DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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TITLE

FINANCE
SOURCE OF FUNDS
ANPWS STATES ASSISTANCE PROGRAM
DUCK BANDING ANALYSIS
VOLUME 1

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CREATION DATE 240388
DESTRUCTION CODE [redacted] KEEP

I photocopied all but a few of the folios of this file. The folios that were not photocopied were of a minor administrative (mainly expenditure) nature.

All folios in this file are numbered sequentially. The missing (ie not photocopied) folios can therefore be easily identified if necessary.

01/10/2015.

3. Breeding. If management theory developed in America is to be applied in Australia, we need better information on recruitment rates than currently exists. All mathematical models examining survival assume birds have at least reached juvenile status but we do not know how many juvenile birds per annum are produced by a breeding pair.

4. Juvenile survival. Explicit estimates of juvenile survival rates and shooting mortality are required to model duck populations properly.

Yours sincerely

DR S.A. HALSE
Senior Research Scientist

May 5, 1988

DEPARTMENT OF C... MENT

Please address all enq... ...FE

Barry

Keiran

As an alternative I suggest mentioning this when we put up the broader advice,

a copy of this might go to the Minister. He probably won't read it but it would give him the impression that something is being done.

(Putting this up on its own may create a demand for the latter. KMcN 23/6

Discussed with & agreed by BRW 24/6 KMcN

.KMcN 16/5

Keiran,

FYI. A summary of our results, which actually are pretty extensive and appear reliable for Black Duck but are less so for Grey Teal. I will be writing it all up for publication later this year.

Stuart

Your Ref:

Our Ref:

Enquiries:

The Director
Australian N...
and Wildli...
P.O. Box 636
CANBERRA AC...

ATTN: DR K.W. LOWE

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WANNEROO W.A. 6065
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Dear Kim

STATES ASSISTANCE PROGRAM
PROJECT NO. 4460 - DUCKBANDING ANALYSIS

② Dr B Wilson fyi

③ Records, plse file on project file (not 025840F2112)

Following our telephone conversation of 3rd May, please find enclosed two more copies of the five duck-banding reports. I would also like to take this opportunity to summarize the results of our analysis.

The major part of the analysis was concerned with estimating annual survival rates and shooting mortality (although the bulk of the money was spent correcting errors in the data set in spite of the fact it had already been vetted several years ago!). We estimated survival using both the U.S. Fish & Wildlife Service programs, which are in public domain and are based on recovery frequencies, and an alternative method that the Statistical Consulting Service developed, which is based on the frequency distribution of known life-times. Similar methods are used in fish research but, as far as we are aware, this is the first time this approach has been used for birds. Our results are set out in the table below, together with results from previous studies in Australia and North America for comparison.

	Annual adult survival (%)	Mean life-span (y)	Annual shooting mortality (%)
Our Results			
Pacific Black Duck	62	2.0	18 (12)[1]
Grey Teal	58	1.5	26 (9)[1]
Frith's NSW results[2]			
Pacific Black Duck	~49	~1.4	~14[3]
Grey Teal	~47	~1.2	~12[3]
Norman's SA results[4]			
Pacific Black Duck	46	1.4	-
Grey Teal	52	1.6	-
North American results[5]			
Mallard	~61	~1.9	19

../2

[1]Opening day mortalities are shown in parentheses
[2]Frith, H.J. (1963) CSIRO Wildl. Res. 8, 119-131
[3]Assuming shooters return 50% of the bands on birds they shoot (see Henny & Burnham (1976) J. Wildl. Manage. 40, 1-14)
[4]Norman, F.I. (1971). Trans. Roy. Soc. S. Aust. 95, 1-7
[5]Anderson, D.R. (1975). U.S. Fish & Wildl. Serv. Res. Publ. 125, 110 pp.

We obtained similar survival rates to those of North American studies, which are significantly higher than those of Frith and Norman. This is almost certainly a result of the mathematical models used - there have been major advances since Frith and Norman undertook their studies. The similar survival rates in Australian and North American birds represents an important finding from a management viewpoint because of the wealth of information and theory about regulation of hunting in North America which, if waterfowl in the two countries behave similarly, can be used here. However, our study represents only the south-western Australian situation and it is desirable that further analysis is undertaken of data from south-eastern Australia.

Mean life-span is probably the most useful parameter for managing a hunted population since it shows how many breeding seasons are available to the average duck to replace itself. Our estimates of mean life-span are based on our alternative method of analysis and represent the average life-span of a duck that has successfully become a juvenile. The other estimates of mean life-span are really estimates of the extra time the average duck lives assuming it successfully reached adulthood. To illustrate the difference in these two methods of estimation, we calculated, using American methods, that the average life-span of a Pacific Black Duck after reaching adulthood is 2y (which means its life from egg to death will last about 3y) whereas, because of high juvenile mortality, the "average" duck dies at 2y. There is an inherent conceptual difficulty with the American methods in estimating true life span because the estimated life-span after reaching the juvenile stage is lower than that of the fitter ducks that survive to adulthood. For this reason I believe our alternative method of analysis, which can take account of differential survival rates, will be used increasingly often.

I have only touched on the complication of differential adult and juvenile survival rates because our data were collected in a way that prevented us examining annual survival rates of juveniles directly and so, while we were able to infer lower survival than for adults, we could not quantify it. Doing so successfully will probably require a much larger data set than we operated with. As in North American studies, we found a lower survival rate amongst females than males which is presumably the result of higher mortality during the breeding season.

../3

Shooting mortality is generally regarded as being low in Australia compared with North America. Our data were collected on a private farm at Moora, where the most organized shoots in Western Australia are held, and hence represent the most intensive shooting pressure. All birds were examined for bands after the shoot, so we have accurate estimates of shooting mortality, which was comparable with the American average but lower than in the sites with greatest shooting pressure. Extensive analysis of American data has shown that shooting mortality is "compensated for" by a reduction in natural mortality at all but the very highest shooting pressure, so that total mortality (or survival) is independent of shooting pressure. We would expect this phenomenon to occur in Australia as well.

In line with popular belief and previous work (e.g. Briggs et al. (1985) Aust. Wildl. Res. 12, 515-522), a substantial proportion of shooting mortality at Moora was associated with the opening-day shoot, especially in the case of Pacific Black Duck which are the preferred game species. Because Moora shoots are so organized the predominance of opening-day mortality is probably much less than at other sites.

The second part of the analysis used band recoveries to examine movement of waterfowl movement and includes results from birds banded in the Northern Territory by CSIRO and south-eastern Australia by State authorities (principally Arthur Rylah Institute) that were recovered in W.A. Results are presented in the table below.

Grey Teal

Birds banded in WA (N = 1026)

Recovered at:		Direction travelled (%)			
		N	S	E	W
banding site (%)	62				
<100 km (%)	12				
100-500 km (%)	20	20	34	30	16
500-1000 km (%)	4	26	-	74	-
>1000 km (%)	2	18	-	82	-

Birds banded interstate (N = 78)

Pacific Black Duck

Birds banded in WA (N = 4596)

Recovered at:		Direction travelled (%)			
		N	S	E	W
banding site (%)	72				
<100 km (%)	14				
100-500 km (%)	13	26	30	13	31
500-1000 km (%)	0.3	83	-	17	-
>1000 km (%)	0.1	50	-	50	-

Birds banded interstate (N = 0)

Seven percent of the Grey Teal recovered in W.A. were banded in the Northern Territory or south-eastern Australia

(NSW, Vic, SA, Tas) and 2% of birds banded in W.A. were recovered on the eastern seaboard. There appears to be both direct east-west movement across the southern part of the continent and also a fairly regular north-south movement along each seaboard with occasional east-west movement through the north.

Pacific Black Duck are more sedentary although a handful of birds banded in the south-west were found either in the Kimberley or eastern Australia. Because of the paucity of shooters in the Kimberley it is possible that a fairly regular north-south movement exists that has not been detected. Nevertheless, movement is not as great as in Grey Teal. In agreement with what is known of their biology, Pacific Black Duck banded at inland sites showed a much greater tendency to move to the coast (westwards) than Grey Teal did.

In conclusion, I would like to make four points.

1. Movement. Although it has been recognized that Grey Teal move extensively, the number of birds involved in the movement appears to have been underestimated. Recently there have been moves towards co-operative management of ducks in south-eastern Australia by the different States but, in fact, there may well be a need for an Australia-wide approach to managing Grey Teal. Birds banded in northern Australia can be found in the south-west within one month, birds from the south-west can be recovered in the south-east in the same time-span, so impacts on ducks in any part of the continent probably ultimately affect all other areas.

2. Mortality. Survival rates and shooting mortality appear to be of similar magnitude in Australia and North America suggesting that much of the waterfowl management theory developed in American can be applied here, provided recruitment rates and juvenile mortality are similar. Even in sites with high shooting pressure in Western Australia, there would appear to be plenty of scope for compensatory mortality so that it is unlikely that waterfowl numbers are affected by shooting.

   Because of the growing debate surrounding duck-shooting, it would be extremely useful to repeat our analysis for the very large numbers of birds banded in Victoria. I believe that recent work at specific sites by Loyn in Victoria and Briggs in NSW (Briggs et al. (1983), Aust. Wildl. Res. 10, 537-541) showing high shooting mortality may not reflect the situation for the majority of birds in south-eastern Australia. Furthermore, with the large number of birds banded in Victoria it may be possible to examine whether there is a relationship between shooting mortality and annual survival in that State, which has the most intense shooting pressure in Australia.

../5

3. Breeding. If management theory developed in America is to be applied in Australia, we need better information on recruitment rates than currently exists. All mathematical models examining survival assume birds have at least reached juvenile status but we do not know how many juvenile birds per annum are produced by a breeding pair.

4. Juvenile survival. Explicit estimates of juvenile survival rates and shooting mortality are required to model duck populations properly.

Yours sincerely

DR S.A. HALSE
Senior Research Scientist

May 5, 1988

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Please address all enquiries to:

WESTERN AUSTRALIAN WILDLIFE
RESEARCH CENTRE
OCEAN REEF ROAD
WOODVALE
Phone (09) 405 5100

Your Ref:
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Enquiries:

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Arthur Rylah Institute
Dept of Conservation, Forests & Lands
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Victoria 3084

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WANNEROO W.A. 6065
Facsimile (09) 306 1641
Telex AA94616

2nd May 1988

Dear Ian,

Please find enclosed four reports from the analysis of Western Australian duck-banding data. I have only included the part of Report II that outlines methodology etc and have omitted the vast number of tables and cross-tabulations we did to check the data and look for trends in plumage state, body weight etc. We didn't get any interesting information out of that exercise but it was invaluable for checking for errors in the data. I have added the Addendum to Report II that gives information on movements - you will recognize many Victorian birds amongst those that have moved long distances. There may still be a few errors in the movement data - I haven't checked it fully yet and we had trouble with both the program and cleaning-up the data set.

As far as survival analyses are concerned, you will see that the American models gave two kinds of results depending on whether one allowed differential mortality the first year. Our models 2 and 3 are closest to the models you and Frith used and give similar results. Our other models effectively adjust for differential mortality in the first year and only measure mortality rates in years subsequent to the one in which banding occurred. Thus, we get higher survival rates with these models (2*, 3*, 4* they are somewhat higher than your early results but we are measuring a different thing - survival rates <u>in adulthood</u>.

The results we got by following individual ducks are comparable to those using American models but it is better to use mean life-times than survival rates to make comparisons. As pointed out on the last page of the report dealing with American models, when

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one remembers that one system calculates life-times of a group of ducks banded as juveniles and the other only considers mortality after reaching adulthood, the apparent conflicts in the results are easy to reconcile (even if they represent real contradictions!).

In the report on daily shooting mortality, Table 1 refers only to the opening shoot where P.B.D. have about 10% mortality and G.T. about 8%. Table 2 is biased to give a probable underestimate of mortality rates in the opening shoot and also for each subsequent shoot in the season. However, results for both methods are similar. Moora is one of the most intensively shot areas in south-western Australia.

Hope you have luck with your project and find these reports useful.

Best wishes

Stuart Halse.

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DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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The Director
Australian National Parks and
Wildlife Service
P.O. Box 636
CANBERRA ACT 2607

ATTN: Dr K. Lowe

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Facsimile (09) 306 1641
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sent photocopy by error.

Dear Kim

STATES ASSISTANCE PROGRAM
PROJECT NO. 4460 - DUCK BANDING ANALYSIS

Please find enclosed the final report on the duck-banding analysis, consisting of five parts:

1. Data analysis and tabulations - Report II
2. Analysis of survival rates for ducks based on recovery frequency data
3. Analysis of survival times for ducks based on individual time intervals
4. Duck populations estimates for Moora shooting seasons, 1968-76
5. Addendum - Distances and directions

We intend publishing the bulk of the material contained in the report and will keep you informed of progress on this front. Please also find enclosed eight floppy disks which contain all the banding data for the Western Australian project. The file has been tidied up and corrected. The disks are named nduck.001 - nduck.008 and are in the format of the original data file, for which I have included a set of explanatory notes. The disks can be concatenated using standard operating utilities or the "assemble" program provided. Details are included on Disk 1.

Yours sincerely

Stuart A Halse

DR STUART HALSE
Senior Research Scientist

April 18, 1988

THE UNIVERSITY OF WESTERN AUSTRALIA STATISTICAL CONSULTING GROUP

Department of Mathematics · Nedlands · WA 6009 · Tel: (09) 380-3346

14 April 1988

Dr. Stuart Halse
WA Wildlife Research Centre
P.O. Box 51
Wanneroo WA 6065

Dear Stuart

Enclosed is another set of Distance and Direction tables Dean has just passed on to me, this time broken down by species. These supplement the previous tables which combined all species.

I forgot to mention last time that the final payment cheque has been received. Thanks.

Please get in touch if you have any queries.

Regards

Ian James
Director

THE UNIVERSITY OF WESTERN AUSTRALIA STATISTICAL CONSULTING GROUP

Department of Mathematics · Nedlands · WA 6009 · Tel: (09) 380-3346

14 April 1988

Dr. Stuart Halse
WA Wildlife Research Centre
P.O. Box 51
Wanneroo W.A. 6065

Dear Stuart

Enclosed are copies of the revised tables of distances and directions from Dean, and the revised Moora shooting report from Pat and me.

I understand from Dean that there are still a few lats and longs incorrect in his tables, but that you are aware of which ones they are.

The Moora report has been completely rethought and simplified, and considerable cross checking of the numbers has been carried out. I think it is now more like what you had in mind as discussed at our last meeting. Nevertheless we have refrained from putting covers on it at this stage until you have had a look at it. If all seems to be in order we will submit the formal version when we hear from you.

Regards

Ian James
Director

THE UNIVERSITY OF WESTERN AUSTRALIA STATISTICAL CONSULTING GROUP

Department of Mathematics · Nedlands · WA 6009 · Tel: (09) 380-3346

15 March 1988

Dr. S.A. Halse
Western Australian Wildlife
Research Centre
P.O. Box 51
Wanneroo W.A. 6065

Dear Stuart

Enclosed are copies of our final report on the analyses of the duck banding data, including the tidy data file on floppy disks.

I believe the analyses now cover all of the aspects discussed in the original proposal. Please get in touch if you have any queries about the reports or any other aspects of this or any other projects.

Regards

Ian R. James
Director

THE UNIVERSITY OF WESTERN AUSTRALIA STATISTICAL CONSULTING GROUP

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WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

DUCK BANDING PROGRAMME

Final Report

The final report on the WA Wildlife Research Centre Duck Banding Programme data analysis project consists of four bound reports, an unbound addendum containing information on the distances and directions of ducks who have travelled further than 1000 km, and the tidy data set in original format on eight floppy disks, together with a program called "assemble" which concatenates the split file into a single unit. Other reports on interim analyses have been submitted during the progress of the project.

1. Data analysis and tabulations - Report II

This report briefly describes modifications made to the original codes, consistency checks which have been carried out, new and derived variables which were created for the summary tabulations, and numerous cross tabulations of some of the variables of interest. Additional summaries of distances and directions of ducks who travelled further than 1000km are contained in a separate addendum. A very large proportion of the time spent on the project was taken up with data corrections after consistency checks. Some of the later corrections necessitated reanalyses of the survival aspects described below.

2. Analysis of survival times for ducks based on individual time intervals

This report analyses the survival times of ducks according to species and other characteristics of interest using longitudinal methods. The data needed for such analyses were somewhat sparse, but the juvenile classes, in particular, allowed reasonable estimation. Parametric Weibull models were found to provide reasonable summaries of the survival curve shapes, and some non-parametric approaches were also considered.

3. Analysis of survival rates for ducks based on recovery frequency data

This report describes methods of analysis of survival times using frequencies of recoveries by year, and utilising multinomial models. The approach is quite different from that in Report 2, and a comparison of the estimates is of interest. Again, the data were too sparse for some of the more complicated models to be sensibly fitted, but for Black Duck and Grey Teal reasonable estimation procedures were attainable.

4. Duck population estimates for Moora shooting seasons, 1968 - 76

Tag recapture methods were used to estimate population sizes and shooting rates in the Moora area in the years shown.

5. The cleaned data file

The data file after corrections and tidying up has been stored on floppy disks under the names nduck.001 - nduck.008. These are in the same format as the original file, and can be concatenated using standard operating system utilities or the "assemble" program provided. Details are included on Disk 1.

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WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

Duck Banding Programme

Data Analysis and Tabulations - Report II

Report prepared for: Western Australian Wildlife Research Centre,
Ocean Reef road,
Woodvale. 6062
W.A. (Dr. Stuart Halse)

By: D.A. Diepeveen
Statistical Consulting Group
University of Western Australia

March 1988

CONTENTS:

APPENDIX 1. TABLE LISTINGS

Two way tables for initial banding of:

APPENDIX 1. TABLE LISTINGS (cont. 2)

APPENDIX 2. TABLE LISTINGS A2.1

Two way tables for recoveries of:

APPENDIX 2. TABLE LISTINGS (cont. 2)

1. INTRODUCTION

This report is in effect the combination of two interim reports, "Data file preparation and summary" and "Data analysis and tabulations", updated to contain the current corrections to the data and to provide appropriate tables after these corrections have been made. Additional tables, including directions and distances, will be prepared separately.

Many changes have been made to the base data file. Approximately a third (14,000) of the entries have been checked due to inconsistent recordings, though not all of these had to be changed.

The file originally consisted of 41,176 records on 33,114 ducks. A further 63 ducks were added to this file. After selecting out the duplicated information and a small number of bad records (17), the number of records is now 40,471 from 33,168 ducks.

2. DESCRIPTIVE SUMMARY

The information from the original records has been processed in this report as indicated in the table below. Following the table is a short summary of the variables that have been recoded or computed in order to provide the summary tables in the appendices.

variable	var_name	info
DATE	DD	used as is
TIME	TIME	used as is
STATION	STATION	used as is
LATITUDE	LAT	used to compute DIST and DIRECT
LONGITUDE	LONG	used to compute DIST and DIRECT
NUMBER OF BIRDS ON THE FORM	NBIRD	not used
REPEAT CODE	RCODE	used as is
TITANIUM BAND NUMBER	TBAND	used as is
MONELMETAL BAND NUMBER	MBAND	used as is

variable (cont)	var_name	info
SPECIES CODE	SPECIES	coded to NSPEC
SEX CODE	SEX	coded to NSEX
WEIGHT	WEIGHT	coded to NWEIGHT
PELLETS	PELLETS	not used
AGE CODE	AGE	coded to NAGE
STATUS CODE	STATUS	not used
PLUMAGE CODE	PLUMAGE	coded to NPLUM
HOW OBTAINED CODE	OBTAIN	used in combination with RCODE
X_RAY	XRAY	not used

new variables	var_name	info
WIDTH OF BAND	BANDSIZE	width of band
DUCKS WITH MORE THAN ONE RECORD	IDENT	identify ducks with recapture/recovery info
REPEATED RECOVERY/RECAPTURES	REP	a counter for each subsequent record
DAYS SINCE BANDING	DAYBAND	number of days since first tagged
STATE OF TAGGING	STATE	in which state of AUST the duck was tagged
SEASON OF YEAR	SEASON	in which season the duck was caught
HALF MONTH CODE	HMONTH	a half monthly code
DISTANCE TRAVELLED	DIST	distance between tagging and last recapture/recovery
DIRECTION TRAVELLED	DIRECT	direction the duck travelled (as for DIST)

2.1. BANDSIZE - is a variable used to measure the size of Titanium or Monelmetal band used on the duck. (ie larger sized ducks would use larger sized bands). This band size has been used as a check for inconsistent Titanium and Monelmetal bands. For consistentency, all Black Ducks have been recoded to have 11 mm band, Grey Teal to have 9mm band and Mountain Duck to have 15 mm band. All the other species have been left as they were because it appears that some species may have been banded with more than one band size. (This variable has only been used for checking purposes.)

2.2. IDENT - This computed variable distinguishes between ducks that have only been seen once (ie at tagging), and those ducks with recapture and/or recovery information. This variable was used to check for inconsistency within the variable RCODE. The inconsistencies that did arise from this were modified so that the first sighting of the duck was considered to be the tagging record and any subsequent records as recaptures and/or recoveries. If a record had RCODE = 3 (ie recovery) and the subsequent record was a recapture then the recovery record was changed to a recapture record.

2.3. REP - This computed variable distinguishes between the recapture and recovery records with respect to time. Record "0" was when the duck was tagged, record "1" the next time the duck was caught, and so on until no more records for that duck existed. This order in REP is by time so that REP = 0 must be either on the same day or subsequent to REP = 1. If two or more records occurred on the same day then the variable TIME was used to help distinguish between records. If that was also the same then the RCODE variable was used. If this was also the same, as in a few cases, then the order in which they were entered into the file (ie at data entry) was used.

2.4. DAYBAND - This variable was computed to determine how many days the duck had been alive since tagging. For example, if a duck was caught one week after it was tagged then DAYBAND = 7 and if caught again a week later then DAYBAND = 14. This was necessary for determining the upper and lower limits on the survival times of the ducks.

2.5. STATE - With the possibility of obtaining information from other states about ducks tagged elsewhere but caught in Western Australia, this variable was added to distinguish the state from which the duck had come. It is also used to help with sorting out ducks that have been tagged with the same number as ducks here in W.A.

2.6. SPECIES - Because of the wide variety of species (26 different species with another category being for the remainder) it was necessary to recode this variable to 4 species. These are: 1 = Black Duck, 2 = Grey Teal, 3 = Mountain Duck, and then the rest clumped into category 0. This was necessary so that sufficient numbers existed for cross tabulations.

2.7. AGE - Age was also recoded into fewer categories. These recoded categories are: 1 = ducklings; 2 = juveniles; 3 = sub adults (ie only for Mountain Ducks); and 4 = adults. This was necessary to calculate the upper and lower survival limits as shown in the table below.

TABLE 1. CALCULATION TABLE FOR UPPER AND LOWER LIMITS ON SURVIVAL.

	1 recording				2 recordings			
	alive		dead		alive		dead	
age	Low	Up	Low	Up	Low	Up	Low	Up
unknown	0	*	na	na	df	*	df	*
duckling (0-60)	0	*	na	na	df	*	df	df+a
juvenile (60-240)	a	*	na	na	df+a	*	df+a	df+b
sub-adult (240-450)	b	*	na	na	df+b	*	df+b	df+c
adult (240+)	b	*	na	na	df+b	*	df+b	*
adult2 (450+)	c	*	na	na	df+c	*	df+c	*

coding scheme: df = DAYBAND
* = infinity (99999 is used here)
a = 60, b = 240, c = 450
na = not applicable

note: sub-adults and adult2 relate only to mountain ducks.

2.8. SEX - This is to distinguish between males, females and ducks with no recorded sex. Corrections to ducks with inconsistent sex between different captures were applied as follows. If the sex coding changed from banding to capture or between captures then the most frequent code was adopted. If there were two such recordings and they differed, then the sex was considered unknown if not attainable from other sources. Also, because of the large numbers with unknown sex and the techniques used to sex the ducks, ducks with AGE (before recoding) of 4 and SEX (before recoding) of 1 or 2 were recoded to an AGE category of juveniles. Ducks in the same AGE group (4) and with a SEX of 3 (before recoding) were considered adults. This involved some 1500 male ducks being changed (ie mostly from adults to juveniles). It was not possible to do the same for females because all females are clumped into one SEX category (before recoding).

2.9. WEIGHT - This variable is for the weight of the duck which was originally in ounces but has been recoded to grams. The recoded categories are: 1 = 0 - 250g; 2 = 250 - 500g; 3 = 500 - 750g; 4 = 750g - 1000g; 5 = 1000 - 1250g; 6= 1250 - 1500g and 7 for above this weight. This variable was checked against AGE and either the WEIGHT or the AGE was changed in accordance with other recorded information on the duck if inconsistent.

2.10. PLUMAGE - This is another variable that was recoded for easier analysis. The recodes were: 1 = not in moult; 2= body in moult; 3 = new primaries; 4 = new tail; and 5 = downy. Checks were made here with downy PLUMAGE = 5 and AGE (ducklings) and corrections made accordingly.

2.11. DAY,MONTH,YEAR,TIME,SEASON,HMONTH - These are all time related variables and only range checking (ie day in range 1 - 31, months in range 1 - 12, etc) has been carried out for these variables. SEASON is based on the month of the year and HMONTH (ie half monthly) is based on months and days of the year. For example, if the MONTH is January and DAYS is less than or equal to 15 then HMONTH = 1, and for DAYS greater than 15 HMONTH = 2. HMONTHs of 3 and 4 occur in Febuary and so on to December where HMONTHs of 23 and 24 occur.

