leave the field blank.

- O - Outer two rectrices were pulled (i.e., rectrix 6 from both the left and right side of the tail). Previously, this was indicated by FTHR. PULL = P.
- I - An inner and an outer rectrix were pulled (i.e., rectrix 1 from one side and rectrix 6 from the other side were pulled).

SWAB -- Enter the size of the swab used to collect the cloacal swab sample into the SWAB field on the banding data sheet for any bird that had a cloacal swab sample taken from within the cloacal cavity (note: only record this information when the swab is actually taken,

not on a recaptured bird that has previously been swabbed). We recommend that you record the barcode number of the vial into which the swab was placed in the note field on the reverse of the banding sheet in addition to recording the barcode number on the separate swab datasheet. If no swab sample was taken, leave the field blank.

- 1 - 1mm wide swab used to collect the sample from within the cloacal cavity
- 2 - 2mm wide swab used to collect the sample from within the cloacal cavity

NOTE -- Record notes on the back of the banding-data sheet. These include characterizations of examined feather tracts in adult birds (see AHY/SY/ASY/TY/ATY above). Other examples of notes include measurements of difficult-to-identify species such as *Empidonax* flycatchers; documentation of rarities or extralimital species; suspected age or sex determinations of birds given age code “0” or “9” or sex code “U” or “X”; details of any “O” (other) code for HOW AGED or HOW SEXED; explanations for injured, dead, and unbanded birds; and sequence of color bands, if present. Please be liberal in your note-taking, especially to indicate which, if any, flight feathers are missing, erupting, or in sheath.

A strategy for ageing and sexing birds

A useful strategy for ageing and sexing is to complete the skull, cloacal protuberance, brood patch, molt, wear, and juvenal plumage fields first (that is, after identifying the bird and banding it or, if a recapture, reading the band number). In most cases, ageing and sexing should be straightforward if you keep the following breeding-season “rules” in mind:

- A skull of 0 to 4 indicates a hatching year bird (except in a few species such as cuckoos that may never progress beyond 4); a skull of 5 or 6 indicates an adult.
- Presence of a CP indicates an adult male (except in Wrentits).
- Presence of a BP indicates an adult and, in most species, a female (for exceptions see "Sex" in individual species accounts (Pyle 1997) or “List of species in which males can develop brood patches” at <http://www.birdpop.org/MANUALS.HTM>) on the IBP website. A full (class 3) BP indicates a female (except in cuckoos, kingfishers, woodpeckers, Clark’s Nutcracker and Wrenit, in which males develop full brood patches).
- Heavy body molt in the absence of symmetric flight-feather molt generally indicates a hatching year bird. Conversely, symmetric flight-feather molt, especially of the primaries, indicates an adult in most species (see "Molt" in individual species accounts (Pyle 1997) for exceptions).
- Flight-feather wear of 3 or greater generally indicates an adult.
- Presence of juvenal body plumage indicates a hatching year bird.

If your data conflict with one another, look again! And remember that the absence of CP, BP, molt, or wear is not, by itself, conclusive evidence of anything!

Remember, if you use how-aged codes of “L” or “P”, you must fill in at least one of the first seven MOLT LIMITS & PLUMAGE fields. Also, if you have an adult bird prior to its prebasic molt, please go on and attempt to age it more specifically to SY, ASY, etc., by recording the feather generations of the relevant feather groups (or soft-part features) in the appropriate MOLT LIMITS & PLUMAGE fields.