2.12. LAT,LONG,DIST,DIRECT - Latitude and Longitude relate to the location of tagging or capture. When ducks have been caught at least once after tagging then it is possible to calculate a DISTance and a DIRECTion from where they were tagged to the capture position. The DISTance and the DIRECTion used in this analysis is from the tagging site to the site the duck was last sighted. The DIST is in kilometres and the DIRECTion is a numeric form of the compass. The problem with this calculation is that a duck may have flown to the Eastern States and back, but if it was last sighted in W.A. then the recorded distance does not take the Eastern states fight into account. It does, however, give an indication of how migratory some species of ducks are and of the likely areas of recapture for these birds.

3. TABULATIONS

The tables have been put into two appendices:

Appendix 1 : two way tables for the ducks at tagging

Appendix 2 : two way tables for ducks that have been recovered

These tables have percentages of the total in brackets and should be self explanatory.

Summary of the new codes:

NAGE =	1	duckling
	2	juvenile
	3	subadult
	4	adult
	0	unknown
NSPEC =	1	Black Duck
	2	Grey Teal
	3	Mountain Duck
	0	others
NSEX =	1	male
	2	female
	0	unknown
NWEIGHT =	1	0.01 - 0.25 Kg
	2	0.26 - 0.50 Kg
	3	0.51 - 0.75 Kg
	4	0.76 - 1.00 Kg
	5	1.01 - 1.25 Kg
	6	1.26 - 1.50 Kg
	7	> 1.5 Kg
	0	unknown
NPLUM =	1	not in moult
	2	body in moult
	3	moulting - new primaries
	4	moulting - new tail
	5	down (ducklings)
	0	unknown
SEASON	1	summer (months 12, 1, 2)
	2	autumn (months 3, 4, 5)
	3	winter (months 6, 7, 8)
	4	spring (months 9, 10, 11)

Other codes are unchanged from the original coding scheme.

APPENDIX 1. Cross - tabulations of AGE, SEX, and SPECIES for various categories (initial banding)

1.1 Nage by Age

count	0	1	2	3	4
0	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	170(0.51)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	3389(10.22)	6369(19.20)	0(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	14(0.04)	0(0.00)
4	0(0.00)	0(0.00)	0(0.00)	0(0.00)	13791(41.58)
total	170(0.51)	3389(10.22)	6369(19.20)	14(0.04)	13791(41.58)

1.1 Nage by Age (cont. 2)

count	5	6	total
0	0(0.00)	9434(28.44)	9434(28.44)
1	0(0.00)	0(0.00)	170(0.51)
2	0(0.00)	0(0.00)	9758(29.42)
3	0(0.00)	0(0.00)	14(0.04)
4	1(0.00)	0(0.00)	13792(41.58)
total	1(0.00)	9434(28.44)	33168(100.00)

1.2 Nspec by Age

count	0	1	2	3	4
0	17(0.05)	103(0.31)	62(0.19)	0(0.00)	162(0.49)
1	68(0.21)	2206(6.65)	5366(16.18)	0(0.00)	11951(36.03)
2	85(0.26)	936(2.82)	914(2.76)	0(0.00)	1522(4.59)
3	0(0.00)	144(0.43)	27(0.08)	14(0.04)	156(0.47)
total	170(0.51)	3389(10.22)	6369(19.20)	14(0.04)	13791(41.58)

1.2 Nspec by Age (cont. 2)

count	5	6	total
0	0(0.00)	393(1.18)	737(2.22)
1	1(0.00)	6544(19.73)	26136(78.80)
2	0(0.00)	2182(6.58)	5639(17.00)
3	0(0.00)	315(0.95)	656(1.98)
total	1(0.00)	9434(28.44)	33168(100.00)

1.3 Nsex by Age

count	0	1	2	3	4
0	9(0.03)	10(0.03)	2(0.01)	0(0.00)	21(0.06)
1	88(0.27)	1739(5.24)	4157(12.53)	8(0.02)	7208(21.73)
2	73(0.22)	1640(4.94)	2210(6.66)	6(0.02)	6562(19.78)
total	170(0.51)	3389(10.22)	6369(19.20)	14(0.04)	13791(41.58)

1.3 Nsex by Age (cont. 2)

count	5	6	total
0	0(0.00)	9404(28.35)	9446(28.48)
1	1(0.00)	19(0.06)	13220(39.86)
2	0(0.00)	11(0.03)	10502(31.66)
total	1(0.00)	9434(28.44)	33168(100.00)

2.1 Nage by Day

count	0	1	2	3	4
0	0(0.00)	148(0.45)	414(1.25)	401(1.21)	335(1.01)
1	0(0.00)	7(0.02)	7(0.02)	4(0.01)	7(0.02)
2	12(0.04)	280(0.84)	286(0.86)	324(0.98)	402(1.21)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	8(0.02)	520(1.57)	539(1.63)	440(1.33)	411(1.24)
total	20(0.06)	955(2.88)	1246(3.76)	1169(3.52)	1155(3.48)

2.1 Nage by Day (cont. 2)

count	5	6	7	8	9
0	513(1.55)	359(1.08)	364(1.10)	374(1.13)	473(1.43)
1	7(0.02)	1(0.00)	8(0.02)	1(0.00)	7(0.02)
2	520(1.57)	463(1.40)	456(1.37)	397(1.20)	277(0.84)
3	0(0.00)	0(0.00)	1(0.00)	1(0.00)	1(0.00)
4	469(1.41)	343(1.03)	422(1.27)	422(1.27)	282(0.85)
total	1509(4.55)	1166(3.52)	1251(3.77)	1195(3.60)	1040(3.14)

2.1 Nage by Day (cont. 3)

count	10	11	12	13	14
0	487(1.47)	406(1.22)	347(1.05)	416(1.25)	277(0.84)
1	5(0.02)	5(0.02)	8(0.02)	5(0.02)	3(0.01)
2	408(1.23)	258(0.78)	421(1.27)	413(1.25)	306(0.92)
3	1(0.00)	2(0.01)	1(0.00)	1(0.00)	0(0.00)
4	545(1.64)	345(1.04)	542(1.63)	583(1.76)	454(1.37)
total	1446(4.36)	1016(3.06)	1319(3.98)	1418(4.28)	1040(3.14)

2.1 Nage by Day (cont. 4)

count	15	16	17	18	19
0	274(0.83)	283(0.85)	191(0.58)	175(0.53)	233(0.70)
1	6(0.02)	5(0.02)	6(0.02)	4(0.01)	4(0.01)
2	283(0.85)	376(1.13)	266(0.80)	294(0.89)	246(0.74)
3	0(0.00)	0(0.00)	0(0.00)	1(0.00)	4(0.01)
4	557(1.68)	740(2.23)	432(1.30)	432(1.30)	348(1.05)
total	1120(3.38)	1404(4.23)	895(2.70)	906(2.73)	835(2.52)

2.1 Nage by Day (cont. 5)

count	20	21	22	23	24
0	279(0.84)	441(1.33)	251(0.76)	478(1.44)	293(0.88)
1	10(0.03)	17(0.05)	2(0.01)	5(0.02)	1(0.00)
2	258(0.78)	217(0.65)	209(0.63)	270(0.81)	201(0.61)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	629(1.90)	424(1.28)	355(1.07)	332(1.00)	245(0.74)
total	1176(3.55)	1099(3.31)	817(2.46)	1085(3.27)	740(2.23)

2.1 Nage by Day (cont. 6)

count	25	26	27	28	29
0	221(0.67)	191(0.58)	207(0.62)	224(0.68)	156(0.47)
1	0(0.00)	3(0.01)	9(0.03)	13(0.04)	6(0.02)
2	291(0.88)	252(0.76)	309(0.93)	363(1.09)	275(0.83)
3	1(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	383(1.15)	431(1.30)	718(2.16)	598(1.80)	442(1.33)
total	896(2.70)	877(2.64)	1243(3.75)	1198(3.61)	879(2.65)

2.1 Nage by Day (cont. 7)

count	30	31	total
0	139(0.42)	84(0.25)	9434(28.44)
1	4(0.01)	0(0.00)	170(0.51)
2	291(0.88)	134(0.40)	9758(29.42)
3	0(0.00)	0(0.00)	14(0.04)
4	319(0.96)	82(0.25)	13792(41.58)
total	753(2.27)	300(0.90)	33168(100.00)

2.2 Nspec by Day

count	0	1	2	3	4
0	0(0.00)	16(0.05)	24(0.07)	17(0.05)	17(0.05)
1	20(0.06)	828(2.50)	1094(3.30)	967(2.92)	958(2.89)
2	0(0.00)	106(0.32)	125(0.38)	179(0.54)	167(0.50)
3	0(0.00)	5(0.02)	3(0.01)	6(0.02)	13(0.04)
total	20(0.06)	955(2.88)	1246(3.76)	1169(3.52)	1155(3.48)

2.2 Nspec by Day (cont. 2)

count	5	6	7	8	9
0	21(0.06)	19(0.06)	20(0.06)	33(0.10)	38(0.11)
1	1169(3.52)	842(2.54)	967(2.92)	924(2.79)	824(2.48)
2	294(0.89)	287(0.87)	252(0.76)	217(0.65)	145(0.44)
3	25(0.08)	18(0.05)	12(0.04)	21(0.06)	33(0.10)
total	1509(4.55)	1166(3.52)	1251(3.77)	1195(3.60)	1040(3.14)

2.2 Nspec by Day (cont. 3)

count	10	11	12	13	14
0	85(0.26)	57(0.17)	53(0.16)	42(0.13)	33(0.10)
1	1076(3.24)	698(2.10)	971(2.93)	1112(3.35)	783(2.36)
2	239(0.72)	207(0.62)	241(0.73)	204(0.62)	201(0.61)
3	46(0.14)	54(0.16)	54(0.16)	60(0.18)	23(0.07)
total	1446(4.36)	1016(3.06)	1319(3.98)	1418(4.28)	1040(3.14)

2.2 Nspec by Day (cont. 4)

count	15	16	17	18	19
0	18(0.05)	41(0.12)	19(0.06)	18(0.05)	16(0.05)
1	895(2.70)	1153(3.48)	630(1.90)	617(1.86)	625(1.88)
2	185(0.56)	176(0.53)	205(0.62)	195(0.59)	166(0.50)
3	22(0.07)	34(0.10)	41(0.12)	76(0.23)	28(0.08)
total	1120(3.38)	1404(4.23)	895(2.70)	906(2.73)	835(2.52)

2.2 Nspec by Day (cont. 5)

count	20	21	22	23	24
0	9(0.03)	10(0.03)	10(0.03)	21(0.06)	5(0.02)
1	978(2.95)	887(2.67)	650(1.96)	877(2.64)	603(1.82)
2	175(0.53)	190(0.57)	154(0.46)	177(0.53)	131(0.39)
3	14(0.04)	12(0.04)	3(0.01)	10(0.03)	1(0.00)
total	1176(3.55)	1099(3.31)	817(2.46)	1085(3.27)	740(2.23)

2.2 Nspec by Day (cont. 6)

count	25	26	27	28	29
0	10(0.03)	7(0.02)	16(0.05)	24(0.07)	13(0.04)
1	749(2.26)	692(2.09)	1069(3.22)	960(2.89)	744(2.24)
2	132(0.40)	163(0.49)	149(0.45)	209(0.63)	121(0.36)
3	5(0.02)	15(0.05)	9(0.03)	5(0.02)	1(0.00)
total	896(2.70)	877(2.64)	1243(3.75)	1198(3.61)	879(2.65)

2.2 Nspec by Day (cont. 7)

count	30	31	total
0	15(0.05)	10(0.03)	737(2.22)
1	549(1.66)	225(0.68)	26136(78.80)
2	183(0.55)	64(0.19)	5639(17.00)
3	6(0.02)	1(0.00)	656(1.98)
total	753(2.27)	300(0.90)	33168(100.00)

2.3 Nsex by Day

count	0	1	2	3	4
0	0(0.00)	147(0.44)	419(1.26)	404(1.22)	338(1.02)
1	7(0.02)	460(1.39)	456(1.37)	395(1.19)	462(1.39)
2	13(0.04)	348(1.05)	371(1.12)	370(1.12)	355(1.07)
total	20(0.06)	955(2.88)	1246(3.76)	1169(3.52)	1155(3.48)

2.3 Nsex by Day (cont. 2)

count	5	6	7	8	9
0	512(1.54)	362(1.09)	364(1.10)	372(1.12)	472(1.42)
1	496(1.50)	408(1.23)	514(1.55)	443(1.34)	323(0.97)
2	501(1.51)	396(1.19)	373(1.12)	380(1.15)	245(0.74)
total	1509(4.55)	1166(3.52)	1251(3.77)	1195(3.60)	1040(3.14)

2.3 Nsex by Day (cont. 3)

count	10	11	12	13	14
0	484(1.46)	400(1.21)	345(1.04)	414(1.25)	277(0.84)
1	532(1.60)	351(1.06)	566(1.71)	602(1.82)	436(1.31)
2	430(1.30)	265(0.80)	408(1.23)	402(1.21)	327(0.99)
total	1446(4.36)	1016(3.06)	1319(3.98)	1418(4.28)	1040(3.14)

2.3 Nsex by Day (cont. 4)

count	15	16	17	18	19
0	275(0.83)	282(0.85)	191(0.58)	178(0.54)	235(0.71)
1	498(1.50)	640(1.93)	412(1.24)	411(1.24)	307(0.93)
2	347(1.05)	482(1.45)	292(0.88)	317(0.96)	293(0.88)
total	1120(3.38)	1404(4.23)	895(2.70)	906(2.73)	835(2.52)

2.3 Nsex by Day (cont. 5)

count	20	21	22	23	24
0	283(0.85)	443(1.34)	251(0.76)	477(1.44)	293(0.88)
1	544(1.64)	366(1.10)	303(0.91)	336(1.01)	221(0.67)
2	349(1.05)	290(0.87)	263(0.79)	272(0.82)	226(0.68)
total	1176(3.55)	1099(3.31)	817(2.46)	1085(3.27)	740(2.23)

2.3 Nsex by Day (cont. 6)

count	25	26	27	28	29
0	221(0.67)	193(0.58)	207(0.62)	226(0.68)	158(0.48)
1	361(1.09)	376(1.13)	558(1.68)	572(1.72)	396(1.19)
2	314(0.95)	308(0.93)	478(1.44)	400(1.21)	325(0.98)
total	896(2.70)	877(2.64)	1243(3.75)	1198(3.61)	879(2.65)

2.3 Nsex by Day (cont. 7)

count	30	31	total
0	139(0.42)	84(0.25)	9446(28.48)
1	344(1.04)	124(0.37)	13220(39.86)
2	270(0.81)	92(0.28)	10502(31.66)
total	753(2.27)	300(0.90)	33168(100.00)

3.1 Nage by Month

count	1	2	3	4	5
0	1159(3.49)	1796(5.41)	3237(9.76)	1729(5.21)	490(1.48)
1	44(0.13)	7(0.02)	0(0.00)	0(0.00)	0(0.00)
2	3128(9.43)	1612(4.86)	1190(3.59)	408(1.23)	35(0.11)
3	3(0.01)	0(0.00)	5(0.02)	0(0.00)	0(0.00)
4	2685(8.10)	2431(7.33)	3062(9.23)	2135(6.44)	684(2.06)
total	7019(21.16)	5846(17.63)	7494(22.59)	4272(12.88)	1209(3.65)

3.1 Nage by Month (cont. 2)

count	6	7	8	9	10
0	74(0.22)	6(0.02)	4(0.01)	58(0.17)	103(0.31)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	7(0.02)	5(0.02)	0(0.00)	5(0.02)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	9(0.03)	25(0.08)	6(0.02)	1(0.00)	100(0.30)
total	83(0.25)	38(0.11)	15(0.05)	59(0.18)	208(0.63)

3.1 Nage by Month (cont. 3)

count	11	12	total
0	363(1.09)	415(1.25)	9434(28.44)
1	49(0.15)	70(0.21)	170(0.51)
2	570(1.72)	2798(8.44)	9758(29.42)
3	0(0.00)	6(0.02)	14(0.04)
4	493(1.49)	2161(6.52)	13792(41.58)
total	1475(4.45)	5450(16.43)	33168(100.00)

3.2 Nspec by Month

count	1	2	3	4	5
0	100(0.30)	45(0.14)	239(0.72)	58(0.17)	3(0.01)
1	5318(16.03)	5186(15.64)	6371(19.21)	3846(11.60)	1117(3.37)
2	1540(4.64)	584(1.76)	673(2.03)	368(1.11)	88(0.27)
3	61(0.18)	31(0.09)	211(0.64)	0(0.00)	1(0.00)
total	7019(21.16)	5846(17.63)	7494(22.59)	4272(12.88)	1209(3.65)

3.2 Nspec by Month (cont. 2)

count	6	7	8	9	10
0	2(0.01)	0(0.00)	0(0.00)	15(0.05)	10(0.03)
1	76(0.23)	0(0.00)	0(0.00)	22(0.07)	73(0.22)
2	5(0.02)	38(0.11)	15(0.05)	16(0.05)	98(0.30)
3	0(0.00)	0(0.00)	0(0.00)	6(0.02)	27(0.08)
total	83(0.25)	38(0.11)	15(0.05)	59(0.18)	208(0.63)

3.2 Nspec by Month (cont. 3)

count	11	12	total
0	99(0.30)	166(0.50)	737(2.22)
1	557(1.68)	3570(10.76)	26136(78.80)
2	753(2.27)	1461(4.40)	5639(17.00)
3	66(0.20)	253(0.76)	656(1.98)
total	1475(4.45)	5450(16.43)	33168(100.00)

3.3 Nsex by Month

count	1	2	3	4	5
0	1158(3.49)	1796(5.41)	3233(9.75)	1726(5.20)	487(1.47)
1	3195(9.63)	2178(6.57)	2481(7.48)	1448(4.37)	444(1.34)
2	2666(8.04)	1872(5.64)	1780(5.37)	1098(3.31)	278(0.84)
total	7019(21.16)	5846(17.63)	7494(22.59)	4272(12.88)	1209(3.65)

3.3 Nsex by Month (cont. 2)

count	6	7	8	9	10
0	74(0.22)	7(0.02)	5(0.02)	54(0.16)	101(0.30)
1	8(0.02)	15(0.05)	5(0.02)	3(0.01)	57(0.17)
2	1(0.00)	16(0.05)	5(0.02)	2(0.01)	50(0.15)
total	83(0.25)	38(0.11)	15(0.05)	59(0.18)	208(0.63)

3.3 Nsex by Month (cont. 3)

count	11	12	total
0	371(1.12)	434(1.31)	9446(28.48)
1	610(1.84)	2776(8.37)	13220(39.86)
2	494(1.49)	2240(6.75)	10502(31.66)
total	1475(4.45)	5450(16.43)	33168(100.00)

4.1 Nspec by Nage

count	0	1	2	3	4
0	393(1.18)	17(0.05)	165(0.50)	0(0.00)	162(0.49)
1	6544(19.73)	68(0.21)	7572(22.83)	0(0.00)	11952(36.03)
2	2182(6.58)	85(0.26)	1850(5.58)	0(0.00)	1522(4.59)
3	315(0.95)	0(0.00)	171(0.52)	14(0.04)	156(0.47)
total	9434(28.44)	170(0.51)	9758(29.42)	14(0.04)	13792(41.58)

4.1 Nspec by Nage (cont. 2)

count	total
0	737(2.22)
1	26136(78.80)
2	5639(17.00)
3	656(1.98)
total	33168(100.00)

4.2 Nsex by Nage

count	0	1	2	3	4
0	9404(28.35)	9(0.03)	12(0.04)	0(0.00)	21(0.06)
1	19(0.06)	88(0.27)	5896(17.78)	8(0.02)	7209(21.73)
2	11(0.03)	73(0.22)	3850(11.61)	6(0.02)	6562(19.78)
total	9434(28.44)	170(0.51)	9758(29.42)	14(0.04)	13792(41.58)

4.2 Nsex by Nage (cont. 2)

count	total
0	9446(28.48)
1	13220(39.86)
2	10502(31.66)
total	33168(100.00)

5.1 Nage by Nplum

count	0	1	2	3	4
0	9413(28.38)	16(0.05)	1(0.00)	3(0.01)	1(0.00)
1	25(0.08)	25(0.08)	0(0.00)	79(0.24)	0(0.00)
2	63(0.19)	2624(7.91)	831(2.51)	95(0.29)	6145(18.53)
3	0(0.00)	2(0.01)	6(0.02)	2(0.01)	4(0.01)
4	66(0.20)	7635(23.02)	1671(5.04)	176(0.53)	4244(12.80)
total	9567(28.84)	10302(31.06)	2509(7.56)	355(1.07)	10394(31.34)

5.1 Nage by Nplum (cont. 2)

count	5	total
0	0(0.00)	9434(28.44)
1	41(0.12)	170(0.51)
2	0(0.00)	9758(29.42)
3	0(0.00)	14(0.04)
4	0(0.00)	13792(41.58)
total	41(0.12)	33168(100.00)

5.2 Nspec by Nplum

count	0	1	2	3	4
0	400(1.21)	138(0.42)	59(0.18)	30(0.09)	108(0.33)
1	6596(19.89)	8923(26.90)	1989(6.00)	160(0.48)	8459(25.50)
2	2256(6.80)	1179(3.55)	351(1.06)	87(0.26)	1736(5.23)
3	315(0.95)	62(0.19)	110(0.33)	78(0.24)	91(0.27)
total	9567(28.84)	10302(31.06)	2509(7.56)	355(1.07)	10394(31.34)

5.2 Nspec by Nplum (cont. 2)

count	5	total
0	2(0.01)	737(2.22)
1	9(0.03)	26136(78.80)
2	30(0.09)	5639(17.00)
3	0(0.00)	656(1.98)
total	41(0.12)	33168(100.00)

5.3 Nsex by Nplum

count	0	1	2	3	4
0	9399(28.34)	24(0.07)	8(0.02)	3(0.01)	5(0.02)
1	97(0.29)	6132(18.49)	1459(4.40)	191(0.58)	5321(16.04)
2	71(0.21)	4146(12.50)	1042(3.14)	161(0.49)	5068(15.28)
total	9567(28.84)	10302(31.06)	2509(7.56)	355(1.07)	10394(31.34)

5.3 Nsex by Nplum (cont. 2)

count	5	total
0	7(0.02)	9446(28.48)
1	20(0.06)	13220(39.86)
2	14(0.04)	10502(31.66)
total	41(0.12)	33168(100.00)

6.1 Nage by Nsex

count	0	1	2	total
0	9404(28.35)	19(0.06)	11(0.03)	9434(28.44)
1	9(0.03)	88(0.27)	73(0.22)	170(0.51)
2	12(0.04)	5896(17.78)	3850(11.61)	9758(29.42)
3	0(0.00)	8(0.02)	6(0.02)	14(0.04)
4	21(0.06)	7209(21.73)	6562(19.78)	13792(41.58)
total	9446(28.48)	13220(39.86)	10502(31.66)	33168(100.00)

6.2 Nspec by Nsex

count	0	1	2	total
0	420(1.27)	146(0.44)	171(0.52)	737(2.22)
1	6538(19.71)	11009(33.19)	8589(25.90)	26136(78.80)
2	2174(6.55)	1931(5.82)	1534(4.62)	5639(17.00)
3	314(0.95)	134(0.40)	208(0.63)	656(1.98)
total	9446(28.48)	13220(39.86)	10502(31.66)	33168(100.00)

7.1 Nage by Nspec

count	0	1	2	3	total
0	393(1.18)	6544(19.73)	2182(6.58)	315(0.95)	9434(28.44)
1	17(0.05)	68(0.21)	85(0.26)	0(0.00)	170(0.51)
2	165(0.50)	7572(22.83)	1850(5.58)	171(0.52)	9758(29.42)
3	0(0.00)	0(0.00)	0(0.00)	14(0.04)	14(0.04)
4	162(0.49)	11952(36.03)	1522(4.59)	156(0.47)	13792(41.58)
total	737(2.22)	26136(78.80)	5639(17.00)	656(1.98)	33168(100.00)

7.2 Nsex by Nspec

count	0	1	2	3	total
0	420(1.27)	6538(19.71)	2174(6.55)	314(0.95)	9446(28.48)
1	146(0.44)	11009(33.19)	1931(5.82)	134(0.40)	13220(39.86)
2	171(0.52)	8589(25.90)	1534(4.62)	208(0.63)	10502(31.66)
total	737(2.22)	26136(78.80)	5639(17.00)	656(1.98)	33168(100.00)

8.1 Nage by Nweight

count	0	1	2	3	4
0	9424(28.41)	0(0.00)	2(0.01)	3(0.01)	5(0.02)
1	12(0.04)	58(0.17)	53(0.16)	28(0.08)	19(0.06)
2	165(0.50)	13(0.04)	1788(5.39)	460(1.39)	5269(15.89)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	2(0.01)
4	72(0.22)	0(0.00)	1281(3.86)	348(1.05)	5469(16.49)
total	9673(29.16)	71(0.21)	3124(9.42)	839(2.53)	10764(32.45)

8.1 Nage by Nweight (cont. 2)

count	5	6	7	total
0	0(0.00)	0(0.00)	0(0.00)	9434(28.44)
1	0(0.00)	0(0.00)	0(0.00)	170(0.51)
2	2027(6.11)	34(0.10)	2(0.01)	9758(29.42)
3	6(0.02)	5(0.02)	1(0.00)	14(0.04)
4	6447(19.44)	167(0.50)	8(0.02)	13792(41.58)
total	8480(25.57)	206(0.62)	11(0.03)	33168(100.00)

8.2 Nspec by Nweight

count	0	1	2	3	4
0	398(1.20)	5(0.02)	88(0.27)	90(0.27)	148(0.45)
1	6702(20.21)	2(0.01)	33(0.10)	430(1.30)	10521(31.72)
2	2258(6.81)	64(0.19)	3002(9.05)	315(0.95)	0(0.00)
3	315(0.95)	0(0.00)	1(0.00)	4(0.01)	95(0.29)
total	9673(29.16)	71(0.21)	3124(9.42)	839(2.53)	10764(32.45)

8.2 Nspec by Nweight (cont. 2)

count	5	6	7	total
0	7(0.02)	1(0.00)	0(0.00)	737(2.22)
1	8311(25.06)	137(0.41)	0(0.00)	26136(78.80)
2	0(0.00)	0(0.00)	0(0.00)	5639(17.00)
3	162(0.49)	68(0.21)	11(0.03)	656(1.98)
total	8480(25.57)	206(0.62)	11(0.03)	33168(100.00)

8.3 Nsex by Nweight

count	0	1	2	3	4
0	9409(28.37)	6(0.02)	27(0.08)	3(0.01)	0(0.00)
1	142(0.43)	34(0.10)	1608(4.85)	407(1.23)	4071(12.27)
2	122(0.37)	31(0.09)	1489(4.49)	429(1.29)	6693(20.18)
total	9673(29.16)	71(0.21)	3124(9.42)	839(2.53)	10764(32.45)

8.3 Nsex by Nweight (cont. 2)

count	5	6	7	total
0	1(0.00)	0(0.00)	0(0.00)	9446(28.48)
1	6772(20.42)	177(0.53)	9(0.03)	13220(39.86)
2	1707(5.15)	29(0.09)	2(0.01)	10502(31.66)
total	8480(25.57)	206(0.62)	11(0.03)	33168(100.00)

9.1 Nage by Obtain

count	0	1	2	3	4
0	1(0.00)	0(0.00)	9382(28.29)	2(0.01)	0(0.00)
1	0(0.00)	0(0.00)	170(0.51)	0(0.00)	0(0.00)
2	2(0.01)	8(0.02)	8876(26.76)	668(2.01)	0(0.00)
3	0(0.00)	0(0.00)	14(0.04)	0(0.00)	0(0.00)
4	3(0.01)	33(0.10)	10700(32.26)	2549(7.69)	1(0.00)
total	6(0.02)	41(0.12)	29142(87.86)	3219(9.71)	1(0.00)

9.1 Nage by Obtain (cont. 2)

count	7	8	10	total
0	14(0.04)	33(0.10)	2(0.01)	9434(28.44)
1	0(0.00)	0(0.00)	0(0.00)	170(0.51)
2	0(0.00)	204(0.62)	0(0.00)	9758(29.42)
3	0(0.00)	0(0.00)	0(0.00)	14(0.04)
4	0(0.00)	506(1.53)	0(0.00)	13792(41.58)
total	14(0.04)	743(2.24)	2(0.01)	33168(100.00)

9.2 Nspec by Obtain

count	0	1	2	3	4
0	0(0.00)	0(0.00)	711(2.14)	18(0.05)	0(0.00)
1	3(0.01)	40(0.12)	22235(67.04)	3200(9.65)	1(0.00)
2	3(0.01)	1(0.00)	5546(16.72)	1(0.00)	0(0.00)
3	0(0.00)	0(0.00)	650(1.96)	0(0.00)	0(0.00)
total	6(0.02)	41(0.12)	29142(87.86)	3219(9.71)	1(0.00)

9.2 Nspec by Obtain (cont. 2)

count	7	8	10	total
0	0(0.00)	8(0.02)	0(0.00)	737(2.22)
1	4(0.01)	651(1.96)	2(0.01)	26136(78.80)
2	4(0.01)	84(0.25)	0(0.00)	5639(17.00)
3	6(0.02)	0(0.00)	0(0.00)	656(1.98)
total	14(0.04)	743(2.24)	2(0.01)	33168(100.00)

9.3 Nsex by Obtain

count	0	1	2	3	4
0	1(0.00)	0(0.00)	9416(28.39)	0(0.00)	0(0.00)
1	2(0.01)	19(0.06)	10900(32.86)	1851(5.58)	0(0.00)
2	3(0.01)	22(0.07)	8826(26.61)	1368(4.12)	1(0.00)
total	6(0.02)	41(0.12)	29142(87.86)	3219(9.71)	1(0.00)

9.3 Nsex by Obtain (cont. 2)

count	7	8	10	total
0	11(0.03)	18(0.05)	0(0.00)	9446(28.48)
1	2(0.01)	445(1.34)	1(0.00)	13220(39.86)
2	1(0.00)	280(0.84)	1(0.00)	10502(31.66)
total	14(0.04)	743(2.24)	2(0.01)	33168(100.00)

10.1 Nage by Plumage

count	0	1	2	3	5
0	16(0.05)	1(0.00)	3(0.01)	1(0.00)	0(0.00)
1	25(0.08)	0(0.00)	79(0.24)	0(0.00)	4(0.01)
2	2624(7.91)	831(2.51)	95(0.29)	6145(18.53)	0(0.00)
3	2(0.01)	6(0.02)	2(0.01)	4(0.01)	0(0.00)
4	7635(23.02)	1671(5.04)	176(0.53)	4244(12.80)	0(0.00)
total	10302(31.06)	2509(7.56)	355(1.07)	10394(31.34)	4(0.01)

10.1 Nage by Plumage (cont. 2)

count	6	7	8	9	total
0	0(0.00)	0(0.00)	0(0.00)	9413(28.38)	9434(28.44)
1	2(0.01)	12(0.04)	23(0.07)	25(0.08)	170(0.51)
2	0(0.00)	0(0.00)	0(0.00)	63(0.19)	9758(29.42)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	14(0.04)
4	0(0.00)	0(0.00)	0(0.00)	66(0.20)	13792(41.58)
total	2(0.01)	12(0.04)	23(0.07)	9567(28.84)	33168(100.00)

10.2 Nspec by Plumage

count	0	1	2	3	5
0	138(0.42)	59(0.18)	30(0.09)	108(0.33)	0(0.00)
1	8923(26.90)	1989(6.00)	160(0.48)	8459(25.50)	0(0.00)
2	1179(3.55)	351(1.06)	87(0.26)	1736(5.23)	4(0.01)
3	62(0.19)	110(0.33)	78(0.24)	91(0.27)	0(0.00)
total	10302(31.06)	2509(7.56)	355(1.07)	10394(31.34)	4(0.01)

10.2 Nspec by Plumage (cont. 2)

count	6	7	8	9	total
0	1(0.00)	0(0.00)	1(0.00)	400(1.21)	737(2.22)
1	1(0.00)	1(0.00)	7(0.02)	6596(19.89)	26136(78.80)
2	0(0.00)	11(0.03)	15(0.05)	2256(6.80)	5639(17.00)
3	0(0.00)	0(0.00)	0(0.00)	315(0.95)	656(1.98)
total	2(0.01)	12(0.04)	23(0.07)	9567(28.84)	33168(100.00)

10.3 Nsex by Plumage

count	0	1	2	3	5
0	24(0.07)	8(0.02)	3(0.01)	5(0.02)	4(0.01)
1	6132(18.49)	1459(4.40)	191(0.58)	5321(16.04)	0(0.00)
2	4146(12.50)	1042(3.14)	161(0.49)	5068(15.28)	0(0.00)
total	10302(31.06)	2509(7.56)	355(1.07)	10394(31.34)	4(0.01)

10.3 Nsex by Plumage (cont. 2)

count	6	7	8	9	total
0	0(0.00)	1(0.00)	2(0.01)	9399(28.34)	9446(28.48)
1	0(0.00)	7(0.02)	13(0.04)	97(0.29)	13220(39.86)
2	2(0.01)	4(0.01)	8(0.02)	71(0.21)	10502(31.66)
total	2(0.01)	12(0.04)	23(0.07)	9567(28.84)	33168(100.00)

11.1 Nage by Rep

count	0	total
0	9434(28.44)	9434(28.44)
1	170(0.51)	170(0.51)
2	9758(29.42)	9758(29.42)
3	14(0.04)	14(0.04)
4	13792(41.58)	13792(41.58)
total	33168(100.00)	33168(100.00)

11.2 Nspec by Rep

count	0	total
0	737(2.22)	737(2.22)
1	26136(78.80)	26136(78.80)
2	5639(17.00)	5639(17.00)
3	656(1.98)	656(1.98)
total	33168(100.00)	33168(100.00)

11.3 Nsex by Rep

count	0	total
0	9446(28.48)	9446(28.48)
1	13220(39.86)	13220(39.86)
2	10502(31.66)	10502(31.66)
total	33168(100.00)	33168(100.00)

12.1 Nage by Season

count	1	2	3	4	total
0	3370(10.16)	5456(16.45)	84(0.25)	524(1.58)	9434(28.44)
1	121(0.36)	0(0.00)	0(0.00)	49(0.15)	170(0.51)
2	7538(22.73)	1633(4.92)	12(0.04)	575(1.73)	9758(29.42)
3	9(0.03)	5(0.02)	0(0.00)	0(0.00)	14(0.04)
4	7277(21.94)	5881(17.73)	40(0.12)	594(1.79)	13792(41.58)
total	18315(55.22)	12975(39.12)	136(0.41)	1742(5.25)	33168(100.00)

12.2 Nspec by Season

count	1	2	3	4	total
0	311(0.94)	300(0.90)	2(0.01)	124(0.37)	737(2.22)
1	14074(42.43)	11334(34.17)	76(0.23)	652(1.97)	26136(78.80)
2	3585(10.81)	1129(3.40)	58(0.17)	867(2.61)	5639(17.00)
3	345(1.04)	212(0.64)	0(0.00)	99(0.30)	656(1.98)
total	18315(55.22)	12975(39.12)	136(0.41)	1742(5.25)	33168(100.00)

12.3 Nsex by Season

count	1	2	3	4	total
0	3388(10.21)	5446(16.42)	86(0.26)	526(1.59)	9446(28.48)
1	8149(24.57)	4373(13.18)	28(0.08)	670(2.02)	13220(39.86)
2	6778(20.44)	3156(9.52)	22(0.07)	546(1.65)	10502(31.66)
total	18315(55.22)	12975(39.12)	136(0.41)	1742(5.25)	33168(100.00)

13.1 Nage by Sex

count	0	1	2	3	4
0	19(0.06)	8(0.02)	1(0.00)	4(0.01)	6(0.02)
1	0(0.00)	88(0.27)	0(0.00)	0(0.00)	0(0.00)
2	1(0.00)	4932(14.87)	915(2.76)	36(0.11)	12(0.04)
3	0(0.00)	6(0.02)	2(0.01)	0(0.00)	0(0.00)
4	6(0.02)	0(0.00)	0(0.00)	7190(21.68)	19(0.06)
total	26(0.08)	5034(15.18)	918(2.77)	7230(21.80)	37(0.11)

13.1 Nage by Sex (cont. 2)

count	5	6	7	9	total
0	11(0.03)	1(0.00)	0(0.00)	9384(28.29)	9434(28.44)
1	73(0.22)	9(0.03)	0(0.00)	0(0.00)	170(0.51)
2	3850(11.61)	11(0.03)	1(0.00)	0(0.00)	9758(29.42)
3	6(0.02)	0(0.00)	0(0.00)	0(0.00)	14(0.04)
4	6562(19.78)	15(0.05)	0(0.00)	0(0.00)	13792(41.58)
total	10502(31.66)	36(0.11)	1(0.00)	9384(28.29)	33168(100.00)

13.2 Nspec by Sex

count	0	1	2	3	4
0	1(0.00)	77(0.23)	14(0.04)	54(0.16)	1(0.00)
1	5(0.02)	3839(11.57)	803(2.42)	6362(19.18)	5(0.02)
2	20(0.06)	1055(3.18)	92(0.28)	754(2.27)	30(0.09)
3	0(0.00)	63(0.19)	9(0.03)	60(0.18)	1(0.00)
total	26(0.08)	5034(15.18)	918(2.77)	7230(21.80)	37(0.11)

13.2 Nspec by Sex (cont. 2)

count	5	6	7	9	total
0	171(0.52)	27(0.08)	0(0.00)	392(1.18)	737(2.22)
1	8589(25.90)	2(0.01)	0(0.00)	6531(19.69)	26136(78.80)
2	1534(4.62)	7(0.02)	0(0.00)	2147(6.47)	5639(17.00)
3	208(0.63)	0(0.00)	1(0.00)	314(0.95)	656(1.98)
total	10502(31.66)	36(0.11)	1(0.00)	9384(28.29)	33168(100.00)

13.3 Nsex by Sex

count	0	1	2	3	4
0	26(0.08)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	0(0.00)	5034(15.18)	918(2.77)	7230(21.80)	37(0.11)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	26(0.08)	5034(15.18)	918(2.77)	7230(21.80)	37(0.11)

13.3 Nsex by Sex (cont. 2)

count	5	6	7	9	total
0	0(0.00)	36(0.11)	0(0.00)	9384(28.29)	9446(28.48)
1	0(0.00)	0(0.00)	1(0.00)	0(0.00)	13220(39.86)
2	10502(31.66)	0(0.00)	0(0.00)	0(0.00)	10502(31.66)
total	10502(31.66)	36(0.11)	1(0.00)	9384(28.29)	33168(100.00)

14.1 Nage by Species

count	1	2	3	4	5
0	6544(19.73)	2182(6.58)	1(0.00)	55(0.17)	315(0.95)
1	68(0.21)	85(0.26)	0(0.00)	7(0.02)	0(0.00)
2	7572(22.83)	1850(5.58)	0(0.00)	14(0.04)	171(0.52)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	14(0.04)
4	11952(36.03)	1522(4.59)	1(0.00)	12(0.04)	156(0.47)
total	26136(78.80)	5639(17.00)	2(0.01)	88(0.27)	656(1.98)

14.1 Nage by Species (cont. 2)

count	7	8	9	13	14
0	192(0.58)	18(0.05)	14(0.04)	0(0.00)	0(0.00)
1	1(0.00)	1(0.00)	3(0.01)	2(0.01)	0(0.00)
2	75(0.23)	42(0.13)	21(0.06)	1(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	110(0.33)	8(0.02)	6(0.02)	4(0.01)	1(0.00)
total	378(1.14)	69(0.21)	44(0.13)	7(0.02)	1(0.00)

14.1 Nage by Species (cont. 3)

count	20	21	22	23	25
0	6(0.02)	49(0.15)	6(0.02)	0(0.00)	0(0.00)
1	0(0.00)	3(0.01)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	8(0.02)	0(0.00)	1(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	15(0.05)	1(0.00)	2(0.01)	2(0.01)
total	6(0.02)	75(0.23)	7(0.02)	3(0.01)	2(0.01)

14.1 Nage by Species (cont. 4)

count	26	27	total
0	48(0.14)	4(0.01)	9434(28.44)
1	0(0.00)	0(0.00)	170(0.51)
2	1(0.00)	2(0.01)	9758(29.42)
3	0(0.00)	0(0.00)	14(0.04)
4	0(0.00)	0(0.00)	13792(41.58)
total	49(0.15)	6(0.02)	33168(100.00)

14.2 Nspec by Species

count	1	2	3	4	5
0	0(0.00)	0(0.00)	2(0.01)	88(0.27)	0(0.00)
1	26136(78.80)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	5639(17.00)	0(0.00)	0(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	656(1.98)
total	26136(78.80)	5639(17.00)	2(0.01)	88(0.27)	656(1.98)

14.2 Nspec by Species (cont. 2)

count	7	8	9	13	14
0	378(1.14)	69(0.21)	44(0.13)	7(0.02)	1(0.00)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	378(1.14)	69(0.21)	44(0.13)	7(0.02)	1(0.00)

14.2 Nspec by Species (cont. 3)

count	20	21	22	23	25
0	6(0.02)	75(0.23)	7(0.02)	3(0.01)	2(0.01)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	6(0.02)	75(0.23)	7(0.02)	3(0.01)	2(0.01)

14.2 Nspec by Species (cont. 4)

count	26	27	total
0	49(0.15)	6(0.02)	737(2.22)
1	0(0.00)	0(0.00)	26136(78.80)
2	0(0.00)	0(0.00)	5639(17.00)
3	0(0.00)	0(0.00)	656(1.98)
total	49(0.15)	6(0.02)	33168(100.00)

14.3 Nsex by Species

count	1	2	3	4	5
0	6538(19.71)	2174(6.55)	1(0.00)	55(0.17)	314(0.95)
1	11009(33.19)	1931(5.82)	1(0.00)	15(0.05)	134(0.40)
2	8589(25.90)	1534(4.62)	0(0.00)	18(0.05)	208(0.63)
total	26136(78.80)	5639(17.00)	2(0.01)	88(0.27)	656(1.98)

14.3 Nsex by Species (cont. 2)

count	7	8	9	13	14
0	193(0.58)	18(0.05)	13(0.04)	0(0.00)	0(0.00)
1	94(0.28)	20(0.06)	11(0.03)	3(0.01)	0(0.00)
2	91(0.27)	31(0.09)	20(0.06)	4(0.01)	1(0.00)
total	378(1.14)	69(0.21)	44(0.13)	7(0.02)	1(0.00)

14.3 Nsex by Species (cont. 3)

count	20	21	22	23	25
0	6(0.02)	75(0.23)	6(0.02)	0(0.00)	0(0.00)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(0.00)
2	0(0.00)	0(0.00)	1(0.00)	3(0.01)	1(0.00)
total	6(0.02)	75(0.23)	7(0.02)	3(0.01)	2(0.01)

14.3 Nsex by Species (cont. 4)

count	26	27	total
0	49(0.15)	4(0.01)	9446(28.48)
1	0(0.00)	1(0.00)	13220(39.86)
2	0(0.00)	1(0.00)	10502(31.66)
total	49(0.15)	6(0.02)	33168(100.00)

15.1 Nage by State

count	2	3	5	6	7
0	0(0.00)	16(0.05)	0(0.00)	9402(28.35)	1(0.00)
1	0(0.00)	0(0.00)	0(0.00)	170(0.51)	0(0.00)
2	4(0.01)	1(0.00)	0(0.00)	9741(29.37)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	14(0.04)	0(0.00)
4	0(0.00)	0(0.00)	1(0.00)	13756(41.47)	0(0.00)
total	4(0.01)	17(0.05)	1(0.00)	33083(99.74)	1(0.00)

15.1 Nage by State (cont. 2)

count	8	total
0	15(0.05)	9434(28.44)
1	0(0.00)	170(0.51)
2	12(0.04)	9758(29.42)
3	0(0.00)	14(0.04)
4	35(0.11)	13792(41.58)
total	62(0.19)	33168(100.00)

15.2 Nspec by State

count	2	3	5	6	7
0	0(0.00)	0(0.00)	0(0.00)	737(2.22)	0(0.00)
1	0(0.00)	0(0.00)	0(0.00)	26136(78.80)	0(0.00)
2	4(0.01)	17(0.05)	1(0.00)	5554(16.75)	1(0.00)
3	0(0.00)	0(0.00)	0(0.00)	656(1.98)	0(0.00)
total	4(0.01)	17(0.05)	1(0.00)	33083(99.74)	1(0.00)

15.2 Nspec by State (cont. 2)

count	8	total
0	0(0.00)	737(2.22)
1	0(0.00)	26136(78.80)
2	62(0.19)	5639(17.00)
3	0(0.00)	656(1.98)
total	62(0.19)	33168(100.00)

15.3 Nsex by State

count	2	3	5	6	7
0	0(0.00)	4(0.01)	1(0.00)	9428(28.42)	1(0.00)
1	4(0.01)	11(0.03)	0(0.00)	13180(39.74)	0(0.00)
2	0(0.00)	2(0.01)	0(0.00)	10475(31.58)	0(0.00)
total	4(0.01)	17(0.05)	1(0.00)	33083(99.74)	1(0.00)

15.3 Nsex by State (cont. 2)

count	8	total
0	12(0.04)	9446(28.48)
1	25(0.08)	13220(39.86)
2	25(0.08)	10502(31.66)
total	62(0.19)	33168(100.00)

16.1 Nage by Station

count	0	1	2	3	4
0	9417(28.39)	7(0.02)	4(0.01)	2(0.01)	4(0.01)
1	0(0.00)	141(0.43)	0(0.00)	0(0.00)	29(0.09)
2	17(0.05)	5272(15.89)	687(2.07)	721(2.17)	3042(9.17)
3	0(0.00)	9(0.03)	0(0.00)	0(0.00)	5(0.02)
4	36(0.11)	3379(10.19)	2158(6.51)	2137(6.44)	5843(17.62)
total	9470(28.55)	8808(26.56)	2849(8.59)	2860(8.62)	8923(26.90)

16.1 Nage by Station (cont. 2)

count	5	6	total
0	0(0.00)	0(0.00)	9434(28.44)
1	0(0.00)	0(0.00)	170(0.51)
2	16(0.05)	3(0.01)	9758(29.42)
3	0(0.00)	0(0.00)	14(0.04)
4	140(0.42)	99(0.30)	13792(41.58)
total	156(0.47)	102(0.31)	33168(100.00)

16.2 Nspec by Station

count	0	1	2	3	4
0	392(1.18)	299(0.90)	23(0.07)	4(0.01)	19(0.06)
1	6531(19.69)	5149(15.52)	2826(8.52)	2855(8.61)	8665(26.12)
2	2232(6.73)	3055(9.21)	0(0.00)	1(0.00)	203(0.61)
3	315(0.95)	305(0.92)	0(0.00)	0(0.00)	36(0.11)
total	9470(28.55)	8808(26.56)	2849(8.59)	2860(8.62)	8923(26.90)

16.2 Nspec by Station (cont. 2)

count	5	6	total
0	0(0.00)	0(0.00)	737(2.22)
1	8(0.02)	102(0.31)	26136(78.80)
2	148(0.45)	0(0.00)	5639(17.00)
3	0(0.00)	0(0.00)	656(1.98)
total	156(0.47)	102(0.31)	33168(100.00)

16.3 Nsex by Station

count	0	1	2	3	4
0	9401(28.34)	40(0.12)	0(0.00)	1(0.00)	4(0.01)
1	42(0.13)	4660(14.05)	1779(5.36)	1564(4.72)	5042(15.20)
2	27(0.08)	4108(12.39)	1070(3.23)	1295(3.90)	3877(11.69)
total	9470(28.55)	8808(26.56)	2849(8.59)	2860(8.62)	8923(26.90)

16.3 Nsex by Station (cont. 2)

count	5	6	total
0	0(0.00)	0(0.00)	9446(28.48)
1	80(0.24)	53(0.16)	13220(39.86)
2	76(0.23)	49(0.15)	10502(31.66)
total	156(0.47)	102(0.31)	33168(100.00)

17.1 Nage by Status

count	0	1	2	3	4
0	19(0.06)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	169(0.51)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	9037(27.25)	26(0.08)	2(0.01)	1(0.00)	0(0.00)
3	8(0.02)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	11915(35.92)	54(0.16)	2(0.01)	2(0.01)	2(0.01)
total	21148(63.76)	80(0.24)	4(0.01)	3(0.01)	2(0.01)

17.1 Nage by Status (cont. 2)

count	5	6	7	8	10
0	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	18(0.05)	83(0.25)	1(0.00)	1(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	19(0.06)	117(0.35)	2(0.01)	1(0.00)	1(0.00)
total	37(0.11)	200(0.60)	3(0.01)	2(0.01)	1(0.00)

17.1 Nage by Status (cont. 3)

count	11	99	total
0	0(0.00)	9415(28.39)	9434(28.44)
1	0(0.00)	1(0.00)	170(0.51)
2	1(0.00)	588(1.77)	9758(29.42)
3	0(0.00)	6(0.02)	14(0.04)
4	1(0.00)	1676(5.05)	13792(41.58)
total	2(0.01)	11686(35.23)	33168(100.00)

17.2 Nspec by Status

count	0	1	2	3	4
0	316(0.95)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	17355(52.32)	75(0.23)	2(0.01)	2(0.01)	2(0.01)
2	3175(9.57)	5(0.02)	1(0.00)	1(0.00)	0(0.00)
3	302(0.91)	0(0.00)	1(0.00)	0(0.00)	0(0.00)
total	21148(63.76)	80(0.24)	4(0.01)	3(0.01)	2(0.01)

17.2 Nspec by Status (cont. 2)

count	5	6	7	8	10
0	1(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	35(0.11)	199(0.60)	3(0.01)	1(0.00)	1(0.00)
2	1(0.00)	1(0.00)	0(0.00)	1(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	37(0.11)	200(0.60)	3(0.01)	2(0.01)	1(0.00)

17.2 Nspec by Status (cont. 3)

count	11	99	total
0	0(0.00)	420(1.27)	737(2.22)
1	1(0.00)	8460(25.51)	26136(78.80)
2	1(0.00)	2453(7.40)	5639(17.00)
3	0(0.00)	353(1.06)	656(1.98)
total	2(0.01)	11686(35.23)	33168(100.00)

17.3 Nsex by Status

count	0	1	2	3	4
0	49(0.15)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	11716(35.32)	36(0.11)	3(0.01)	1(0.00)	2(0.01)
2	9383(28.29)	44(0.13)	1(0.00)	2(0.01)	0(0.00)
total	21148(63.76)	80(0.24)	4(0.01)	3(0.01)	2(0.01)

17.3 Nsex by Status (cont. 2)

count	5	6	7	8	10
0	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	25(0.08)	126(0.38)	2(0.01)	1(0.00)	0(0.00)
2	12(0.04)	74(0.22)	1(0.00)	1(0.00)	1(0.00)
total	37(0.11)	200(0.60)	3(0.01)	2(0.01)	1(0.00)

17.3 Nsex by Status (cont. 3)

count	11	99	total
0	0(0.00)	9397(28.33)	9446(28.48)
1	2(0.01)	1306(3.94)	13220(39.86)
2	0(0.00)	983(2.96)	10502(31.66)
total	2(0.01)	11686(35.23)	33168(100.00)

18.1 Nage by Time

count	0	9	12	14	21
0	9417(28.39)	16(0.05)	0(0.00)	0(0.00)	1(0.00)
1	0(0.00)	103(0.31)	0(0.00)	22(0.07)	45(0.14)
2	37(0.11)	6802(20.51)	18(0.05)	610(1.84)	2291(6.91)
3	0(0.00)	7(0.02)	0(0.00)	2(0.01)	5(0.02)
4	49(0.15)	11059(33.34)	6(0.02)	537(1.62)	2141(6.46)
total	9503(28.65)	17987(54.23)	24(0.07)	1171(3.53)	4483(13.52)

18.1 Nage by Time (cont. 2)

count	total
0	9434(28.44)
1	170(0.51)
2	9758(29.42)
3	14(0.04)
4	13792(41.58)
total	33168(100.00)

18.2 Nspec by Time

count	0	9	12	14	21
0	392(1.18)	231(0.70)	0(0.00)	8(0.02)	106(0.32)
1	6564(19.79)	15686(47.29)	20(0.06)	846(2.55)	3020(9.11)
2	2232(6.73)	1906(5.75)	4(0.01)	263(0.79)	1234(3.72)
3	315(0.95)	164(0.49)	0(0.00)	54(0.16)	123(0.37)
total	9503(28.65)	17987(54.23)	24(0.07)	1171(3.53)	4483(13.52)

18.2 Nspec by Time (cont. 2)

count	total
0	737(2.22)
1	26136(78.80)
2	5639(17.00)
3	656(1.98)
total	33168(100.00)

18.3 Nsex by Time

count	0	9	12	14	21
0	9401(28.34)	28(0.08)	0(0.00)	0(0.00)	17(0.05)
1	57(0.17)	10156(30.62)	13(0.04)	615(1.85)	2379(7.17)
2	45(0.14)	7803(23.53)	11(0.03)	556(1.68)	2087(6.29)
total	9503(28.65)	17987(54.23)	24(0.07)	1171(3.53)	4483(13.52)

18.3 Nsex by Time (cont. 2)

count	total
0	9446(28.48)
1	13220(39.86)
2	10502(31.66)
total	33168(100.00)

19.1 Nage by Year

count	52	53	54	55	56
0	131(0.39)	929(2.80)	1037(3.13)	301(0.91)	1038(3.13)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	131(0.39)	929(2.80)	1037(3.13)	301(0.91)	1039(3.13)

19.1 Nage by Year (cont. 2)

count	57	58	59	60	61
0	1066(3.21)	1254(3.78)	363(1.09)	57(0.17)	1032(3.11)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	15(0.05)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	35(0.11)	1(0.00)	0(0.00)	0(0.00)	0(0.00)
total	1116(3.36)	1255(3.78)	363(1.09)	57(0.17)	1032(3.11)

19.1 Nage by Year (cont. 3)

count	62	63	64	65	66
0	1113(3.36)	54(0.16)	875(2.64)	63(0.19)	44(0.13)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	1113(3.36)	54(0.16)	875(2.64)	63(0.19)	44(0.13)

19.1 Nage by Year (cont. 4)

count	67	68	69	70	71
0	47(0.14)	3(0.01)	0(0.00)	1(0.00)	7(0.02)
1	18(0.05)	16(0.05)	0(0.00)	38(0.11)	9(0.03)
2	367(1.11)	787(2.37)	607(1.83)	1539(4.64)	1586(4.78)
3	0(0.00)	2(0.01)	0(0.00)	0(0.00)	0(0.00)
4	308(0.93)	324(0.98)	1369(4.13)	1977(5.96)	2255(6.80)
total	740(2.23)	1132(3.41)	1976(5.96)	3555(10.72)	3857(11.63)

19.1 Nage by Year (cont. 5)

count	72	73	74	75	76
0	3(0.01)	0(0.00)	5(0.02)	1(0.00)	10(0.03)
1	3(0.01)	23(0.07)	27(0.08)	26(0.08)	10(0.03)
2	1381(4.16)	1230(3.71)	1150(3.47)	810(2.44)	284(0.86)
3	0(0.00)	1(0.00)	1(0.00)	9(0.03)	1(0.00)
4	2710(8.17)	1441(4.34)	1063(3.20)	1844(5.56)	465(1.40)
total	4097(12.35)	2695(8.13)	2246(6.77)	2690(8.11)	770(2.32)

19.1 Nage by Year (cont. 6)

count	84	total
0	0(0.00)	9434(28.44)
1	0(0.00)	170(0.51)
2	1(0.00)	9758(29.42)
3	0(0.00)	14(0.04)
4	0(0.00)	13792(41.58)
total	1(0.00)	33168(100.00)

19.2 Nspec by Year

count	52	53	54	55	56
0	2(0.01)	24(0.07)	26(0.08)	1(0.00)	33(0.10)
1	118(0.36)	651(1.96)	715(2.16)	160(0.48)	549(1.66)
2	0(0.00)	238(0.72)	251(0.76)	123(0.37)	432(1.30)
3	11(0.03)	16(0.05)	45(0.14)	17(0.05)	25(0.08)
total	131(0.39)	929(2.80)	1037(3.13)	301(0.91)	1039(3.13)

19.2 Nspec by Year (cont. 2)

count	57	58	59	60	61
0	48(0.14)	37(0.11)	2(0.01)	0(0.00)	2(0.01)
1	714(2.15)	895(2.70)	278(0.84)	50(0.15)	882(2.66)
2	329(0.99)	321(0.97)	83(0.25)	7(0.02)	147(0.44)
3	25(0.08)	2(0.01)	0(0.00)	0(0.00)	1(0.00)
total	1116(3.36)	1255(3.78)	363(1.09)	57(0.17)	1032(3.11)

19.2 Nspec by Year (cont. 3)

count	62	63	64	65	66
0	33(0.10)	0(0.00)	181(0.55)	0(0.00)	3(0.01)
1	846(2.55)	38(0.11)	496(1.50)	50(0.15)	39(0.12)
2	186(0.56)	15(0.05)	80(0.24)	13(0.04)	2(0.01)
3	48(0.14)	1(0.00)	118(0.36)	0(0.00)	0(0.00)
total	1113(3.36)	54(0.16)	875(2.64)	63(0.19)	44(0.13)

19.2 Nspec by Year (cont. 4)

count	67	68	69	70	71
0	59(0.18)	26(0.08)	27(0.08)	104(0.31)	9(0.03)
1	333(1.00)	873(2.63)	1788(5.39)	2776(8.37)	3283(9.90)
2	323(0.97)	220(0.66)	161(0.49)	653(1.97)	562(1.69)
3	25(0.08)	13(0.04)	0(0.00)	22(0.07)	3(0.01)
total	740(2.23)	1132(3.41)	1976(5.96)	3555(10.72)	3857(11.63)

19.2 Nspec by Year (cont. 5)

count	72	73	74	75	76
0	6(0.02)	19(0.06)	31(0.09)	44(0.13)	20(0.06)
1	3863(11.65)	2225(6.71)	1938(5.84)	2178(6.57)	398(1.20)
2	227(0.68)	383(1.15)	242(0.73)	305(0.92)	335(1.01)
3	1(0.00)	68(0.21)	35(0.11)	163(0.49)	17(0.05)
total	4097(12.35)	2695(8.13)	2246(6.77)	2690(8.11)	770(2.32)

19.2 Nspec by Year (cont. 6)

count	84	total
0	0(0.00)	737(2.22)
1	0(0.00)	26136(78.80)
2	1(0.00)	5639(17.00)
3	0(0.00)	656(1.98)
total	1(0.00)	33168(100.00)

19.3 Nsex by Year

count	52	53	54	55	56
0	131(0.39)	929(2.80)	1037(3.13)	301(0.91)	1035(3.12)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	3(0.01)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(0.00)
total	131(0.39)	929(2.80)	1037(3.13)	301(0.91)	1039(3.13)

19.3 Nsex by Year (cont. 2)

count	57	58	59	60	61
0	1065(3.21)	1252(3.77)	363(1.09)	56(0.17)	1030(3.11)
1	27(0.08)	2(0.01)	0(0.00)	1(0.00)	2(0.01)
2	24(0.07)	1(0.00)	0(0.00)	0(0.00)	0(0.00)
total	1116(3.36)	1255(3.78)	363(1.09)	57(0.17)	1032(3.11)

19.3 Nsex by Year (cont. 3)

count	62	63	64	65	66
0	1113(3.36)	54(0.16)	875(2.64)	61(0.18)	42(0.13)
1	0(0.00)	0(0.00)	0(0.00)	2(0.01)	2(0.01)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	1113(3.36)	54(0.16)	875(2.64)	63(0.19)	44(0.13)

19.3 Nsex by Year (cont. 4)

count	67	68	69	70	71
0	67(0.20)	11(0.03)	0(0.00)	0(0.00)	3(0.01)
1	352(1.06)	564(1.70)	1146(3.46)	1994(6.01)	2073(6.25)
2	321(0.97)	557(1.68)	830(2.50)	1561(4.71)	1781(5.37)
total	740(2.23)	1132(3.41)	1976(5.96)	3555(10.72)	3857(11.63)

19.3 Nsex by Year (cont. 5)

count	72	73	74	75	76
0	2(0.01)	1(0.00)	8(0.02)	1(0.00)	9(0.03)
1	2372(7.15)	1594(4.81)	1171(3.53)	1531(4.62)	383(1.15)
2	1723(5.19)	1100(3.32)	1067(3.22)	1158(3.49)	378(1.14)
total	4097(12.35)	2695(8.13)	2246(6.77)	2690(8.11)	770(2.32)

19.3 Nsex by Year (cont. 6)

count	84	total
0	0(0.00)	9446(28.48)
1	1(0.00)	13220(39.86)
2	0(0.00)	10502(31.66)
total	1(0.00)	33168(100.00)

APPENDIX 2. Cross - tabulations of AGE, SEX, and SPECIES for various categories (recoveries)

1.1 Nage by Age

count	1	4	5	6	total
0	0(0.00)	0(0.00)	0(0.00)	3053(99.48)	3053(99.48)
2	1(0.03)	0(0.00)	0(0.00)	0(0.00)	1(0.03)
4	0(0.00)	14(0.46)	1(0.03)	0(0.00)	15(0.49)
total	1(0.03)	14(0.46)	1(0.03)	3053(99.48)	3069(100.00)

1.2 Nspec by Age

count	1	4	5	6	total
0	0(0.00)	0(0.00)	0(0.00)	65(2.12)	65(2.12)
1	1(0.03)	11(0.36)	1(0.03)	2097(68.33)	2110(68.75)
2	0(0.00)	3(0.10)	0(0.00)	826(26.91)	829(27.01)
3	0(0.00)	0(0.00)	0(0.00)	65(2.12)	65(2.12)
total	1(0.03)	14(0.46)	1(0.03)	3053(99.48)	3069(100.00)

1.3 Nsex by Age

count	1	4	5	6	total
0	0(0.00)	0(0.00)	1(0.03)	2559(83.38)	2560(83.41)
1	0(0.00)	7(0.23)	0(0.00)	295(9.61)	302(9.84)
2	1(0.03)	7(0.23)	0(0.00)	199(6.48)	207(6.74)
total	1(0.03)	14(0.46)	1(0.03)	3053(99.48)	3069(100.00)

2.1 Nage by Day

count	0	1	2	3	4
0	2(0.07)	134(4.37)	140(4.56)	57(1.86)	50(1.63)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	2(0.07)	0(0.00)	2(0.07)	0(0.00)
total	2(0.07)	136(4.43)	140(4.56)	59(1.92)	50(1.63)

2.1 Nage by Day (cont. 2)

count	5	6	7	8	9
0	70(2.28)	138(4.50)	34(1.11)	45(1.47)	59(1.92)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	1(0.03)	0(0.00)	0(0.00)	0(0.00)	1(0.03)
total	71(2.31)	138(4.50)	34(1.11)	45(1.47)	60(1.96)

2.1 Nage by Day (cont. 3)

count	10	11	12	13	14
0	151(4.92)	163(5.31)	304(9.91)	74(2.41)	141(4.59)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(0.03)
total	151(4.92)	163(5.31)	304(9.91)	74(2.41)	142(4.63)

2.1 Nage by Day (cont. 4)

count	15	16	17	18	19
0	225(7.33)	44(1.43)	83(2.70)	67(2.18)	136(4.43)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	1(0.03)	0(0.00)	1(0.03)	0(0.00)
total	225(7.33)	45(1.47)	83(2.70)	68(2.22)	136(4.43)

2.1 Nage by Day (cont. 5)

count	20	21	22	23	24
0	212(6.91)	70(2.28)	57(1.86)	67(2.18)	43(1.40)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	1(0.03)	0(0.00)	0(0.00)	1(0.03)	0(0.00)
total	213(6.94)	70(2.28)	57(1.86)	68(2.22)	43(1.40)

2.1 Nage by Day (cont. 6)

count	25	26	27	28	29
0	50(1.63)	103(3.36)	113(3.68)	76(2.48)	42(1.37)
2	0(0.00)	0(0.00)	0(0.00)	1(0.03)	0(0.00)
4	0(0.00)	2(0.07)	1(0.03)	0(0.00)	1(0.03)
total	50(1.63)	105(3.42)	114(3.71)	77(2.51)	43(1.40)

2.1 Nage by Day (cont. 7)

count	30	31	total
0	42(1.37)	61(1.99)	3053(99.48)
2	0(0.00)	0(0.00)	1(0.03)
4	0(0.00)	0(0.00)	15(0.49)
total	42(1.37)	61(1.99)	3069(100.00)

2.2 Nspec by Day

count	0	1	2	3	4
0	0(0.00)	2(0.07)	3(0.10)	1(0.03)	1(0.03)
1	0(0.00)	99(3.23)	101(3.29)	40(1.30)	31(1.01)
2	2(0.07)	32(1.04)	35(1.14)	18(0.59)	17(0.55)
3	0(0.00)	3(0.10)	1(0.03)	0(0.00)	1(0.03)
total	2(0.07)	136(4.43)	140(4.56)	59(1.92)	50(1.63)

2.2 Nspec by Day (cont. 2)

count	5	6	7	8	9
0	2(0.07)	5(0.16)	1(0.03)	1(0.03)	3(0.10)
1	50(1.63)	97(3.16)	28(0.91)	31(1.01)	43(1.40)
2	19(0.62)	31(1.01)	5(0.16)	13(0.42)	13(0.42)
3	0(0.00)	5(0.16)	0(0.00)	0(0.00)	1(0.03)
total	71(2.31)	138(4.50)	34(1.11)	45(1.47)	60(1.96)

2.2 Nspec by Day (cont. 3)

count	10	11	12	13	14
0	4(0.13)	2(0.07)	5(0.16)	0(0.00)	6(0.20)
1	99(3.23)	98(3.19)	253(8.24)	61(1.99)	78(2.54)
2	39(1.27)	56(1.82)	45(1.47)	12(0.39)	56(1.82)
3	9(0.29)	7(0.23)	1(0.03)	1(0.03)	2(0.07)
total	151(4.92)	163(5.31)	304(9.91)	74(2.41)	142(4.63)

2.2 Nspec by Day (cont. 4)

count	15	16	17	18	19
0	2(0.07)	2(0.07)	1(0.03)	2(0.07)	0(0.00)
1	172(5.60)	29(0.94)	58(1.89)	44(1.43)	90(2.93)
2	47(1.53)	13(0.42)	22(0.72)	20(0.65)	45(1.47)
3	4(0.13)	1(0.03)	2(0.07)	2(0.07)	1(0.03)
total	225(7.33)	45(1.47)	83(2.70)	68(2.22)	136(4.43)

2.2 Nspec by Day (cont. 5)

count	20	21	22	23	24
0	10(0.33)	1(0.03)	0(0.00)	0(0.00)	1(0.03)
1	139(4.53)	47(1.53)	36(1.17)	40(1.30)	26(0.85)
2	54(1.76)	19(0.62)	20(0.65)	28(0.91)	15(0.49)
3	10(0.33)	3(0.10)	1(0.03)	0(0.00)	1(0.03)
total	213(6.94)	70(2.28)	57(1.86)	68(2.22)	43(1.40)

2.2 Nspec by Day (cont. 6)

count	25	26	27	28	29
0	3(0.10)	0(0.00)	2(0.07)	2(0.07)	1(0.03)
1	32(1.04)	78(2.54)	67(2.18)	62(2.02)	25(0.81)
2	13(0.42)	24(0.78)	45(1.47)	12(0.39)	17(0.55)
3	2(0.07)	3(0.10)	0(0.00)	1(0.03)	0(0.00)
total	50(1.63)	105(3.42)	114(3.71)	77(2.51)	43(1.40)

2.2 Nspec by Day (cont. 7)

count	30	31	total
0	0(0.00)	2(0.07)	65(2.12)
1	30(0.98)	26(0.85)	2110(68.75)
2	9(0.29)	33(1.08)	829(27.01)
3	3(0.10)	0(0.00)	65(2.12)
total	42(1.37)	61(1.99)	3069(100.00)

2.3 Nsex by Day

count	0	1	2	3	4
0	2(0.07)	104(3.39)	104(3.39)	50(1.63)	42(1.37)
1	0(0.00)	21(0.68)	17(0.55)	6(0.20)	6(0.20)
2	0(0.00)	11(0.36)	19(0.62)	3(0.10)	2(0.07)
total	2(0.07)	136(4.43)	140(4.56)	59(1.92)	50(1.63)

2.3 Nsex by Day (cont. 2)

count	5	6	7	8	9
0	60(1.96)	121(3.94)	28(0.91)	40(1.30)	45(1.47)
1	9(0.29)	9(0.29)	5(0.16)	3(0.10)	8(0.26)
2	2(0.07)	8(0.26)	1(0.03)	2(0.07)	7(0.23)
total	71(2.31)	138(4.50)	34(1.11)	45(1.47)	60(1.96)

2.3 Nsex by Day (cont. 3)

count	10	11	12	13	14
0	134(4.37)	149(4.86)	207(6.74)	65(2.12)	128(4.17)
1	12(0.39)	8(0.26)	52(1.69)	5(0.16)	8(0.26)
2	5(0.16)	6(0.20)	45(1.47)	4(0.13)	6(0.20)
total	151(4.92)	163(5.31)	304(9.91)	74(2.41)	142(4.63)

2.3 Nsex by Day (cont. 4)

count	15	16	17	18	19
0	187(6.09)	38(1.24)	74(2.41)	46(1.50)	121(3.94)
1	23(0.75)	4(0.13)	7(0.23)	12(0.39)	7(0.23)
2	15(0.49)	3(0.10)	2(0.07)	10(0.33)	8(0.26)
total	225(7.33)	45(1.47)	83(2.70)	68(2.22)	136(4.43)

2.3 Nsex by Day (cont. 5)

count	20	21	22	23	24
0	196(6.39)	60(1.96)	51(1.66)	53(1.73)	34(1.11)
1	12(0.39)	7(0.23)	4(0.13)	7(0.23)	5(0.16)
2	5(0.16)	3(0.10)	2(0.07)	8(0.26)	4(0.13)
total	213(6.94)	70(2.28)	57(1.86)	68(2.22)	43(1.40)

2.3 Nsex by Day (cont. 6)

count	25	26	27	28	29
0	44(1.43)	93(3.03)	101(3.29)	58(1.89)	35(1.14)
1	4(0.13)	6(0.20)	10(0.33)	11(0.36)	5(0.16)
2	2(0.07)	6(0.20)	3(0.10)	8(0.26)	3(0.10)
total	50(1.63)	105(3.42)	114(3.71)	77(2.51)	43(1.40)

2.3 Nsex by Day (cont. 7)

count	30	31	total
0	37(1.21)	53(1.73)	2560(83.41)
1	3(0.10)	6(0.20)	302(9.84)
2	2(0.07)	2(0.07)	207(6.74)
total	42(1.37)	61(1.99)	3069(100.00)

3.1 Nage by Month

count	0	1	2	3	4
0	2(0.07)	1211(39.46)	539(17.56)	375(12.22)	251(8.18)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	5(0.16)	2(0.07)	2(0.07)	2(0.07)
total	2(0.07)	1216(39.62)	541(17.63)	377(12.28)	253(8.24)

3.1 Nage by Month (cont. 2)

count	5	6	7	8	9
0	125(4.07)	16(0.52)	24(0.78)	23(0.75)	18(0.59)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	1(0.03)	0(0.00)	2(0.07)
total	125(4.07)	16(0.52)	25(0.81)	23(0.75)	20(0.65)

3.1 Nage by Month (cont. 3)

count	10	11	12	total
0	15(0.49)	19(0.62)	435(14.17)	3053(99.48)
2	0(0.00)	0(0.00)	1(0.03)	1(0.03)
4	0(0.00)	0(0.00)	1(0.03)	15(0.49)
total	15(0.49)	19(0.62)	437(14.24)	3069(100.00)

3.2 Nspec by Month

count	0	1	2	3	4
0	0(0.00)	26(0.85)	13(0.42)	5(0.16)	2(0.07)
1	0(0.00)	822(26.78)	373(12.15)	287(9.35)	189(6.16)
2	2(0.07)	340(11.08)	144(4.69)	79(2.57)	57(1.86)
3	0(0.00)	28(0.91)	11(0.36)	6(0.20)	5(0.16)
total	2(0.07)	1216(39.62)	541(17.63)	377(12.28)	253(8.24)

3.2 Nspec by Month (cont. 2)

count	5	6	7	8	9
0	1(0.03)	2(0.07)	2(0.07)	1(0.03)	0(0.00)
1	107(3.49)	8(0.26)	15(0.49)	17(0.55)	13(0.42)
2	17(0.55)	6(0.20)	8(0.26)	5(0.16)	6(0.20)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(0.03)
total	125(4.07)	16(0.52)	25(0.81)	23(0.75)	20(0.65)

3.2 Nspec by Month (cont. 3)

count	10	11	12	total
0	0(0.00)	0(0.00)	13(0.42)	65(2.12)
1	11(0.36)	12(0.39)	256(8.34)	2110(68.75)
2	3(0.10)	6(0.20)	156(5.08)	829(27.01)
3	1(0.03)	1(0.03)	12(0.39)	65(2.12)
total	15(0.49)	19(0.62)	437(14.24)	3069(100.00)

3.3 Nsex by Month

count	0	1	2	3	4
0	2(0.07)	1022(33.30)	432(14.08)	332(10.82)	224(7.30)
1	0(0.00)	112(3.65)	66(2.15)	32(1.04)	16(0.52)
2	0(0.00)	82(2.67)	43(1.40)	13(0.42)	13(0.42)
total	2(0.07)	1216(39.62)	541(17.63)	377(12.28)	253(8.24)

3.3 Nsex by Month (cont. 2)

count	5	6	7	8	9
0	102(3.32)	11(0.36)	14(0.46)	14(0.46)	10(0.33)
1	19(0.62)	2(0.07)	5(0.16)	6(0.20)	7(0.23)
2	4(0.13)	3(0.10)	6(0.20)	3(0.10)	3(0.10)
total	125(4.07)	16(0.52)	25(0.81)	23(0.75)	20(0.65)

3.3 Nsex by Month (cont. 3)

count	10	11	12	total
0	8(0.26)	11(0.36)	378(12.32)	2560(83.41)
1	1(0.03)	5(0.16)	31(1.01)	302(9.84)
2	6(0.20)	3(0.10)	28(0.91)	207(6.74)
total	15(0.49)	19(0.62)	437(14.24)	3069(100.00)

4.1 Nspec by Nage

count	0	2	4	total
0	65(2.12)	0(0.00)	0(0.00)	65(2.12)
1	2097(68.33)	1(0.03)	12(0.39)	2110(68.75)
2	826(26.91)	0(0.00)	3(0.10)	829(27.01)
3	65(2.12)	0(0.00)	0(0.00)	65(2.12)
total	3053(99.48)	1(0.03)	15(0.49)	3069(100.00)

4.2 Nsex by Nage

count	0	2	4	total
0	2559(83.38)	0(0.00)	1(0.03)	2560(83.41)
1	295(9.61)	0(0.00)	7(0.23)	302(9.84)
2	199(6.48)	1(0.03)	7(0.23)	207(6.74)
total	3053(99.48)	1(0.03)	15(0.49)	3069(100.00)

5.1 Nage by Nplum

count	0	1	total
0	3040(99.06)	13(0.42)	3053(99.48)
2	1(0.03)	0(0.00)	1(0.03)
4	15(0.49)	0(0.00)	15(0.49)
total	3056(99.58)	13(0.42)	3069(100.00)

5.2 Nspec by Nplum

count	0	1	total
0	65(2.12)	0(0.00)	65(2.12)
1	2107(68.65)	3(0.10)	2110(68.75)
2	819(26.69)	10(0.33)	829(27.01)
3	65(2.12)	0(0.00)	65(2.12)
total	3056(99.58)	13(0.42)	3069(100.00)

5.3 Nsex by Nplum

count	0	1	total
0	2550(83.09)	10(0.33)	2560(83.41)
1	300(9.78)	2(0.07)	302(9.84)
2	206(6.71)	1(0.03)	207(6.74)
total	3056(99.58)	13(0.42)	3069(100.00)

6.1 Nage by Nsex

count	0	1	2	total
0	2559(83.38)	295(9.61)	199(6.48)	3053(99.48)
2	0(0.00)	0(0.00)	1(0.03)	1(0.03)
4	1(0.03)	7(0.23)	7(0.23)	15(0.49)
total	2560(83.41)	302(9.84)	207(6.74)	3069(100.00)

6.2 Nspec by Nsex

count	0	1	2	total
0	51(1.66)	6(0.20)	8(0.26)	65(2.12)
1	1737(56.60)	228(7.43)	145(4.72)	2110(68.75)
2	708(23.07)	68(2.22)	53(1.73)	829(27.01)
3	64(2.09)	0(0.00)	1(0.03)	65(2.12)
total	2560(83.41)	302(9.84)	207(6.74)	3069(100.00)

7.1 Nage by Nspec

count	0	1	2	3	total
0	65(2.12)	2097(68.33)	826(26.91)	65(2.12)	3053(99.48)
2	0(0.00)	1(0.03)	0(0.00)	0(0.00)	1(0.03)
4	0(0.00)	12(0.39)	3(0.10)	0(0.00)	15(0.49)
total	65(2.12)	2110(68.75)	829(27.01)	65(2.12)	3069(100.00)

7.2 Nsex by Nspec

count	0	1	2	3	total
0	51(1.66)	1737(56.60)	708(23.07)	64(2.09)	2560(83.41)
1	6(0.20)	228(7.43)	68(2.22)	0(0.00)	302(9.84)
2	8(0.26)	145(4.72)	53(1.73)	1(0.03)	207(6.74)
total	65(2.12)	2110(68.75)	829(27.01)	65(2.12)	3069(100.00)

8.1 Nage by Nweight

count	0	total
0	3053(99.48)	3053(99.48)
2	1(0.03)	1(0.03)
4	15(0.49)	15(0.49)
total	3069(100.00)	3069(100.00)

8.2 Nspec by Nweight

count	0	total
0	65(2.12)	65(2.12)
1	2110(68.75)	2110(68.75)
2	829(27.01)	829(27.01)
3	65(2.12)	65(2.12)
total	3069(100.00)	3069(100.00)

8.3 Nsex by Nweight

count	0	total
0	2560(83.41)	2560(83.41)
1	302(9.84)	302(9.84)
2	207(6.74)	207(6.74)
total	3069(100.00)	3069(100.00)

9.1 Nage by Obtain

count	2	5	7	8	9
0	18(0.59)	1(0.03)	2831(92.25)	199(6.48)	4(0.13)
2	0(0.00)	0(0.00)	1(0.03)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	10(0.33)	5(0.16)	0(0.00)
total	18(0.59)	1(0.03)	2842(92.60)	204(6.65)	4(0.13)

9.1 Nage by Obtain (cont. 2)

count	total
0	3053(99.48)
2	1(0.03)
4	15(0.49)
total	3069(100.00)

9.2 Nspec by Obtain

count	2	5	7	8	9
0	0(0.00)	0(0.00)	61(1.99)	4(0.13)	0(0.00)
1	14(0.46)	1(0.03)	1899(61.88)	192(6.26)	4(0.13)
2	3(0.10)	0(0.00)	821(26.75)	5(0.16)	0(0.00)
3	1(0.03)	0(0.00)	61(1.99)	3(0.10)	0(0.00)
total	18(0.59)	1(0.03)	2842(92.60)	204(6.65)	4(0.13)

9.2 Nspec by Obtain (cont. 2)

count	total
0	65(2.12)
1	2110(68.75)
2	829(27.01)
3	65(2.12)
total	3069(100.00)

9.3 Nsex by Obtain

count	2	5	7	8	9
0	12(0.39)	1(0.03)	2412(78.59)	132(4.30)	3(0.10)
1	4(0.13)	0(0.00)	250(8.15)	48(1.56)	0(0.00)
2	2(0.07)	0(0.00)	180(5.87)	24(0.78)	1(0.03)
total	18(0.59)	1(0.03)	2842(92.60)	204(6.65)	4(0.13)

9.3 Nsex by Obtain (cont. 2)

count	total
0	2560(83.41)
1	302(9.84)
2	207(6.74)
total	3069(100.00)

10.1 Nage by Plumage

count	0	9	total
0	13(0.42)	3040(99.06)	3053(99.48)
2	0(0.00)	1(0.03)	1(0.03)
4	0(0.00)	15(0.49)	15(0.49)
total	13(0.42)	3056(99.58)	3069(100.00)

10.2 Nspec by Plumage

count	0	9	total
0	0(0.00)	65(2.12)	65(2.12)
1	3(0.10)	2107(68.65)	2110(68.75)
2	10(0.33)	819(26.69)	829(27.01)
3	0(0.00)	65(2.12)	65(2.12)
total	13(0.42)	3056(99.58)	3069(100.00)

10.3 Nsex by Plumage

count	0	9	total
0	10(0.33)	2550(83.09)	2560(83.41)
1	2(0.07)	300(9.78)	302(9.84)
2	1(0.03)	206(6.71)	207(6.74)
total	13(0.42)	3056(99.58)	3069(100.00)

11.1 Nage by Rep

count	1	2	3	4	5
0	2710(88.30)	250(8.15)	73(2.38)	13(0.42)	6(0.20)
2	1(0.03)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	12(0.39)	1(0.03)	2(0.07)	0(0.00)	0(0.00)
total	2723(88.73)	251(8.18)	75(2.44)	13(0.42)	6(0.20)

11.1 Nage by Rep (cont. 2)

count	6	total
0	1(0.03)	3053(99.48)
2	0(0.00)	1(0.03)
4	0(0.00)	15(0.49)
total	1(0.03)	3069(100.00)

11.2 Nspec by Rep

count	1	2	3	4	5
0	58(1.89)	6(0.20)	1(0.03)	0(0.00)	0(0.00)
1	1822(59.37)	206(6.71)	64(2.09)	11(0.36)	6(0.20)
2	790(25.74)	30(0.98)	7(0.23)	2(0.07)	0(0.00)
3	53(1.73)	9(0.29)	3(0.10)	0(0.00)	0(0.00)
total	2723(88.73)	251(8.18)	75(2.44)	13(0.42)	6(0.20)

11.2 Nspec by Rep (cont. 2)

count	6	total
0	0(0.00)	65(2.12)
1	1(0.03)	2110(68.75)
2	0(0.00)	829(27.01)
3	0(0.00)	65(2.12)
total	1(0.03)	3069(100.00)

11.3 Nsex by Rep

count	1	2	3	4	5
0	2277(74.19)	205(6.68)	60(1.96)	12(0.39)	6(0.20)
1	273(8.90)	20(0.65)	8(0.26)	1(0.03)	0(0.00)
2	173(5.64)	26(0.85)	7(0.23)	0(0.00)	0(0.00)
total	2723(88.73)	251(8.18)	75(2.44)	13(0.42)	6(0.20)

11.3 Nsex by Rep (cont. 2)

count	6	total
0	0(0.00)	2560(83.41)
1	0(0.00)	302(9.84)
2	1(0.03)	207(6.74)
total	1(0.03)	3069(100.00)

12.1 Nage by Season

count	0	1	2	3	4
0	2(0.07)	2185(71.20)	751(24.47)	63(2.05)	52(1.69)
2	0(0.00)	1(0.03)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	8(0.26)	4(0.13)	1(0.03)	2(0.07)
total	2(0.07)	2194(71.49)	755(24.60)	64(2.09)	54(1.76)

12.1 Nage by Season (cont. 2)

count	total
0	3053(99.48)
2	1(0.03)
4	15(0.49)
total	3069(100.00)

12.2 Nspec by Season

count	0	1	2	3	4
0	0(0.00)	52(1.69)	8(0.26)	5(0.16)	0(0.00)
1	0(0.00)	1451(47.28)	583(19.00)	40(1.30)	36(1.17)
2	2(0.07)	640(20.85)	153(4.99)	19(0.62)	15(0.49)
3	0(0.00)	51(1.66)	11(0.36)	0(0.00)	3(0.10)
total	2(0.07)	2194(71.49)	755(24.60)	64(2.09)	54(1.76)

12.2 Nspec by Season (cont. 2)

count	total
0	65(2.12)
1	2110(68.75)
2	829(27.01)
3	65(2.12)
total	3069(100.00)

12.3 Nsex by Season

count	0	1	2	3	4
0	2(0.07)	1832(59.69)	658(21.44)	39(1.27)	29(0.94)
1	0(0.00)	209(6.81)	67(2.18)	13(0.42)	13(0.42)
2	0(0.00)	153(4.99)	30(0.98)	12(0.39)	12(0.39)
total	2(0.07)	2194(71.49)	755(24.60)	64(2.09)	54(1.76)

12.3 Nsex by Season (cont. 2)

count	total
0	2560(83.41)
1	302(9.84)
2	207(6.74)
total	3069(100.00)

13.1 Nage by Sex

count	0	1	3	4	5
0	18(0.59)	1(0.03)	1(0.03)	293(9.55)	199(6.48)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(0.03)
4	0(0.00)	0(0.00)	7(0.23)	0(0.00)	7(0.23)
total	18(0.59)	1(0.03)	8(0.26)	293(9.55)	207(6.74)

13.1 Nage by Sex (cont. 2)

count	6	9	total
0	3(0.10)	2538(82.70)	3053(99.48)
2	0(0.00)	0(0.00)	1(0.03)
4	0(0.00)	1(0.03)	15(0.49)
total	3(0.10)	2539(82.73)	3069(100.00)

13.2 Nspec by Sex

count	0	1	3	4	5
0	0(0.00)	0(0.00)	0(0.00)	6(0.20)	8(0.26)
1	0(0.00)	1(0.03)	7(0.23)	220(7.17)	145(4.72)
2	18(0.59)	0(0.00)	1(0.03)	67(2.18)	53(1.73)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(0.03)
total	18(0.59)	1(0.03)	8(0.26)	293(9.55)	207(6.74)

13.2 Nspec by Sex (cont. 2)

count	6	9	total
0	0(0.00)	51(1.66)	65(2.12)
1	2(0.07)	1735(56.53)	2110(68.75)
2	1(0.03)	689(22.45)	829(27.01)
3	0(0.00)	64(2.09)	65(2.12)
total	3(0.10)	2539(82.73)	3069(100.00)

13.3 Nsex by Sex

count	0	1	3	4	5
0	18(0.59)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	0(0.00)	1(0.03)	8(0.26)	293(9.55)	0(0.00)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	207(6.74)
total	18(0.59)	1(0.03)	8(0.26)	293(9.55)	207(6.74)

13.3 Nsex by Sex (cont. 2)

count	6	9	total
0	3(0.10)	2539(82.73)	2560(83.41)
1	0(0.00)	0(0.00)	302(9.84)
2	0(0.00)	0(0.00)	207(6.74)
total	3(0.10)	2539(82.73)	3069(100.00)

14.1 Nage by Species

count	1	2	4	5	7
0	2097(68.33)	826(26.91)	8(0.26)	65(2.12)	37(1.21)
2	1(0.03)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	12(0.39)	3(0.10)	0(0.00)	0(0.00)	0(0.00)
total	2110(68.75)	829(27.01)	8(0.26)	65(2.12)	37(1.21)

14.1 Nage by Species (cont. 2)

count	8	9	21	26	27
0	6(0.20)	5(0.16)	1(0.03)	7(0.23)	1(0.03)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	6(0.20)	5(0.16)	1(0.03)	7(0.23)	1(0.03)

14.1 Nage by Species (cont. 3)

count	total
0	3053(99.48)
2	1(0.03)
4	15(0.49)
total	3069(100.00)

14.2 Nspec by Species

count	1	2	4	5	7
0	0(0.00)	0(0.00)	8(0.26)	0(0.00)	37(1.21)
1	2110(68.75)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	829(27.01)	0(0.00)	0(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	65(2.12)	0(0.00)
total	2110(68.75)	829(27.01)	8(0.26)	65(2.12)	37(1.21)

14.2 Nspec by Species (cont. 2)

count	8	9	21	26	27
0	6(0.20)	5(0.16)	1(0.03)	7(0.23)	1(0.03)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	6(0.20)	5(0.16)	1(0.03)	7(0.23)	1(0.03)

14.2 Nspec by Species (cont. 3)

count	total
0	65(2.12)
1	2110(68.75)
2	829(27.01)
3	65(2.12)
total	3069(100.00)

14.3 Nsex by Species

count	1	2	4	5	7
0	1737(56.60)	708(23.07)	3(0.10)	64(2.09)	32(1.04)
1	228(7.43)	68(2.22)	2(0.07)	0(0.00)	2(0.07)
2	145(4.72)	53(1.73)	3(0.10)	1(0.03)	3(0.10)
total	2110(68.75)	829(27.01)	8(0.26)	65(2.12)	37(1.21)

14.3 Nsex by Species (cont. 2)

count	8	9	21	26	27
0	3(0.10)	4(0.13)	1(0.03)	7(0.23)	1(0.03)
1	2(0.07)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
2	1(0.03)	1(0.03)	0(0.00)	0(0.00)	0(0.00)
total	6(0.20)	5(0.16)	1(0.03)	7(0.23)	1(0.03)

14.3 Nsex by Species (cont. 3)

count	total
0	2560(83.41)
1	302(9.84)
2	207(6.74)
total	3069(100.00)

15.1 Nage by Station

count	0	1	3	4	total
0	3049(99.35)	2(0.07)	1(0.03)	1(0.03)	3053(99.48)
2	1(0.03)	0(0.00)	0(0.00)	0(0.00)	1(0.03)
4	15(0.49)	0(0.00)	0(0.00)	0(0.00)	15(0.49)
total	3065(99.87)	2(0.07)	1(0.03)	1(0.03)	3069(100.00)

15.2 Nspec by Station

count	0	1	3	4	total
0	65(2.12)	0(0.00)	0(0.00)	0(0.00)	65(2.12)
1	2106(68.62)	2(0.07)	1(0.03)	1(0.03)	2110(68.75)
2	829(27.01)	0(0.00)	0(0.00)	0(0.00)	829(27.01)
3	65(2.12)	0(0.00)	0(0.00)	0(0.00)	65(2.12)
total	3065(99.87)	2(0.07)	1(0.03)	1(0.03)	3069(100.00)

15.3 Nsex by Station

count	0	1	3	4	total
0	2559(83.38)	0(0.00)	0(0.00)	1(0.03)	2560(83.41)
1	299(9.74)	2(0.07)	1(0.03)	0(0.00)	302(9.84)
2	207(6.74)	0(0.00)	0(0.00)	0(0.00)	207(6.74)
total	3065(99.87)	2(0.07)	1(0.03)	1(0.03)	3069(100.00)

16.1 Nage by Status

count	0	99	total
0	13(0.42)	3040(99.06)	3053(99.48)
2	0(0.00)	1(0.03)	1(0.03)
4	0(0.00)	15(0.49)	15(0.49)
total	13(0.42)	3056(99.58)	3069(100.00)

16.2 Nspec by Status

count	0	99	total
0	0(0.00)	65(2.12)	65(2.12)
1	3(0.10)	2107(68.65)	2110(68.75)
2	10(0.33)	819(26.69)	829(27.01)
3	0(0.00)	65(2.12)	65(2.12)
total	13(0.42)	3056(99.58)	3069(100.00)

16.3 Nsex by Status

count	0	99	total
0	10(0.33)	2550(83.09)	2560(83.41)
1	2(0.07)	300(9.78)	302(9.84)
2	1(0.03)	206(6.71)	207(6.74)
total	13(0.42)	3056(99.58)	3069(100.00)

17.1 Nage by Time

count	0	total
0	3053(99.48)	3053(99.48)
2	1(0.03)	1(0.03)
4	15(0.49)	15(0.49)
total	3069(100.00)	3069(100.00)

17.2 Nspec by Time

count	0	total
0	65(2.12)	65(2.12)
1	2110(68.75)	2110(68.75)
2	829(27.01)	829(27.01)
3	65(2.12)	65(2.12)
total	3069(100.00)	3069(100.00)

17.3 Nsex by Time

count	0	total
0	2560(83.41)	2560(83.41)
1	302(9.84)	302(9.84)
2	207(6.74)	207(6.74)
total	3069(100.00)	3069(100.00)

18.1 Nage by Year

count	53	54	55	56	57
0	34(1.11)	89(2.90)	49(1.60)	52(1.69)	96(3.13)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	34(1.11)	89(2.90)	49(1.60)	52(1.69)	96(3.13)

18.1 Nage by Year (cont. 2)

count	58	59	60	61	62
0	114(3.71)	141(4.59)	82(2.67)	73(2.38)	114(3.71)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	1(0.03)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	115(3.75)	141(4.59)	82(2.67)	73(2.38)	114(3.71)

18.1 Nage by Year (cont. 3)

count	63	64	65	66	67
0	71(2.31)	45(1.47)	42(1.37)	9(0.29)	7(0.23)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	71(2.31)	45(1.47)	42(1.37)	9(0.29)	7(0.23)

18.1 Nage by Year (cont. 4)

count	68	69	70	71	72
0	127(4.14)	261(8.50)	217(7.07)	160(5.21)	148(4.82)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	127(4.14)	261(8.50)	217(7.07)	160(5.21)	148(4.82)

18.1 Nage by Year (cont. 5)

count	73	74	75	76	77
0	42(1.37)	335(10.92)	357(11.63)	305(9.94)	13(0.42)
2	1(0.03)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	1(0.03)	1(0.03)	4(0.13)	8(0.26)
total	43(1.40)	336(10.95)	358(11.67)	309(10.07)	21(0.68)

18.1 Nage by Year (cont. 6)

count	78	79	80	81	82
0	19(0.62)	14(0.46)	2(0.07)	7(0.23)	11(0.36)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
4	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	19(0.62)	14(0.46)	2(0.07)	7(0.23)	11(0.36)

18.1 Nage by Year (cont. 7)

count	83	84	85	total
0	9(0.29)	5(0.16)	3(0.10)	3053(99.48)
2	0(0.00)	0(0.00)	0(0.00)	1(0.03)
4	0(0.00)	0(0.00)	0(0.00)	15(0.49)
total	9(0.29)	5(0.16)	3(0.10)	3069(100.00)

18.2 Nspec by Year

count	53	54	55	56	57
0	1(0.03)	1(0.03)	3(0.10)	1(0.03)	2(0.07)
1	26(0.85)	66(2.15)	18(0.59)	32(1.04)	39(1.27)
2	7(0.23)	18(0.59)	26(0.85)	16(0.52)	54(1.76)
3	0(0.00)	4(0.13)	2(0.07)	3(0.10)	1(0.03)
total	34(1.11)	89(2.90)	49(1.60)	52(1.69)	96(3.13)

18.2 Nspec by Year (cont. 2)

count	58	59	60	61	62
0	3(0.10)	2(0.07)	0(0.00)	0(0.00)	1(0.03)
1	59(1.92)	66(2.15)	43(1.40)	53(1.73)	76(2.48)
2	50(1.63)	72(2.35)	39(1.27)	20(0.65)	37(1.21)
3	3(0.10)	1(0.03)	0(0.00)	0(0.00)	0(0.00)
total	115(3.75)	141(4.59)	82(2.67)	73(2.38)	114(3.71)

18.2 Nspec by Year (cont. 3)

count	63	64	65	66	67
0	0(0.00)	3(0.10)	5(0.16)	1(0.03)	0(0.00)
1	47(1.53)	28(0.91)	27(0.88)	4(0.13)	4(0.13)
2	23(0.75)	10(0.33)	4(0.13)	1(0.03)	2(0.07)
3	1(0.03)	4(0.13)	6(0.20)	3(0.10)	1(0.03)
total	71(2.31)	45(1.47)	42(1.37)	9(0.29)	7(0.23)

18.2 Nspec by Year (cont. 4)

count	68	69	70	71	72
0	7(0.23)	5(0.16)	11(0.36)	4(0.13)	1(0.03)
1	74(2.41)	224(7.30)	146(4.76)	115(3.75)	128(4.17)
2	42(1.37)	30(0.98)	54(1.76)	37(1.21)	19(0.62)
3	4(0.13)	2(0.07)	6(0.20)	4(0.13)	0(0.00)
total	127(4.14)	261(8.50)	217(7.07)	160(5.21)	148(4.82)

18.2 Nspec by Year (cont. 5)

count	73	74	75	76	77
0	1(0.03)	5(0.16)	1(0.03)	7(0.23)	0(0.00)
1	38(1.24)	255(8.31)	281(9.16)	183(5.96)	17(0.55)
2	4(0.13)	64(2.09)	75(2.44)	112(3.65)	4(0.13)
3	0(0.00)	12(0.39)	1(0.03)	7(0.23)	0(0.00)
total	43(1.40)	336(10.95)	358(11.67)	309(10.07)	21(0.68)

18.2 Nspec by Year (cont. 6)

count	78	79	80	81	82
0	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	18(0.59)	11(0.36)	2(0.07)	5(0.16)	10(0.33)
2	1(0.03)	3(0.10)	0(0.00)	2(0.07)	1(0.03)
3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
total	19(0.62)	14(0.46)	2(0.07)	7(0.23)	11(0.36)

18.2 Nspec by Year (cont. 7)

count	83	84	85	total
0	0(0.00)	0(0.00)	0(0.00)	65(2.12)
1	8(0.26)	5(0.16)	2(0.07)	2110(68.75)
2	1(0.03)	0(0.00)	1(0.03)	829(27.01)
3	0(0.00)	0(0.00)	0(0.00)	65(2.12)
total	9(0.29)	5(0.16)	3(0.10)	3069(100.00)

18.3 Nsex by Year

count	53	54	55	56	57
0	34(1.11)	89(2.90)	49(1.60)	52(1.69)	81(2.64)
1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	6(0.20)
2	0(0.00)	0(0.00)	0(0.00)	0(0.00)	9(0.29)
total	34(1.11)	89(2.90)	49(1.60)	52(1.69)	96(3.13)

18.3 Nsex by Year (cont. 2)

count	58	59	60	61	62
0	104(3.39)	128(4.17)	73(2.38)	69(2.25)	112(3.65)
1	5(0.16)	9(0.29)	5(0.16)	3(0.10)	1(0.03)
2	6(0.20)	4(0.13)	4(0.13)	1(0.03)	1(0.03)
total	115(3.75)	141(4.59)	82(2.67)	73(2.38)	114(3.71)

18.3 Nsex by Year (cont. 3)

count	63	64	65	66	67
0	69(2.25)	43(1.40)	41(1.34)	9(0.29)	6(0.20)
1	2(0.07)	2(0.07)	0(0.00)	0(0.00)	1(0.03)
2	0(0.00)	0(0.00)	1(0.03)	0(0.00)	0(0.00)
total	71(2.31)	45(1.47)	42(1.37)	9(0.29)	7(0.23)

18.3 Nsex by Year (cont. 4)

count	68	69	70	71	72
0	118(3.84)	138(4.50)	200(6.52)	123(4.01)	116(3.78)
1	4(0.13)	64(2.09)	14(0.46)	18(0.59)	17(0.55)
2	5(0.16)	59(1.92)	3(0.10)	19(0.62)	15(0.49)
total	127(4.14)	261(8.50)	217(7.07)	160(5.21)	148(4.82)

18.3 Nsex by Year (cont. 5)

count	73	74	75	76	77
0	33(1.08)	301(9.81)	306(9.97)	264(8.60)	0(0.00)
1	7(0.23)	21(0.68)	31(1.01)	29(0.94)	13(0.42)
2	3(0.10)	14(0.46)	21(0.68)	16(0.52)	8(0.26)
total	43(1.40)	336(10.95)	358(11.67)	309(10.07)	21(0.68)

18.3 Nsex by Year (cont. 6)

count	78	79	80	81	82
0	2(0.07)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1	12(0.39)	10(0.33)	2(0.07)	4(0.13)	8(0.26)
2	5(0.16)	4(0.13)	0(0.00)	3(0.10)	3(0.10)
total	19(0.62)	14(0.46)	2(0.07)	7(0.23)	11(0.36)

18.3 Nsex by Year (cont. 7)

count	83	84	85	total
0	0(0.00)	0(0.00)	0(0.00)	2560(83.41)
1	7(0.23)	5(0.16)	2(0.07)	302(9.84)
2	2(0.07)	0(0.00)	1(0.03)	207(6.74)
total	9(0.29)	5(0.16)	3(0.10)	3069(100.00)

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTER

Duck Banding Programme

Addendum to DATA ANALYSIS AND TABULATION - REPORT II

Report prepared for: Western Australian Wildlife Research Center
Ocean Reef road,
Woodvale. 6062
W.A. (Dr Stuart Halse)

By: Dean Diepeveen,
Statistical Consulting Group
University of Western Australia.

April 1988

ADDENDUM - DISTANCES AND DIRECTIONS

A1. TABLE OF NUMBER OF SPECIES.

NOTE:

This is the number of ducks with more than one record (or capture).

NSPEC	COUNT
B.DUCK	4596
G.TEAL	1104
M.DUCK	139
others	107
total	5946

A2. TABLE OF DISTANCE (rows) BY DIRECTION (columns) - BLACK DUCK.

NOTE:

DISTANCE - in Kilometers

DIRECTION - directions of the compass with "0" meaning that the duck did NOT travel in any direction.

These tables (A2-A4) are frequency tables. (ie each cell of the table represents the number of duck that have travelled in that particular direction and distance).

dist	0	N	NE	E	SE	S	SW	W	NW	TOTAL
0	3308	0	0	0	0	0	0	0	0	3308
2	0	11	0	1	0	16	0	38	0	66
3	0	0	23	0	27	0	12	0	17	79
4	0	24	0	34	0	42	0	18	0	118
5	0	0	0	0	0	0	4	0	2	6
6	0	18	0	15	0	2	0	1	0	36
7	0	1	0	0	0	0	0	3	0	4
8	0	6	1	0	0	2	0	3	0	12
10	0	73	0	14	0	9	0	5	0	101
11	0	0	0	6	0	4	0	4	0	14
12	0	5	0	19	0	4	0	1	0	29
13	0	3	1	9	2	32	0	34	0	81
14	0	0	0	0	0	3	0	5	0	8
15	0	2	0	0	0	11	0	13	0	26
16	0	0	2	1	0	4	2	2	0	11
17	0	5	0	2	0	10	0	0	0	17
18	0	3	0	1	0	6	0	9	0	19
19	0	0	2	0	0	6	0	0	0	8
20	0	5	0	6	0	4	0	0	0	15
21	0	0	0	1	0	0	0	0	0	1
22	0	3	0	3	0	0	0	0	0	6
23	0	1	0	2	0	1	0	3	0	7
24	0	0	0	0	0	0	1	0	0	1
114	0	3	0	3	0	8	0	4	0	18
115	0	1	0	1	0	5	0	1	0	8
116	0	3	0	1	0	17	0	8	0	29
117	0	0	0	2	0	0	0	12	0	14
118	0	8	0	0	0	3	0	6	0	17

dist	0	N	NE	E	SE	S	SW	W	NW	TOTAL
119	0	2	0	0	0	0	0	5	0	7
120	0	2	0	1	0	3	0	0	0	6
122	0	0	0	0	0	4	0	1	0	5
124	0	1	0	10	0	2	0	0	0	13
125	0	0	0	1	0	6	0	0	0	7
126	0	48	0	0	0	34	0	0	0	82
127	0	0	0	0	0	6	0	44	0	50
128	0	0	0	0	0	1	0	6	0	7
129	0	0	0	0	0	7	0	24	0	31
130	0	3	0	1	0	3	0	1	0	8
131	0	2	0	1	0	3	0	14	0	20
132	0	0	0	1	0	1	0	0	0	2
161	0	0	0	0	2	0	0	0	0	2
164	0	0	0	1	0	0	0	1	2	4
165	0	0	0	0	0	1	0	3	0	4
167	0	1	0	0	0	0	0	0	4	5
168	0	1	0	1	0	0	0	1	0	3
171	0	0	0	1	0	5	0	0	0	6
172	0	1	0	1	0	6	0	9	0	17
174	0	2	0	0	0	0	0	0	0	2
175	0	0	0	8	0	0	0	17	0	25
176	0	0	0	3	0	0	0	0	0	3
179	0	1	0	3	0	0	0	0	0	4
180	0	1	0	0	0	0	0	0	0	1
181	0	1	0	1	0	3	0	0	0	5
183	0	0	0	2	0	0	0	0	1	3
228	0	8	0	0	0	9	0	0	0	17
229	0	2	0	3	0	0	0	2	0	7
230	0	4	0	0	0	2	0	7	0	13
231	0	0	0	1	0	0	0	1	0	2
232	0	2	0	0	0	0	0	5	0	7
234	0	1	0	1	0	0	0	1	0	3
236	0	1	0	0	0	0	0	1	0	2
241	0	0	0	0	0	4	0	0	0	4
242	0	0	0	1	0	0	0	0	0	1
243	0	0	0	0	0	5	0	0	0	5
245	0	0	0	0	0	1	0	0	0	1
255	0	3	0	0	0	0	0	0	0	3
256	0	1	0	0	0	0	0	0	0	1
257	0	2	0	0	0	0	0	0	0	2
258	0	0	0	1	0	1	0	0	0	2
260	0	7	0	0	0	0	0	0	0	7
261	0	2	0	1	0	0	0	1	0	4
262	0	1	0	0	0	0	0	0	0	1
263	0	0	0	0	0	1	0	1	0	2
264	0	4	0	0	0	0	0	0	0	4
265	0	1	0	1	0	0	0	0	0	2
266	0	0	0	0	0	1	0	0	0	1
267	0	1	0	0	0	0	0	0	0	1
268	0	1	0	0	0	1	0	0	0	2
269	0	0	0	0	0	1	0	0	0	1
270	0	0	0	0	0	1	0	0	0	1
271	0	0	0	0	0	2	0	0	0	2
272	0	19	0	0	0	8	0	0	0	27
274	0	1	0	0	0	0	0	0	0	1
275	0	6	0	0	0	0	0	0	0	6

dist	0	N	NE	E	SE	S	SW	W	NW	TOTAL
276	0	1	0	0	0	1	0	0	0	2
342	0	2	0	1	0	3	0	0	0	6
344	0	0	0	0	0	1	0	0	0	1
352	0	0	0	1	0	1	0	0	0	2
357	0	0	0	0	0	1	0	0	0	1
359	0	0	0	0	0	0	0	1	0	1
360	0	0	0	1	0	1	0	0	0	2
361	0	0	0	0	0	0	0	1	0	1
362	0	0	0	0	0	0	0	1	0	1
364	0	2	0	0	0	2	0	4	0	8
366	0	1	0	0	0	1	0	0	0	2
368	0	0	0	0	0	0	0	2	0	2
371	0	0	0	1	0	1	0	0	0	2
374	0	0	0	0	0	1	0	0	0	1
376	0	1	0	0	0	0	0	0	0	1
421	0	0	0	1	0	0	0	0	0	1
424	0	0	0	0	0	1	0	0	0	1
425	0	0	0	0	0	1	0	0	0	1
432	0	0	0	1	0	0	0	0	0	1
458	0	0	0	1	0	0	0	0	0	1
460	0	0	0	2	0	0	0	0	0	2
462	0	0	0	10	0	0	0	0	0	10
468	0	0	0	0	0	1	0	0	0	1
470	0	1	0	0	0	0	0	0	0	1
471	0	0	0	1	0	0	0	0	0	1
480	0	1	0	0	0	0	0	0	0	1
499	0	0	0	1	0	0	0	0	0	1
511	0	1	0	0	0	0	0	0	0	1
512	0	1	0	0	0	0	0	0	0	1
530	0	1	0	0	0	0	0	0	0	1
572	0	1	0	0	0	0	0	2	0	3
574	0	0	0	0	0	0	0	1	0	1
587	0	0	0	1	0	0	0	0	0	1
596	0	0	0	1	0	0	0	0	0	1
686	0	2	0	0	0	0	0	0	0	2
690	0	1	0	0	0	0	0	0	0	1
692	0	0	0	0	0	0	0	1	0	1
828	0	1	0	0	0	0	0	0	0	1
829	0	1	0	0	0	0	0	0	0	1
847	0	1	0	0	0	0	0	0	0	1
1412	0	1	0	0	0	0	0	0	0	1
1843	0	2	0	0	0	0	0	0	0	2
2358	0	0	0	1	0	0	0	0	0	1
3329	0	0	0	1	0	0	0	0	0	1
3939	0	1	0	0	0	0	0	0	0	1
4033	0	1	0	0	0	0	0	0	0	1
4239	0	5	0	0	0	0	0	0	0	5
total	3308	337	29	191	31	327	19	328	26	4596

A3. TABLE OF DISTANCE (rows) BY DIRECTION (columns) - GREY TEAL.

dist	0	N	NE	E	SE	S	SW	W	NW	TOTAL
0	638	0	0	0	0	0	0	0	0	638
2	0	5	0	3	0	0	0	8	0	16
3	0	0	5	0	4	0	2	0	1	12
4	0	4	0	5	0	6	0	3	0	18
5	0	0	2	0	0	0	0	0	0	2
6	0	9	0	5	0	0	0	2	0	16
7	0	1	0	0	0	0	0	0	0	1
8	0	2	0	1	0	0	0	0	0	3
10	0	1	0	2	0	0	0	2	0	5
11	0	0	0	3	0	0	0	2	0	5
12	0	0	0	3	0	2	0	1	0	6
13	0	0	0	0	0	12	0	2	0	14
14	0	0	0	0	0	1	0	0	0	1
15	0	1	0	0	0	1	0	1	0	3
16	0	0	0	0	0	5	0	0	0	5
17	0	2	0	1	0	3	0	0	0	6
18	0	1	0	0	0	5	0	1	0	7
22	0	0	0	1	0	0	0	0	0	1
23	0	1	0	0	0	0	0	0	0	1
24	0	0	0	0	0	0	0	0	1	1
114	0	2	0	5	0	1	0	4	0	12
115	0	2	0	4	0	1	0	2	0	9
116	0	2	0	1	0	0	0	0	0	3
117	0	0	0	1	0	0	0	1	0	2
118	0	2	0	0	0	4	0	0	0	6
119	0	1	0	0	0	0	0	0	0	1
120	0	3	0	1	0	1	0	0	0	5
122	0	1	0	0	0	0	0	1	0	2
124	0	0	0	1	0	0	0	1	0	2
125	0	0	0	0	0	0	0	2	0	2
126	0	0	0	3	0	1	0	0	0	4
127	0	0	0	0	0	1	0	5	0	6
128	0	0	0	0	0	1	0	0	0	1
129	0	0	0	0	0	1	0	0	0	1
130	0	0	0	0	0	0	0	2	0	2
131	0	0	0	0	0	4	0	3	0	7
161	0	0	0	0	1	0	0	0	0	1
163	0	1	0	2	0	1	0	0	0	4
165	0	0	0	1	0	0	0	0	0	1
168	0	1	0	1	0	0	0	0	0	2
169	0	0	0	0	0	0	0	1	0	1
171	0	0	0	1	0	4	0	0	0	5
172	0	0	0	1	0	3	0	0	0	4
174	0	0	0	0	0	0	0	1	0	1
175	0	0	0	3	0	1	0	0	0	4
176	0	0	0	0	0	1	0	1	0	2
178	0	0	0	0	0	1	0	0	0	1
179	0	0	0	1	0	1	0	0	0	2
180	0	0	0	0	1	0	0	0	0	1
181	0	1	0	3	0	0	0	0	0	4
183	0	0	0	0	1	0	0	0	0	1
228	0	0	0	0	0	1	0	3	0	4
229	0	1	0	0	0	0	0	1	0	2
230	0	2	0	0	0	2	0	2	0	6

dist	0	N	NE	E	SE	S	SW	W	NW	TOTAL
231	0	1	0	0	0	0	0	0	0	1
232	0	1	0	0	0	3	0	0	0	4
234	0	1	0	0	0	0	0	0	0	1
239	0	0	0	1	0	0	0	0	0	1
240	0	0	0	1	0	0	0	0	0	1
241	0	0	0	0	0	2	0	0	0	2
242	0	0	0	0	0	1	0	0	0	1
243	0	0	0	0	0	1	0	0	0	1
245	0	0	0	0	0	1	0	0	0	1
246	0	0	0	1	0	0	0	0	0	1
257	0	0	0	0	0	0	0	1	0	1
258	0	0	0	0	0	2	0	0	0	2
259	0	0	0	0	0	1	0	0	0	1
260	0	3	0	0	0	0	0	0	0	3
261	0	1	0	1	0	0	0	0	0	2
264	0	0	0	0	0	2	0	0	0	2
268	0	0	0	0	0	5	0	0	0	5
269	0	0	0	0	0	1	0	0	0	1
271	0	2	0	0	0	3	0	0	0	5
272	0	6	0	0	0	0	0	0	0	6
273	0	0	0	0	0	1	0	0	0	1
274	0	0	0	0	0	1	0	0	0	1
275	0	1	0	0	0	0	0	0	0	1
276	0	0	0	0	0	2	0	0	0	2
322	0	0	0	0	1	0	0	0	0	1
325	0	0	0	1	0	0	0	0	0	1
326	0	0	0	0	0	1	0	0	0	1
342	0	0	0	1	0	1	0	0	0	2
344	0	2	0	0	1	0	0	0	0	3
346	0	1	0	0	0	0	0	0	0	1
362	0	0	0	0	0	4	0	0	0	4
363	0	0	0	0	0	1	0	0	0	1
364	0	0	0	0	0	1	0	0	0	1
367	0	0	0	0	0	1	0	0	0	1
413	0	0	0	0	0	0	0	1	0	1
420	0	0	0	1	0	0	0	0	0	1
424	0	0	0	1	0	0	0	2	0	3
427	0	0	0	1	0	0	0	0	0	1
428	0	1	0	0	0	0	0	0	0	1
435	0	0	0	1	0	0	0	0	0	1
458	0	0	0	3	0	0	0	0	0	3
462	0	0	0	1	0	0	0	0	0	1
466	0	0	0	1	0	0	0	0	0	1
470	0	1	0	0	0	0	0	0	0	1
473	0	0	0	3	0	0	0	0	0	3
476	0	0	0	2	0	0	0	0	0	2
477	0	0	0	1	0	0	0	0	0	1
481	0	0	0	1	0	0	0	0	0	1
488	0	0	0	1	0	0	0	0	0	1
494	0	0	0	1	0	0	0	0	0	1
496	0	0	0	1	0	0	0	0	0	1
497	0	0	0	3	0	0	0	0	0	3
498	0	0	0	0	0	1	0	0	0	1
500	0	0	0	2	0	0	0	0	0	2
516	0	1	0	2	0	0	0	0	0	3
518	0	0	0	4	0	0	0	0	0	4

dist	0	N	NE	E	SE	S	SW	W	NW	TOTAL
570	0	0	0	1	0	0	0	0	0	1
572	0	0	0	1	0	0	0	0	0	1
574	0	0	0	1	0	0	0	0	0	1
576	0	0	0	1	0	0	0	0	0	1
580	0	0	0	1	0	0	0	0	0	1
581	0	0	0	1	0	0	0	0	0	1
583	0	1	0	0	0	0	0	0	0	1
593	0	1	0	0	0	0	0	0	0	1
594	0	0	0	1	0	0	0	0	0	1
596	0	0	0	2	0	0	0	0	0	2
622	0	0	0	1	0	0	0	0	0	1
627	0	0	0	1	0	0	0	0	0	1
649	0	1	0	0	0	0	0	0	0	1
684	0	0	0	1	0	0	0	0	0	1
694	0	0	0	1	0	0	0	0	0	1
697	0	0	0	1	0	0	0	0	0	1
708	0	1	0	0	0	0	0	0	0	1
711	0	1	0	0	0	0	0	0	0	1
735	0	0	0	1	0	0	0	0	0	1
777	0	0	0	1	0	0	0	0	0	1
788	0	1	0	0	0	0	0	0	0	1
810	0	1	0	0	0	0	0	0	0	1
837	0	0	0	1	0	0	0	0	0	1
940	0	0	0	0	0	0	0	1	0	1
970	0	0	0	0	0	0	1	0	0	1
977	0	1	0	0	0	0	0	0	0	1
989	0	0	0	0	0	0	0	2	0	2
1075	0	0	0	0	0	0	0	1	0	1
1177	0	0	0	0	0	0	0	2	0	2
1376	0	1	0	0	0	0	0	0	0	1
1378	0	1	0	0	0	0	0	0	0	1
1841	0	0	0	0	0	0	0	1	0	1
2027	0	0	0	0	0	1	0	0	0	1
2029	0	0	0	0	0	0	0	1	0	1
2094	0	0	0	0	0	0	0	1	0	1
2106	0	0	0	1	0	0	0	0	0	1
2113	0	0	0	0	0	1	0	0	0	1
2125	0	0	0	0	0	0	0	1	0	1
2200	0	0	0	0	0	1	0	0	0	1
2263	0	0	0	0	0	1	0	0	0	1
2268	0	0	0	0	0	1	0	0	0	1
2270	0	0	0	0	0	1	0	0	0	1
2302	0	0	0	0	0	2	0	0	0	2
2304	0	0	0	0	0	1	0	0	0	1
2350	0	0	0	0	0	1	0	0	0	1
2361	0	0	0	0	0	1	0	0	0	1
2386	0	0	0	0	0	0	0	1	0	1
2428	0	0	0	1	0	0	0	0	0	1
2450	0	1	0	0	0	0	0	0	0	1
2513	0	0	0	0	0	0	0	1	0	1
2522	0	0	0	0	0	2	0	0	0	2
2545	0	0	0	0	0	1	0	0	0	1
2564	0	0	0	0	0	0	0	3	0	3
2605	0	0	0	1	0	0	0	0	0	1
2610	0	0	0	0	0	1	0	0	0	1
2633	0	0	0	0	0	1	0	0	0	1

dist	0	N	NE	E	SE	S	SW	W	NW	TOTAL
2654	0	0	0	1	0	0	0	0	0	1
2667	0	0	0	0	0	0	0	1	0	1
2674	0	0	0	0	0	6	0	0	0	6
2681	0	0	0	0	0	1	0	0	0	1
2684	0	0	0	0	0	2	0	0	0	2
2701	0	0	0	0	0	1	0	0	0	1
2702	0	0	0	0	0	1	0	0	0	1
2703	0	0	0	0	0	1	0	0	0	1
2710	0	0	0	0	0	1	0	0	0	1
2728	0	0	0	0	0	1	0	0	0	1
2737	0	0	0	0	0	1	0	0	0	1
2741	0	0	0	0	0	2	0	1	0	3
2758	0	0	0	0	0	0	0	1	0	1
2763	0	0	0	1	0	0	0	1	0	2
2782	0	1	0	0	0	1	0	1	0	3
2794	0	0	0	0	0	3	0	0	0	3
2818	0	0	0	0	0	1	0	0	0	1
2824	0	0	0	0	0	1	0	0	0	1
2825	0	0	0	0	0	3	0	0	0	3
2853	0	0	0	1	0	0	0	0	0	1
2861	0	0	0	1	0	1	0	0	0	2
2869	0	0	0	0	0	1	0	0	0	1
2873	0	0	0	0	0	1	0	0	0	1
2874	0	0	0	0	0	1	0	0	0	1
2881	0	0	0	1	0	0	0	0	0	1
2900	0	0	0	0	0	1	0	0	0	1
2913	0	1	0	0	0	0	0	0	0	1
2971	0	0	0	1	0	0	0	0	0	1
2979	0	0	0	1	0	0	0	0	0	1
2982	0	0	0	1	0	0	0	0	0	1
3013	0	0	0	0	0	0	0	1	0	1
3114	0	0	0	0	0	0	0	4	0	4
3119	0	0	0	1	0	0	0	0	0	1
3133	0	0	0	1	0	0	0	0	0	1
3134	0	0	0	0	0	0	0	1	0	1
3135	0	0	0	0	0	0	0	1	0	1
3214	0	0	0	1	0	0	0	0	0	1
3226	0	0	0	1	0	0	0	0	0	1
3241	0	0	0	0	0	0	0	1	0	1
3262	0	0	0	0	0	0	0	1	0	1
3331	0	0	0	0	0	0	0	2	0	2
3339	0	0	0	1	0	0	0	0	0	1
3733	0	0	0	1	0	0	0	0	0	1
3737	0	0	0	1	0	0	0	0	0	1
3781	0	0	0	0	0	0	0	1	0	1
3883	0	1	0	0	0	0	0	0	0	1
3939	0	1	0	0	0	0	0	0	0	1
4239	0	1	0	0	0	0	0	0	0	1
4242	0	1	0	0	0	0	0	0	0	1
total	638	85	7	124	9	148	3	88	2	1104

A4. TABLE OF DISTANCE (rows) BY DIRECTION (columns) - MOUNTAIN DUCK.

dist	0	N	NE	E	S	W	NW	TOTAL
0	100	0	0	0	0	0	0	100
2	0	1	0	0	0	0	0	1
3	0	0	1	0	0	0	1	2
4	0	0	0	1	0	0	0	1
6	0	2	0	1	0	1	0	4
7	0	1	0	0	0	0	0	1
11	0	0	0	1	1	0	0	2
12	0	0	0	0	0	1	0	1
13	0	0	0	0	1	0	0	1
17	0	1	0	0	0	0	0	1
20	0	0	0	0	1	0	0	1
22	0	0	0	0	1	0	0	1
114	0	1	0	0	1	0	0	2
115	0	0	0	1	1	0	0	2
116	0	3	0	0	0	0	0	3
118	0	2	0	0	0	0	0	2
119	0	0	0	1	0	0	0	1
120	0	3	0	0	0	0	0	3
122	0	0	0	0	0	1	0	1
126	0	0	0	0	4	0	0	4
165	0	0	0	0	0	1	0	1
231	0	0	0	1	0	0	0	1
272	0	0	0	0	1	0	0	1
275	0	1	0	0	0	0	0	1
342	0	1	0	0	0	0	0	1
total	100	16	1	6	11	4	1	139

A5. TABLE OF DUCKS THAT HAVE TRAVELLED MORE THAN 1000Kms.

NOTE:

TBAND - titanium band number

MBAND - monelmetal band number

CBAND - computed band number (from TBAND and MBAND)

st - state in which the duck was banded (2 = NSW; 3 = VIC; 4 = QLD; 5 = SA; 6 = WA; 7 = TAS; 8 = NT);

sp - code for species (NSPEC)

ag - code for age (NAGE)

sx - code for sex (NSEX)

dist - distance travelled by the duck (in kilometers)

dr - direction in which the duck travelled (1 = N; 2 = NE; 3 = E; 4 = SE; 5 = S; 6 = SW; 7 = W; 8 = NW).

lt1 - latitude of banding (as recorded in Duck Banding programme)

lt2 - latitude of last capture (as recorded in Duck Banding programme)

lg1 - longitude of banding (as recorded in Duck Banding programme)

lg2 - longitude of last capture (as recorded in Duck Banding programme)

TBAND	MBAND	CBAND	st	sp	ag	sx	dist	dr	lt1	lt2	lg1	lg2
90001126	0	901126	2	2	2	1	3331	7	344	324	.453	154
90001164	0	901164	2	2	2	1	3331	7	344	323	.453	154
90020457	0	920457	2	2	2	1	2913	1	341	153	.460	280
90031271	0	931271	2	2	2	1	2763	7	341	304	.455	213
90510641	0	910641	3	2	0	0	2758	7	380	302	.442	205
90535148	0	935148	3	2	0	0	2667	7	371	325	.405	173
90535644	0	935644	3	2	0	1	3013	7	380	335	.442	175
90536713	0	936713	3	2	0	1	2741	7	380	310	.442	212
90537333	0	937333	3	2	0	1	3135	7	380	323	.442	171
90538351	0	938351	3	2	2	2	3114	7	380	331	.442	172
90542681	0	942681	3	2	0	1	3114	7	380	331	.442	172
90545944	0	945944	3	2	0	1	3134	7	380	325	.442	171
90548413	0	948413	3	2	0	1	3114	7	380	331	.442	172
90616799	0	916799	3	2	0	0	2513	7	354	335	.435	214
90624777	0	924777	3	2	0	0	3241	7	380	333	.442	154
90906041	0	906041	3	2	0	1	2564	7	380	335	.442	215
90909563	0	909563	3	2	0	1	3262	7	380	322	.442	153
90914268	0	914268	3	2	0	1	2564	7	380	335	.442	215
90914460	0	914460	3	2	0	1	2782	7	380	291	.442	212
90939137	0	939137	3	2	0	2	3114	7	380	331	.442	172
90944577	0	944577	3	2	0	1	2564	7	380	335	.442	215
90022778	0	922778	5	2	4	0	2029	7	344	285	.383	211
0	90002672	902672	6	2	0	0	2979	3	315	323	155	423
0	90002973	902973	6	2	0	0	2861	3	322	342	170	421
0	90003920	903920	6	2	0	0	1376	1	333	212	172	155
0	90004216	904216	6	2	0	0	3733	3	332	194	173	473
0	90004753	904753	6	2	0	0	2450	1	333	142	172	273
0	90005871	905871	6	2	0	0	2853	3	333	350	172	422
0	90012169	912169	6	2	0	0	1378	1	334	212	174	155
0	90027081	927081	6	2	4	1	2971	3	304	382	160	414
0	90027167	927167	6	2	4	1	3226	3	304	350	160	440
0	90027277	927277	6	2	4	1	2881	3	304	341	160	415
0	90027325	927325	6	2	4	2	2428	3	304	342	160	374
0	110006568	1106568	6	1	0	0	1843	1	315	172	155	235
0	110010158	1110158	6	1	0	0	1412	1	343	223	185	151
0	110010583	1110583	6	1	0	0	1843	1	315	172	155	235
90038662	0	938662	6	2	2	1	2654	3	304	342	160	394
90038798	0	938798	6	2	2	1	3737	3	304	233	160	481
90038900	0	938900	6	2	4	2	3133	3	304	363	160	430
90039327	0	939327	6	2	2	2	2106	3	333	234	172	335
90039383	0	939383	6	2	2	1	2982	3	333	350	172	440
90039440	0	939440	6	2	4	2	3214	3	304	341	160	441
90039521	0	939521	6	2	2	1	3339	3	304	352	160	450
90039676	0	939676	6	2	2	1	3119	3	304	352	160	433
90040212	0	940212	6	2	4	1	2605	3	304	414	160	362
90040517	0	940517	6	2	4	2	2763	3	304	341	160	402
110022472	110014972	1114972	6	0	4	2	3213	3	304	340	160	441
110026551	110019551	1119551	6	1	2	1	2358	3	304	390	160	352
110027247	110020247	1120247	6	1	2	1	3329	3	333	353	172	470
90024328	0	924328	7	2	0	0	3781	7	420	274	.481	180
90000001	0	900001	8	2	4	2	2874	5	124	333	.312	153
90010745	0	910745	8	2	0	2	2782	1	323	124	154	312
90010818	0	910818	8	2	4	2	2684	5	124	311	.312	160
90010887	0	910887	8	2	2	1	2824	5	124	334	.312	174
90010893	0	910893	8	2	4	1	2825	5	124	340	.312	182
90010896	0	910896	8	2	2	2	2818	5	124	334	.312	180

TBAND	MBAND	CBAND	st	sp	ag	sx	dist	dr	lt1	lt2	lg1	lg2
90010937	0	910937	8	2	4	1	2684	5	124	311	.312	160
90010970	0	910970	8	2	4	1	2674	5	124	304	.312	160
90010984	0	910984	8	2	4	1	2302	5	124	304	.312	213
90011010	0	911010	8	2	2	1	1075	7	124	174	.312	232
90011104	0	911104	8	2	2	1	2794	5	124	330	.312	171
90011141	0	911141	8	2	4	2	2674	5	124	304	.312	160
90011177	0	911177	8	2	2	1	2674	5	124	304	.312	160
90011226	0	911226	8	2	4	2	2701	5	124	321	.312	172
90011276	0	911276	8	2	4	2	2361	5	124	282	.312	164
90011280	0	911280	8	2	4	2	2113	5	124	264	.312	183
90011316	0	911316	8	2	4	1	2125	7	124	235	.312	160
90011337	0	911337	8	2	4	2	2633	5	124	314	.312	174
90011343	0	911343	8	2	0	0	2350	5	124	305	.312	211
90011417	0	911417	8	2	4	2	1177	7	124	176	.312	221
90011532	0	911532	8	2	4	1	2610	5	124	311	.312	172
90011560	0	911560	8	2	4	2	2522	5	124	293	.312	155
90011672	0	911672	8	2	4	2	2710	5	124	321	.312	460
90012863	0	912863	8	2	2	1	2825	5	124	340	.312	182
90012932	0	912932	8	2	2	1	2674	5	124	304	.312	160
90013007	0	913007	8	2	0	0	2674	5	124	304	.312	160
90013209	0	913209	8	2	4	2	2782	5	124	323	.312	154
90013355	0	913355	8	2	4	2	2674	5	124	304	.312	160
90013487	0	913487	8	2	4	0	2703	5	124	322	.312	172
90013499	0	913499	8	2	4	1	2794	5	124	330	.312	171
90013534	0	913534	8	2	4	2	2681	5	124	304	.312	154
90013605	0	913605	8	2	4	1	2869	5	124	331	.312	155
90013765	0	913765	8	2	4	2	2304	5	123	304	.312	213
90013947	0	913947	8	2	4	0	2200	5	124	273	.312	175
90014186	0	914186	8	2	4	1	2386	7	124	245	.312	134
90014245	0	914245	8	2	0	0	2094	7	124	214	.312	151
90014292	0	914292	8	2	4	2	2900	5	124	343	.312	164
90014513	0	914513	8	2	0	0	2263	5	124	302	.312	210
90014915	0	914915	8	2	0	0	2728	5	124	324	.312	174
90015268	0	915268	8	2	2	2	2702	5	124	321	.312	171
90015304	0	915304	8	2	2	2	2741	5	124	332	.312	173
90015441	0	915441	8	2	4	1	2302	5	124	304	.312	213
90015548	0	915548	8	2	2	2	2027	5	124	254	.312	184
90015609	0	915609	8	2	0	0	1177	7	124	176	.312	221
90015713	0	915713	8	2	4	1	1841	7	124	205	.312	171
90015824	0	915824	8	2	2	1	2825	5	124	334	.312	173
90016357	0	916357	8	2	4	2	2737	5	124	330	.312	174
90016378	0	916378	8	2	4	2	2522	5	124	293	.312	155
90016389	0	916389	8	2	4	1	2873	5	124	333	.312	154
90016454	0	916454	8	2	0	0	2268	5	124	302	.312	205
90016531	0	916531	8	2	4	2	2545	5	124	312	.312	181
90016773	0	916773	8	2	0	1	2861	5	124	325	.312	154
90016788	0	916788	8	2	0	0	2741	5	124	332	.312	173
90016800	0	916800	8	2	0	1	2270	5	124	303	.312	205
90017520	0	917520	8	2	0	1	2794	5	124	330	.312	171

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Duck Population Estimates for Moora Shooting Seasons, 1968-1976

Report prepared for: Dr Stuart Halse
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Contents

1. Introduction

In this report we discuss estimates related to duck population sizes at Moora, based on data from the WA Wildlife Research Centre Duck Banding Programme, during the years 1968 to 1976. Of particular interest are the proportions of the populations shot during each shooting day and the numbers of ducks present at Moora at shooting time.

Prior to each shoot, the data typically consist of a number of banding runs of about 10 days banding followed by 4 days off. Because of the time delays there will be some emigration of the banded birds from the area before the shoot commences, so that the total number of birds banded in the population at shooting time is not known. This leads to estimation of the proportions of the separate banding runs that remain to shooting time, in addition to the quantities mentioned above. It turns out that to estimate any of the quantities, one needs to assume that all of the banded birds in the final run prior to the shoot remain in the population. In this case, the (approximate) maximum likelihood estimates of proportion shot and total population size are based only on the final banding run data, with the previous runs providing information only on the proportions of emigrating birds.

For this reason, the estimates are unstable in some cases. For comparison we also include estimates based on the assumption that there is no emigration. Since the numbers of banded birds available to be shot are overestimated in this case, the population sizes will be overestimated also, and the proportions shot will be underestimated.

The methods used to obtain the estimates are outlined in Section 2. Section 3 contains the estimates and discussion assuming migration, while the estimates obtained assuming no migration are given in Section 4. Note that estimates for second and successive shooting days in a season are particularly suspect since shooting will tend to encourage emigration of the birds, so we only give estimates for the first shooting day and for days preceded by additional banding. Results are produced for Black Ducks, Grey Teal and Mountain Ducks separately.

2. Methods of estimation

In the following we denote by b_i and r_i the numbers of birds banded in run i and the number of run i bands recovered in the shoot, respectively, where $i = 1$ refers to the most recent banding run prior to the shoot, $i = 2$ the next most recent, and so on. Denote by N the population size at shoot time, by s the number of birds shot, by p_i the proportion of birds from the ith banding run remaining in the population at shoot time, by b_i the number of bands from run i, by b the total number of bands in the population at shoot time, and by p_s, the proportion of the population shot on a particular shooting day. Our main interest is in estimating N and p_s.

Methods for estimating animal abundance from tag-recapture data are discussed in Seber's (1982) book. Here we use the following estimates:

$$\hat{N} = b_1 s / r_1$$

$$\hat{p}_s = r_1 / b_1 = s / \hat{N}$$

$$\hat{p}_i = r_i b_1 / r_1 b_i = r_i \hat{N} / b_i s \ , \ i = 2, 3, \ldots, \text{ with } \hat{p}_1 = 1$$

$\hat{b} = b_1 + \sum_{i \neq 1} b_i \hat{p}_i = b_1 + \sum_{i \neq 1} \hat{\beta}_i$ say, is the number of banded birds still present at the start of the shoot. Note that $\hat{b} = r\, b_1 / r_1$ where is r the total number recovered, and β_i the number of bands from banding run i present on the first shooting day.

These estimates can be obtained from simple moment considerations as follows:

We expect the proportions of the various banding runs in the total shot to reflect the overall proportions in the population. Thus we should have approximately

$$r_i / s = \beta_i / N = p_i b_i / N , \; i = 1, 2, \ldots$$

Solving these in terms of the unknown gives the estimates above. Note that we need to assume $p_1 = 1$ in order to solve the equations.

An alternative derivation can be obtained via approximate likelihood considerations. Thus for ducks banded in the last run prior to the shoot, $r_1 \sim \text{Bin}(b_1 \; p_s)$. For ducks banded in a previous run, the probability that the banded bird will be in the population at the lake and be shot is $q_i = p_i \, p_s$. Independence of the r_i's then leads to the approximate likelihood

$$L(r_1, r_2, \ldots) = p_s^{r_1} (1 - p_s)^{b_1 - r_1} \prod_{i \neq 1} \{ q_i^{r_i} (1 - q_i)^{b_i - r_i} \}$$

where $q_i = p_i p_s$. Maximising this gives the estimates as required.

The approximation in this derivation results from use of the Binomial distribution rather than the correct hypergeometric, and assumes the proportions shot are small.

Essentially the same derivation goes as follows:
Given β_1, β_2, ..., the variables r_1, r_2, ... are multivariate hypergeometric. Since the numbers of recoveries constitute a small proportion of the total population, we can approximate the hypergeometric by independent binomials, so that approximately $r_i \sim \text{Bin}(\beta_i, p_s)$. Further, the $\beta_i \sim \text{Bin}(b_i, p_i)$, and are independent. Constructing the joint likelihood for $(r_1, r_2, \ldots , \beta_1, \beta_2, \ldots)$ and summing out the β terms leads to the same likelihood as above.

This estimate of $\hat{N}$ is often referred to as Petersen's estimate. As mentioned above, $\hat{N}$ and $\hat{p}_s$ are estimated from only the final banding data, and the other banding data is used to estimate the proportions p_i. Variance estimates of the quantities of interest are given by the following. Firstly,

$$\mathrm{var}(\hat{N}) = b_1\, s^2(s-r_1) \;/\; r_1^3.$$

From the likelihood derivation of the estimates, $\hat{p}_i = b_1 r_i / b_i r_1$. Hence $\mathrm{Var}(\hat{p}_i) = \mathrm{Var}(b_1 r_i / b_i r_1) = \left[b_1/b_i\right]^2 \mathrm{Var}(r_i/r_1)$. An approximate formula for the variance of a ratio of two non-negative random variables is given in Kendall and Stuart (1969, p232):

$$\mathrm{Var}(r_i/r_1) \approx \mathrm{Var}(r_i)/\mathbb{E}(r_1^2) + \mathbb{E}(r_i^2)\, \mathrm{Var}(r_1)/\mathbb{E}(r_1^4)\ .$$

This assumes that r_1 and r_i are uncorrelated, which was previously assumed in the approximation of the hypergeometric distribution of the r's by Binomial distributions. Hence

$$\begin{aligned} \mathrm{Var}(\hat{p}_i) &= \left[\frac{b_1}{b_i}\right]^2 \mathbb{E}(r_i)^2/\mathbb{E}(r_1)^2 \left[\mathrm{Var}(r_i)/\mathbb{E}(r_i)^2 + \mathrm{Var}(r_1)/\mathbb{E}(r_1)^2\right] \\ &= \left[q_i/q_1\right]^2 \left[b_i q_i(1 - q_i)/(b_i q_i)^2 + b_1 q_1(1 - q_1)/(b_1 q_1)^2\right]. \\ &\doteq \left[q_i/q_1\right]^2 \left[(1 - q_i)/b_i q_i + (1 - q_1)/b_1 q_1\right]. \end{aligned}$$

Since we assume $r_1 \sim \mathrm{Bin}(b_1, p_s)$, we have $\mathrm{Var}(\hat{p}_s) = \hat{p}_s(1 - \hat{p}_s)/b_1$. When assuming that no migration occurs, the above formulae apply by assuming a single banding run.

A number of other estimates have been developed in order to reduce the bias present in Petersen's estimate. These include:

(a) the modified Petersen's estimate

N is estimated by $\hat{N}_{mp} = \dfrac{(b+1) \times (s+1)}{(r+1)} - 1$, with

variance estimate $\hat{\sigma}^2_{mp} = \dfrac{(b+1) \times (s+1) \times (b-r) \times (s-r)}{(r+1)^2 \times (r+2)}$.

and (b) Bailey's estimate

N is estimated by $\hat{N}_b = \dfrac{b \times (s+1)}{(r+1)}$,

and $\hat{\sigma}^2_b = \dfrac{b^2 \times (s+1) \times (s-r)}{(r+1)^2 \times (r+2)}$.

These are given for the pooled data only. In general, differences between these estimates will be small. Further, in years where there are a succession of shooting days, an overall estimate for the population size can be made by using the average estimate of the population size. In view of the migration problems this was felt to be inappropriate.

3. Assessment of Shooting Mortality and Migration.

The data for the first day of the shoot yielded the following results:

Table 1:Mortality estimates based on banding before the first day

Black Ducks:

Season	Period	b_i	r_i	s	$\hat{N}_p$	se	$\hat{p}_i$	se
1967-68	15/11-22/11	63	4				>1	–
	27/11-8/12	97	8				>1	–
	15/12-21/12	127	11				>1	–
	2/1 - 9/1	191	5	268	10238	4235		
1968-69	30/11- 6/12	151	15				0.6878	0.1859
	11/12-19/12	345	44				0.8831	0.1599
	27/12- 8/1	457	66	267	1849	197		
1970-71	10/11-23/11	133	7				0.3989	0.1548
	30/11-16/12	432	57	100	758	66		
1973-74	28/11-19/12	378	31	203	2475	421		
1974-75	20/11-29/11	209	7				0.4075	0.1648
	5/12-13/12	351	15				0.5199	0.1554
	19/12-23/12	177	5				0.3437	0.1611
	4/1 - 11/1	438	36	142	1728	118		
1975-76	26/11- 3/12	7	0				0	-
	8/12-19/12	195	18				>1	-
	3/1 - 11/1	224	16	109	1526	249		

Season	$\hat{b}$	$\hat{p}_s$	se
1967-68	478	0.02618	0.01155
1968-69	866	0.14434	0.02543
1970-71	485	0.13196	0.01581
1973-74	378	0.17455	0.04672
1974-75	767	0.08214	0.00991
1975-76	419	0.07143	0.01721

Grey Teal:

Season	Period	b_i	r_i	s	$\hat{N}_p$	se	$\hat{p}_i$	se
1967-68	15/11-22/11	61	2				0.6604	0.5198
	27/11-8/12	204	5				0.4937	0.2840
	15/12-21/12	58	1				0.3473	0.3673
	2/1 - 9/1	141	7	600	12086	4541		
1968-69	30/11- 6/12	22	2				0.6515	0.5038
	11/12-19/12	25	3				0.8600	0.5683
	27/12- 8/1	43	6	373	2673	1083		
1970-71	10/11-23/11	186	6				0.7081	0.3200
	30/11-16/12	459	21	349	7661	1621		
1973-74	28/11-19/12	254	13	294	4393	1034		
1974-75	20/11-29/11	40	3				0.9375	0.6879
	5/12-13/12	68	1				0.1838	0.2026
	19/12-23/12	86	5				0.7267	0.4701
	4/1 - 11/1	50	4	142	6263	875		
1975-76	26/11- 3/12	6	1				>1	-
	8/12-19/12	146	10				0.5777	0.2095
	3/1 - 11/1	194	23	411	1526	702		

Season	$\hat{b}$	$\hat{p}_s$	se
1967-68	302	0.04965	0.01820
1968-69	79	0.13953	0.05284
1970-71	593	0.04555	0.00971
1973-74	254	0.06693	0.01568
1974-75	163	0.08000	0.03837
1975-76	284	0.11856	0.02321

Mountain Duck:

Season	Period	b_i	r_i	s	$\hat{N}_p$	se	$\hat{p}_i$	se
1970-71	10/11-23/11	11	1				0.3333	0.36577
	30/11-16/12	11	3	49	180	101		
1975-76	26/11- 3/12	13	0				0	-
	8/12-19/12	7	4				>1	-
	3/1 - 11/1	2	1	59	118	117		

Season	$\hat{b}$	$\hat{p}_s$	se
1968-69	15	0.26667	0.11418
1975-76	49	0.50000	0.35355

For Mountain Ducks, estimates were possible only for the seasons given. This is not surprising given that Mountain Ducks are by far the smallest group.

The results indicate that there is a substantial proportion of birds banded early do not remain up to the start of the shoot. This can be seen from the many low $\hat{p}_i$ values. Further, $\hat{p}_s = s / \hat{N}_p = s / (b_I \times s / r_I) = r_I / b_I$ so that not all of the information is required to calculate the proportion shot. Thirdly, there are shoots where the bands recovered from the last day's banding are unusually low. This makes it impossible to calculate reasonable $\hat{p}_i$ values, since the estimate of $\hat{N}_p$ is unusually high which results in $\hat{p}_i$ estimates greater than one. In this case we have taken $p_i = 1$ as the best estimate, although the large variability makes this assumption doubtful.

4. Estimation of Population Size Ignoring Migration Effects.

The following are tables of the various population estimates discussed in Section 2, with their corresponding standard errors, broken down by year for each species of interest. In view of the previous results these should be regarded with caution as they assume no migration occurs.

After the shoot day number the first three columns of data are the appropriate values for b, s, and r used in obtaining the estimates. These are the figures corresponding to the number of ducks banded, shot, and the number of tags recovered for each day's shoot. For the first day, all data from previous banding runs has been combined. Again, for Mountain Ducks, estimates were only possible on two seasons.

Table 2: Population estimates pooling initial banding data.

i	b_i	s_i	r_i	$\hat{N}_p$	$\hat{\sigma}_p$	$\hat{N}_{mp}$	$\hat{\sigma}_{mp}$	$\hat{N}_b$	$\hat{\sigma}_b$	$\hat{p}_s$	$\hat{\sigma}_{Ps}$
Black Ducks:											
1967-68:											
1	478	268	28	4575	818	4442	743	4434	765	0.05858	0.01074
1968-69:											
1	953	267	125	2036	133	2028	122	2027	131	0.13116	0.01094
1970-71:											
1	565	100	64	883	66	878	61	878	65	0.11327	0.01333
1973-74:											
1	378	203	31	2475	409	2415	370	2410	385	0.08201	0.01411
3	108	146	12	1314	363	1232	295	1221	312	0.11111	0.03024
4	209	102	7	3045	1111	2703	849	2691	861	0.03349	0.01245
1974-75:											
1	1175	142	63	2648	249	2627	236	2625	242	0.05362	0.00657
3	93	56	5	1042	445	892	309	884	316	0.05376	0.02339
4	22	153	2	1683	1182	1180	545	1129	559	0.09091	0.06129
1975-76:											
1	426	109	34	1366	194	1341	177	1339	184	0.07981	0.01313
3	127	30	4	953	443	793	291	787	294	0.03150	0.01550
5	47	23	1	1081	1057	575	312	564	312	0.02128	0.02105
Grey Teal:											
1967-68:											
1	464	600	15	18560	4732	17466	4107	17429	4171	0.03233	0.00821
1968-69:											
1	90	373	11	3052	906	2835	721	2805	765	0.12222	0.03453
1970-71:											
1	648	349	27	8376	1548	8112	1413	8100	1443	0.04167	0.00785
1973-74:											
1	254	294	13	5744	1558	5372	1316	5352	1349	0.05118	0.01383
3	14	297	0	-	-	2234	1197	2086	1200	0.07143	0.06883
4	31	227	4	1759	872	1458	541	1414	571	0.12903	0.06021

i	b_i	s_i	r_i	$\hat{N}_p$	$\hat{\sigma}_p$	$\hat{N}_{mp}$	$\hat{\sigma}_{mp}$	$\hat{N}_b$	$\hat{\sigma}_b$	$\hat{p}_s$	$\hat{\sigma}_{ps}$
1974-75:											
1	247	501	14	8839	2329	8299	1981	8266	2035	0.05668	0.01471
3	57	474	8	3377	1184	3060	881	3008	942	0.14035	0.04601
4	41	410	4	4202	2091	3451	1315	3370	1367	0.09756	0.04634
1975-76:											
1	346	411	36	3950	629	3863	565	3853	596	0.10405	0.01641
3	114	214	21	1162	241	1123	200	1114	220	0.18421	0.03631
5	27	130	1	3510	3496	1833	1013	1768	1013	0.03704	0.03634
Mountain Ducks:											
1968-69:											
1	22	49	4	269	129	229	79	220	85	0.18182	0.08223
1975-76:											
1	134	59	5	1581	677	1349	473	1340	480	0.03731	0.01637

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Analysis of survival rates for ducks based on recovery frequency data

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CONTENTS

SUMMARY

Survival rates of Black Ducks, Grey Teal and Mountain Ducks are estimated using the frequencies of recoveries by years obtained from the WA Wildlife Research Centre Duck Banding Programme, and based on models developed by Brownie et al (1978) with extensions to cater for the problems of differential rates in the first year after banding. The models which do not allow for this first year typically give lower estimates of mean survival time after reaching adulthood, and we tend to favour the higher estimates, even though there were problems associated with estimation.

Estimates of mean lifetime after reaching adulthood using the more complex models may be summarised as:

		Estimate (yrs)	SE	
Black Ducks -	Males	2.3	0.17	
	Females	1.7	0.15	
Grey Teal -	Males	2.5	0.58	** Note the large
	Females	2.9	0.97	** standard errors
Mountain Duck -	No sensible estimates possible.			

Estimates based on other models are detailed in the text.

1. INTRODUCTION

This report presents analyses of survival rates for ducks, based on data from the WA Wildlife Research Centre Duck Banding Programme, and using models similar to those developed in Brownie, Anderson, Burnham and Robson (1978). For these analyses the data for a particular species are set out as a triangular table of frequencies in which the rows correspond to year of banding and the columns to year of band recovery as follows :-

Year of band recovery

		'52	'53	'54	'55	....	'83	Total banded
	'52	*	*	*	*		*	x
Year	'53		*	*	*		*	x
of	'54			*	*		*	x
banding	'55				*		*	x
	.					....		.
	.					....		.
	'76					*	*	x

Each row in the table constitutes a multinomial sample with sample size given by the Total banded, and with associated cell probabilities representing the probabilities that ducks banded in the particular year will die and have their band returned in the recovery year. In its most general form the cell probabilities are estimated by the corresponding sample proportions, and there is little information regarding survival rates in any year since the survival rates are confounded with recovery rates. The essence of the methods outlined in Brownie, Anderson, Burnham and Robson is to postulate some form of restricted pattern for the cell probabilities so that the survival rates can be disentangled from other factors operating.

Thus, if p_{ij} is the probability that a bird banded in the year labelled i dies and has its band recovered in year j, then

p_{ij} = (probability that the bird survived to the beginning of year j) × (probability that a bird alive at the start of year j will die and have its band reported during year j)

$= S_{ji} \times f_{ji}$, say.

Certain restrictions are then imposed on the parameters S_{ji} and f_{ji} to enable estimation of the effects separately. For example, one might assume that the probability of surviving year j given survival to the beginning of year j is S_j for all i, postulating that survival in any year does not depend on the year in which banding took place, but may still vary from year to year. This is the "minimal" assumption made in the models considered here and by Brownie et al. Additional restrictions are still necessary on the form of the f_{ji} in order for the S_j to be estimable from the data. One posibility is to assume that $f_{ji} = f_j$, similar to the assumption for the survival parameters, so that recovery is assumed also to be independent of the year banding occurred. This leads to

$$p_{ii} = f_i$$

and

$$p_{ij} = S_i S_{i+1} \ldots S_{j-1} f_{j+1} \quad , j > i .$$

This is Model 1 of Brownie et al. Parameters in the model can be estimated by employing maximum likelihood techniques, and in this case are obtained explicitly. In general, iterative numerical procedures are required to carry out the appropriate optimisation, as discussed in detail by Brownie et al.

Note that once the survival parameters $S_1,\ldots,S_c$ are estimated for all c columns of data available, one can estimate survival beyond year s given survival at the beginning of year 1 as the product $S_1 S_2 \ldots S_s$, and hence estimate mean survival etc. The "recovery" parameters are of less interest here, and as we shall see in the next sections, are sometimes confounded with other parameters, which makes them separately inestimable in any case.

In Section 2 we outline the models used in the present study, and discuss problems associated with them which led to modifications for the data at hand. It is doubtful that any of the simple models considered are adequate to realistically describe the cell proportions, but there is a certain consistency in the estimates of survival which leads to a degree of confidence in their values.

The estimates for the separate species Black Duck, Grey Teal and Mountain Duck are given and discussed in Section 3. Only for Black Ducks are the data sufficiently comprehensive to enable reasonable estimation of all the postulated models, while the data for Mountain Duck are too sparse for realistic estimation.

Although the banding commenced in 1952 and ceased in 1976, inspection of the frequency tables indicates that there were a large number of ducks banded in the early years, a reduction in the mid sixties, and then a resurgence from 1967 onwards. In addition, data on ages, species, sexes etc. was very incomplete prior to 1967, and the recovery data quite sparse in places in the tables. Further, the models of Brownie et al assume a "stationarity" in the rates over banding years which is unlikely to hold over such an extensive time range. Finally, the numbers of ducks banded in 1967 were small.

Consequently, we considered only data from 1968 onwards for the analyses of survival via the frequency table methods, and considered follow-up only for those years for which reasonable numbers of recoveries were obtained. Frequency tables are given in the appropriate sections.

2. MODELS CONSIDERED

Brownie et al considered a wide variety of models for estimating survival. Some of these are appropriate for the present study, and we modified others to more realistically describe our data. The models used are described and discussed below.

Model 1

$$p_{ij} = \begin{cases} f_i & \text{if } j = i; \\ s_i s_{i+1} \ldots s_{j-1} f_{j+1} & \text{if } j > i\ . \end{cases}$$

This is Model 1 of Brownie et al. It assumes that survival rates and recovery rates are independent of the year of banding, and of age of the bird, leading Brownie et al to suggest it as appropriate for birds banded as adults. Both survival and recovery rates are allowed to vary with year. S_i represents the probability of survival beyond year i given survival to the beginning of that year. These are the parameters of most interest.

Model 2

As for Model 1, but with $S_j = S$ for all j. This model thus simplifies Model 1 by assuming that survival rates are constant for all birds over the period of the experiment, corresponding to an exponential distribution assumption for survival.

Model 3

As for Model 2, but assuming in addition that $f_j = f$ for all j. This is a very simple model which assumes that both recovery and survival rates are constant for all birds over the study period.

One of the assumptions made in the work of Brownie et al which is not valid for the present study is that banding takes place at a particular time of each year so that years are well defined by the period between bandings. In the present study, banding occurred irregularly, with the bulk being carried out between October and May. This causes some problems with the above models which assume that the first year is similar to those subsequent. It is clear that in the first year, however defined, there will be birds which were "at risk" for less than the full 12 months. For instance, if the year was chosen as Jan - Jan, some half of the birds will be at risk for less than a few months in the first year. This may not be a big problem if recoveries are mostly due to a relatively short shooting season, but it should nevertheless be considered. In order to minimise the effect as much as possible, we defined the year to begin at October, so that the peak in banding tended to occur just after the start of the year. Nevertheless, there are still many birds with a first "year" considerably less than 12 months.

To accommodate the problem to some extent, we modified the models so that the parameters for the first year differed from those of subsequent years. Modification of Model 1 in this way leads to cell proportions as below :

		Year recovered				
		1	2	3	4	5 .....
Year	1	f_1^*	$S_1^* f_2$	$S_1^* S_2 f_3$	$S_1^* S_2 S_3 f_4$	.....
banded	2		f_2^*	$S_2^* f_3$	$S_2^* S_3 f_4$	.....
	3			f_3^*	$S_3^* f_4$	.....

where the starred parameters refer to the first year. It will be clear from the table that the survival rates of interest will not always be estimable from such a model. This model is discussed by Brownie et al p.34, and is confounded with other models, in particular their Model 0. We thus need to go to a modification of the simpler models 2 and 3.

Model 2^*

Model 2^* is again most easily described by a table of cell proportions. It corresponds to that above, but with constant survival rates over banding years.

		Year recovered				
		1	2	3	4	5 .....
Year	1	f_1^*	$S^* f_2$	$S^* S\ f_3$	$S^* S^2 f_4$	.....
banded	2		f_2^*	$S^* f_3$	$S^* S f_4$	.....
	3			f_3^*	$S^* f_4$	.....

In this model the recovery rates are confounded with the S^* parameter, but the constant survival rate S is estimable. Note that both the survival and recovery rates are adjusted for the incomplete first year.

Model 3^*

Model 3^* is a simplification of Model 2^* in which the f_j are assumed the same, though the f_j^* are allowed to differ to account for possible differences in banding times in different years.

Model 4^*

As for Model 3^* but with the assumption that the f_j^* are the same.

Brownie et al also develop models to cater for the situation in which adult and sub-adult or juvenile birds are analysed together. The models for young birds incorporate different parameters in the first year after banding to account for the different rates of mortality in young birds. Our * models incorporate essentially the same modifications, and we prefer to analyse the different age groups separately in view of the relatively small numbers of young birds in some of the samples and the extra assumptions needed when combining the analyses.

Computer programs

As shown by Brownie et al, the estimates in Model 1 are explicitly obtainable, along with their standard errors. All of the others require numerical iteration to maximise the likelihood function.

Preliminary study shows that Model 2 can be estimated as a log-linear model in the GLIM computer package (Numerical Algorithms Group, 1986), and very good approximations in Models 2 and 3 can be obtained by assuming Poisson distributions with appropriate conditioning. This is a theoretical aspect which will be further pursued at the completion of the present study. The approximations for the starred models were not as good. These programs were used to obtain extremely good starting values for the iterations, and separate programs for all the models mentioned above, complete with asymptotic standard errors, were written in the GAUSS programming language (Edlefsen & Jones, 1986), utilising Procedure MAXMUM, a general purpose optimising algorithm. In many cases the iterations failed to converge after attempts starting at different values, and then the approximate GLIM analyses were used. These are indicated where they occurred. The approximations involve using only the data excluding the main diagonal, with appropriate conditioning on the total numbers at risk and consequent reduction in the numbers of parameters estimated. Since the majority of the data lies on the diagonal, the estimates obtained by this method are somewhat dubious.

The GLIM program is given in the APPENDIX.

All computations were carried out on an IBM PC/AT.

Analyses

All models mentioned above were fitted to each table of recovery frequencies, possibly using approximations where necessary, except where the data did not permit sensible estimation, such as for Mountain Ducks. Of the models considered, Model 1 is in a sense the most general, since it allows the survival rates to vary over time, though it does not contain the * models as submodels. It is clear that survival rates can be expected to vary with different yearly shooting patterns. Model 2^* contains Model 2, Model 3^* contains Model 3, as does Model 2, and so on. We can thus not compare models 1 and 2^* directly, but can compare most of the others relative to them. It was always the case that Models 1 and 2^* fitted the data significantly better than the others. However, because of the flexibility and large numbers of parameters in Model 1, it was often the case that parameter estimates outside the range 0 to 1 were obtained. Strictly speaking, this implies that the estimates were on the boundaries of the parameter space, and the usual asymptotics were not valid. It also implies a degree of instability in the estimation procedure due generally to relatively small numbers. The models with a constant survival rate S are easier to interpret, and we believe they provide reasonable "average" rates. The models 2^* and 3^* were difficult to fit because of the large numbers of parameters and sparse data, so we concentrate mainly on the models 1 - 3 and 4^*.

As mentioned above, the models do not fit the data well when judged by statistical significance. However, inspection of the tables of fitted values indicates this was generally due to a few discrepant values, and we regard the models merely as reasonable approximations to the underlying data structure, and do not dwell on goodness of fit tests. It will be seen that even though the simpler models are poor fits by comparison with Model 1 there is evidence of stability in the survival parameter estimates across models which adds confidence to their values.

3. RESULTS

Despite the fact that the data file contains entries on a large number of ducks, the frequency tables for recoveries are relatively sparse when broken down by species, sex, age and so on. For Black Ducks and Grey Teal we analysed the data by sex and for adults and juveniles. There were too few Mountain Duck recoveries to obtain reasonable estimates, and we considered only the combined recoveries in this case. The small numbers and instabilities in the estimates for some models did not allow a breakdown by sex and age simultaneously.

It should be noted that in the models considered, the S parameters all refer to survival after reaching adulthood, so this is all we estimate. The breakdown by age merely gives two different populations to consider - those that are followed from reaching juvenile stage and being in a position to be banded then, and those that have already reached adulthood at banding, and who are already therefore longer survivors. We would expect the estimates in the latter case to exceed those in the former because we are biasing towards the hardier ducks. In all cases we are no doubt working with biased samples from the general duck populations.

For all models other than Model 1 the estimate of mean lifetime after attaining adulthood is given by 1/(-ln(survival rate estimate)), while the probability of a duck exceeding time t years after reaching adulthood is given by exp(-t*(estimate of S)).

3.1 Black Ducks

Tables

All combined

Year banded	Year recovered 68	69	70	71	72	73	74	75	76	77	78	Total banded
68	72	15	0	2	0	1	1	0	0	0	2	478
69		207	14	16	7	4	6	6	2	2	1	1728
70			10	56	41	9	16	11	8	2	0	2952
71				117	78	12	27	22	5	2	0	3682
72					41	11	46	27	8	6	0	3883
73						7	28	11	7	1	2	1993
74							130	29	21	2	2	1577
75								175	46	10	12	2715
76									75	2	0	600

Males only

Year banded	Year recovered 68	69	70	71	72	73	74	75	76	77	78	Total banded
68	43	7	0	1	0	1	1	0	0	0	2	242
69		108	8	10	3	4	1	2	1	2	1	957
70			9	33	30	6	11	8	8	2	0	1701
71				58	49	5	18	13	3	2	0	1949
72					20	5	34	17	4	5	0	2252
73						5	13	5	7	1	2	1194
74							67	19	11	0	2	813
75								93	27	6	7	1546
76									44	1	0	355

Females only

Year banded	Year recovered 68	69	70	71	72	73	74	75	76	77	78	Total banded
68	29	7	0	1	0	0	0	0	0	0	0	233
69		99	6	6	4	0	5	4	1	0	0	771
70			1	23	11	3	5	3	0	0	0	1251
71				59	29	7	8	9	2	0	0	1732
72					21	6	12	10	4	1	0	1628
73						2	15	6	0	0	0	799
74							63	10	10	2	0	761
75								82	19	4	5	1169
76									31	1	0	244

Juveniles when banded

Year banded	Year recovered 68	69	70	71	72	73	74	75	76	77	78	Total banded
68	43	11	0	0	0	0	0	0	0	0	1	274
69		130	2	4	0	0	4	2	0	0	1	594
70			1	12	7	0	3	4	2	0	0	820
71				90	22	2	11	5	3	2	0	1142
72					22	2	19	6	4	2	0	1194
73						1	18	6	0	0	0	761
74							80	8	6	0	0	534
75								102	9	3	3	659
76									32	1	0	192

Adults when banded

Year banded	Year recovered: 68	69	70	71	72	73	74	75	76	77	78	Total banded
68	28	4	0	2	0	1	1	0	0	0	1	194
69		77	12	12	7	4	2	4	2	2	0	1129
70			9	44	33	9	13	7	5	2	0	2107
71				25	56	10	15	17	2	0	0	2530
72					19	9	27	21	4	4	0	2683
73						6	10	5	7	1	2	1232
74							49	21	15	2	2	1035
75								66	37	7	9	2037
76									43	1	0	406

Analyses

Males

Model 1

	Recovery rates (f's)	SE	Survival rates (S's)	SE
1.	0.178	0.025	0.337	0.098
2.	0.111	0.010	0.561	0.105
3.	0.007	0.002	0.726	0.092
4.	0.028	0.003	1.251	0.176
5.	0.015	0.002	0.802	0.167
6.	0.004	0.001	0.194	0.038
7.	0.067	0.007	0.628	0.090
8.	0.054	0.005	0.248	0.045
9.	0.096	0.014		

Other models

	Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2	0.578	0.016	1.82	0.09
Model 3	0.557	0.014	1.71	0.07
Model 2*	0.695	0.027	2.75	0.29
Model 3*	0.649	0.021	2.31	0.17
Model 4*	0.648	0.021	2.31	0.17

The survival rate parameter estimates for Model 1 fluctuate considerably, and exceed 1 in one instance. The "average" estimates for Models 2 and 3 are very similar, and give estimated mean lifetimes after reaching adulthood of 1.7 - 1.8 years. The starred models give larger means, and it is difficult to determine which are the more appropriate. Based on the estimates for adults, which are more stable for <u>all</u> models, it would appear that the estimates of around 2.3 years may be the more reasonable, particularly since the starred models take into account the differential rates for the first years after banding.

<u>Females</u>

Model 1

	Recovery rates (f's)	SE	Survival rates (S's)	SE
1.	0.124	0.022	0.210	0.075
2.	0.129	0.012	0.877	0.210
3.	0.004	0.001	0.501	0.088
4.	0.033	0.004	0.986	0.175
5.	0.015	0.002	0.610	0.156
6.	0.005	0.001	0.210	0.049
7.	0.071	0.008	0.429	0.073
8.	0.068	0.007	0.195	0.044
9.	0.110	0.019		

Other models

		Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2		0.475	0.018	1.34	0.07
Model 3		0.453	0.016	1.26	0.06
Model 2^*	********	0.685	0.056		
Model 3^*	********	0.583	0.050		
Model 4^*		0.558	0.028	1.71	0.15

Models 2^* and 3^* failed to converge for these data and the estimates must be regarded as very approximate. The survival rates from Model 1 again fluctuate wildly, although they remain within the allowable ranges. Average rates from Models 2 and 3 are again relatively stable, and somewhat smaller than those from the starred models. According to these estimates, females survive a significantly shorter time than males.

Both sexes combined

Model 1

	Recovery rates (f's)	SE	Survival rates (S's)	SE
1.	0.151	0.016	0.286	0.063
2.	0.119	0.008	0.658	0.097
3.	0.006	0.001	0.643	0.065
4.	0.030	0.002	1.152	0.126
5.	0.015	0.002	0.735	0.119
6.	0.004	0.001	0.204	0.031
7.	0.068	0.005	0.537	0.058
8.	0.060	0.004	0.230	0.032
9.	0.101	0.011		

Other models

	Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2	0.537	0.012	1.61	0.06
Model 3	0.516	0.010	1.51	0.04
Model 2*	0.656	0.021	2.37	0.18
Model 3*	0.616	0.017	2.06	0.12
Model 4*	0.616	0.017	2.06	0.12

All models converged here. As before, the estimated average survival times from the starred models are larger than from Models 2 and 3, the values falling between those for males and females. In view of the results for adults we tend to favour the longer survival times. The estimates do not differ by a huge amount relative to the standard errors.

<u>Juveniles when banded</u>

Model 1

	Recovery rates (f's)	SE	Survival rates (S's)	SE
1.	0.157	0.022	0.181	0.053
2.	0.219	0.017	0.595	0.191
3.	0.002	0.001	0.276	0.056
4.	0.072	0.007	0.995	0.180
5.	0.019	0.003	0.795	0.197
6.	0.002	0.001	0.176	0.038
7.	0.127	0.013	0.274	0.047
8.	0.140	0.013	0.215	0.050
9.	0.139	0.024		

Other models

		Estimate of S	SE	Mean surv. time (yrs)	SE
Model 1		0.388	0.017	1.06	0.05
Model 2		0.381	0.015	1.04	0.04
Model 2*	********	0.733	0.060		
Model 3*	********	0.633	0.052		
Model 4*		0.607	0.031	2.00	0.20

Again Models 2* and 3* failed to converge. In this case the starred models differ considerably from Models 2 and 3, which give very similar estimates. Since these latter models fail to account for the differential survival rates of young birds in the first year it is likely that they underestimate the adult survival times, and Model 4* may be closer to the correct value.

Adults when banded

Model 1

	Recovery rates (f's)	SE	Survival rates (S's)	SE
1.	0.144	0.025	0.426	0.143
2.	0.067	0.007	0.707	0.117
3.	0.007	0.002	1.021	0.130
4.	0.015	0.002	1.091	0.157
5.	0.013	0.002	0.706	0.151
6.	0.005	0.001	0.231	0.048
7.	0.041	0.005	0.757	0.112
8.	0.034	0.004	0.224	0.041
9.	0.084	0.013		

Other models

		Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2		0.637	0.017	2.22	0.13
Model 3		0.610	0.014	2.02	0.09
Model 2*	**********	0.778	0.039		
Model 3*	**********	0.647	0.033		
Model 4*		0.617	0.020	2.07	0.14

There is much more consistency for the adults, as expected from the discussion of Brownie et al. Models 2* and 3* failed to converge, but at least in the latter case the approximate estimate of S differs little from the other models. Mean survival time after reaching adulthood is estimated to be around two years.

3.2 Grey Teal

Tables

All combined

Year recovered

Year banded	68	69	70	71	72	73	74	75	76	Total banded
68	41	14	3	4	4	0	1	1	0	465
69		13	0	3	0	0	0	1	0	90
70			0	4	1	0	1	0	0	154
71				71	14	3	13	4	5	1206
72					3	0	3	0	0	175
73						0	2	3	1	185
74							42	3	3	299
75								64	4	350
76									99	487

Males only

Year recovered

Year banded	68	69	70	71	72	73	74	75	76	Total banded
68	24	8	2	1	3	0	0	1	0	246
69		4	0	3	0	0	0	0	0	47
70			0	2	1	0	1	0	0	78
71				41	11	1	7	3	3	706
72					2	0	1	0	0	101
73						0	0	2	1	105
74							23	3	3	170
75								43	2	191
76									52	247

Females only

Year recovered

Year banded	68	69	70	71	72	73	74	75	76	Total banded
68	17	6	1	3	1	0	1	0	0	219
69		9	0	0	0	0	0	1	0	42
70			0	2	0	0	0	0	0	76
71				30	3	2	6	1	2	499
72					1	0	2	0	0	74
73						0	2	1	0	80
74							19	0	0	128
75								19	2	154
76									47	236

Juveniles when banded

Year recovered

Year banded	68	69	70	71	72	73	74	75	76	Total banded
68	22	5	0	1	1	0	0	0	0	208
69		7	0	3	0	0	0	1	0	57
70			0	0	0	0	0	0	0	12
71				42	9	1	8	2	2	734
72					1	0	2	0	0	118
73						0	0	2	0	102
74							22	1	0	161
75								36	2	180
76									30	112

Adults when banded

Year banded	Year recovered 68	69	70	71	72	73	74	75	76	Total banded
68	19	8	3	3	3	0	1	1	0	251
69		4	0	0	0	0	0	0	0	23
70			0	4	1	0	1	0	0	142
71				27	5	2	5	2	3	457
72					1	0	1	0	0	54
73						0	2	1	1	83
74							15	2	3	121
75								26	2	161
76									63	343

Analyses

Males

Model 1

	Recovery rates (f's)	SE	Survival rates (S's)	SE
1.	0.098	0.019	0.366	0.157
2.	0.081	0.032	1.070	0.688
3.	0.007	0.006	0.464	0.238
4.	0.056	0.008	0.947	0.566
5.	0.015	0.009	0.394	0.324
6.	0.001	0.002	0.155	0.092
7.	0.114	0.022	0.237	0.070
8.	0.201	0.028	0.163	0.058
9.	0.211	0.026		

Other models

		Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2		0.405	0.028	1.11	0.08
Model 3		0.386	0.028	1.05	0.08
Model 2*	********	0.855	0.102		
Model 3*	********	0.738	0.093		
Model 4*		0.668	0.063	2.48	0.58

As for Black Ducks, the estimates in Model 1 fluctuate wildly. There is a considerable discrepancy between the estimates from the starred and unstarred models. Due to the very low frequencies off the main diagonal the SE for the estimate from Model 4^* is large, and a 95% confidence interval based on this model is 1.34 years to 3.62 years.

Females

Model 1

	Recovery rates (f's)	SE	Survival rates (S's)	SE
1.	0.078	0.018	0.214	0.084
2.	0.162	0.051	1.944	1.580
3.	0.003	0.003	0.260	0.188
4.	0.059	0.010	0.541	0.333
5.	0.010	0.007	0.616	0.499
6.	0.004	0.004	0.215	0.131
7.	0.127	0.028	0.149	0.076
8.	0.115	0.025	0.104	0.054
9.	0.199	0.026		

Other models

		Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2		0.396	0.034	1.08	0.10
Model 3		0.367	0.033	1.00	0.09
Model 2^*	********	0.878	0.131		
Model 3^*	********	0.791	0.110		
Model 4^*		0.712	0.080	2.94	0.97

Model 1 contains some very wild values. Again there is a discrepancy between the estimates from the starred and unstarred models. Based on any of the models there is little difference between the mean survival times of males and females for Grey Teal, unlike the situation with Black Ducks. It is difficult to determine which of the estimates is closer to the mark, but we suspect Models 2 and 3, which do not take into account the first year differential rates, may under-estimate the mean lifetime.

Both sexes combined

Model 1

	Recovery rates (f's)	SE	Survival rates (S's)	SE
1.	0.088	0.013	0.294	0.084
2.	0.116	0.029	1.616	0.798
3.	0.005	0.003	0.368	0.154
4.	0.058	0.007	0.847	0.362
5.	0.014	0.006	0.540	0.312
6.	0.003	0.002	0.183	0.078
7.	0.120	0.018	0.207	0.053
8.	0.166	0.019	0.138	0.041
9.	0.203	0.018		

Other models

		Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2		0.401	0.021	1.09	0.06
Model 3		0.377	0.021	1.03	0.06
Model 2*	********	0.863	0.080		
Model 3*	********	0.759	0.071		
Model 4*		0.685	0.049	2.64	0.50

As expected, the results here are very similar to those for males and females separately.

Juveniles when banded

		Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2		0.355	0.087	0.97	0.23
Model 3		0.333	0.030	0.91	0.07
Model 2*	*********	0.843	0.134		
Model 3*	*********	0.752	0.113		
Model 4*		0.680	0.078	2.59	0.77

The table of frequencies for juveniles contains a row of zeros, which precludes estimation in Model 1. Models 2* and 3* failed to converge, and the estimated mean average lifetimes from the starred models are significantly higher than for Models 2 and 3, which are themselves relatively consistent. Note that a 95% confidence interval for the estimated mean from Model 4^* is given by 1.05 to 4.13, so the value is not inconsistent with a mean around one year as suggested by Models 2 and 3, though again we suspect the last two under-estimate.

<u>Adults when banded</u>

Model 1

	Recovery rates (f's)	SE	Survival rates (S's)	SE
1.	0.076	0.017	0.363	0.184
2.	0.091	0.045	1.699	1.093
3.	0.007	0.005	0.354	0.155
4.	0.056	0.010	0.730	0.530
5.	0.014	0.010	0.383	0.330
6.	0.005	0.004	0.252	0.135
7.	0.109	0.026	0.316	0.110
8.	0.136	0.026	0.205	0.074
9.	0.184	0.021		

Other models

		Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2		0.467	0.031	1.31	0.11
Model 3		0.436	0.031	1.20	0.10
Model 2^*	********	0.865	0.100		
Model 3^*	********	0.766	0.090		
Model 4^*		0.691	0.064	2.71	0.68

As for the juveniles, there is a large discrepancy between the estimates from Models 2 and 3 and that from Model 4^*, though again in the last case the standard errors are very large.

3.3 Mountain Ducks

Table

Year banded	Year recovered 73	74	75	76	Total banded
73	0	1	0	0	6
74		11	0	0	76
75			1	0	60
76				6	141

The numbers prior to 1973 are too small to include in the analysis.

Analysis

All combined

The data are far too sparse for any reliable estimation in the case of Mountain Ducks, and only the simplest models are considered.

		Estimate of S	SE	Mean surv. time (yrs)	SE
Model 2	*********	0.184	0.950	0.59	1.80
Model 3		0.102	0.099	0.44	0.19

Note that the standard errors are very large, and little confidence could be placed on the estimates.

4. DISCUSSION

The above estimates of survival rates are based on models describing the way in which probabilities of recovery in any year are related to survival and band return probabilities. The validity of the estimates depends on the correctness of the models and on the sampling assumptions which give multinomial frequencies, in particular on independence of the birds' behaviour. These assumptions are undoubtedly not correct for our data, but the stability of estimates for at least some of the models lends some confidence to the estimates obtained.

In other cases, where the recovery numbers are relatively small and estimates from the different models vary considerably, one could not be confident that the estimates are meaningful. In particular, the estimates for Mountain Duck and some of the breakdowns for Grey Teal must be regarded with some suspicion.

The approach adopted here can be compared with that used in the other report on survival estimates, "Analysis of survival times for ducks based on individual time intervals" by Pat Fitzgerald (March 1988), which follows each bird longitudinally. There, for Black Ducks followed from the juvenile stage the estimated mean lifetime was approximately two years. It is interesting to note that using Models 2 and 3 we obtain for this group estimated mean lifetime <u>after reaching adulthood</u> of about one year. Using Model 4^*, which takes account of the higher initial mortality, gives mean estimate of about two years after reaching adulthood.

REFERENCES

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APPENDIX: GLIM program for approximate analyses

The following GLIM code is for approximate fitting of the models described herein. It is assumed that the recovery frequencies are in a vector y representing a %m by %n array in which rows correspond to the banding years, with the last column giving the numbers of birds not recovered (not the total banded as in the text) and with zeros below the main diagonal.

```
$yvar y$
$fact r %m c %n$calc r=%gl(%m,%n):c=%gl(%n,1)$
$calc w=(r<=c)$         * weight out below diagonal *
$fit r-1$
$cal tot=%fv*(%n)$
$calc lt=%log(tot)$
$offset lt$             * total number banded *
$cal w=w*(c/=%n)$
$wei w$error p$
$cal diag=c-r$
$fit c+r-1$$extr %pe$   * model 1 *
$loo %pe$
$fit c+diag-1$extr %pe %vc$  * model 2 *
$calc %exp(%pe)$print %vc$
$fit diag$extr %pe %vc$   * model 3 *
$cal %exp(%pe)$print %vc$
$calc w=(r<c)$   * omit main diagonal *
$fit r-1$
$cal tot=%fv*(%n)$
$calc lt=%log(tot)$
$offset lt$
$cal w=w*(c/=%n)$
$wei w$error p$
$cal diag=c-r-1$
$fit c+diag-1$extr %pe %vc$   * model 2* *
$calc %exp(%pe)$print %vc$
$fit diag$extr %pe %vc$      * model 3* *
$cal %exp(%pe)$print %vc$
```