

DISTRIBUTION AND ABUNDANCE OF WADING BIRDS IN THE WATER CONSERVATION AREAS OF THE FLORIDA EVERGLADES, 2002



Watercolor by Dinah Lazor

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Prepared for the U. S. Army Corps of Engineers, Jacksonville District and South Florida Water Management District

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OF WADING BIRDS IN THE WATER
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EXECUTIVE SUMMARY

Major changes in water management that are currently being proposed or implemented will alter the hydrology of the Water Conservation Areas and, consequently, the use of these areas by wading birds. Because these areas support huge concentrations of foraging wading birds (Hoffman et al. 1994) and the largest percentage of the remaining nesting wading birds in the Everglades (Ogden 1994), monthly systematic reconnaissance flights (SRF) were conducted to investigate and monitor the relationship between modified hydrologic patterns in the Everglades system and the distribution and abundance of these wading birds.

Surveys were flown with a fixed winged aircraft at an altitude of 60 meters along 50 parallel transects with 2 km spacing in the Water Conservation Areas from February to June 2002. The Holey Land and Everglades Nutrient Removal Area are adjacent to the Water Conservation Areas and were also surveyed each month. Wading birds were enumerated, their positions recorded, entered into a database, and summarized into tables. Densities of each species were separated into 4 km² cells and plotted onto maps of the study area.

Water levels rose from June 2001 to November 2001, declined from November 2001 until May 2002 then began to increase again in June 2002. Decreasing water levels allow wading birds to take advantage of the drying conditions that concentrate prey and allow water depths that can be waded by the birds. In 2002, the monthly percent of wet cells ranged from 99 % in February to 67 % in May. In 2002 and 2000, water levels declined to 20 cm for Gauges 1-7 and 3A4 by May and June while in 2001 they reached this level by March. Gauge 2A-17 had already declined to 20 cm by January 2001 and January 2002 but did not reach that level until March 2000. Conditions were dryer in 2001 than in 2002 and 2000. In 2001, the monthly percent of wet cells ranged from 85 %

in January to 31 % in April which was much dryer than for 2000 (100% in January to 91 % in June) and 2002. Based on water levels and percent wet cells the 2002 survey period started as mostly wet in the fall becoming dryer from winter into early spring then less dry in summer. The 2001 survey period started as mostly wet in the winter becoming dry in the early spring then less dry in late spring. The 2000 survey period started as wet then less wet during late winter and early spring then became wetter in early spring then less wet again in late spring and summer. The 1999 survey period started as wet and then became dry in early spring then back to wet in late spring and summer. The 1996, 1997, and 1999 survey had water conditions that were considered wet and the 1995 and 1998 survey water conditions were extremely wet (flood).

In 2002, wading bird numbers peaked in February and May. In 2001, wading bird numbers peaked in January and February. In 2000, wading bird numbers peaked in May and June. The difference in water conditions was reflected in a large increase in numbers of wading birds in February 2001 then a rapid decline in wading bird numbers coincident with decreasing water levels through June 2001.

The mean monthly estimated abundances in 2002 were lower than in 2001 for all species except White Ibis (Appendices D, H and I). White Ibis mean monthly estimated abundance was slightly higher for 2002 than 2001. The mean monthly estimated abundances in 2001 were higher than in 2000 for all species except White Ibis and Glossy Ibis (Appendices D, H and I). White Ibis and Glossy Ibis had mean monthly estimated abundances close to the same levels for 2000 and 2001. The mean monthly estimated abundance was used as an index of long term trends to compare each respective species/species group mean monthly estimated abundance in 2002 with the overall mean monthly estimated abundance. The monthly estimated abundance in 2002 for Great Blue Herons, Glossy Ibises and small herons was lower than the 11-year monthly mean estimated abundance(1985-1995). Great Egret mean monthly estimated abundance exceeded its 11-year mean during all months except March 2002. White Ibis monthly

estimated abundance exceeded its respective 11-year mean during February, April, and June. Wood Storks mean monthly estimated abundance exceeded its respective 11-year mean only in May 2002. While the values of the estimated numbers for the comparison of long term trends should be viewed with caution (because they are estimates extrapolated from counts), the numbers do serve as an index for examining changes in estimated abundance for the survey area.

During the 2002 survey year January was wet and became less wet until June 2002 when water levels began to increase again. In 2001, the survey area was already beginning to dry in January and became dryer until June 2001. The 2000 survey year was a "dry down" year (water levels dropped from winter to early spring) like 1999 concentrating prey and birds as water levels declined. The 2001 survey represented an early drying year with most species relative abundance estimates close to or exceeding comparable values for the 2000 survey. The 2000 survey and the 1998 "El Nino" year (very wet all months) represents a dramatic contrast in wading bird numbers. The increase of wading bird numbers in 2000 were similar to the higher abundances in 1996, 1997 and 1999 while 1998 numbers were comparable to the lower abundance, "flood year" survey results as in 1995. These year to year differences demonstrate how wading birds respond in successive years to changing water levels.

In 2002, wading bird estimated abundance in the Holey Land was highest in February (2607) and the species were predominantly Great Egrets and White Ibises. In 2002, wading bird estimated abundance was lowest in June (33). No survey was conducted in the Holey Land for January 2002. For the 2001 survey wading birds in the Holey Land were at their highest estimated abundance during January (4,381) and were predominantly Great Egrets and White Ibises. During the 2000 survey wading birds in the Holey Land were at their highest estimated abundances during February (1947) and were composed mostly of Great Egrets and White Ibises. Estimated abundance was highest during March 1998 (860) and March 1999 (1447) and was composed mostly of Great

Egret and White Ibises. During the 1997 survey, wading bird estimated abundances were highest during March (3,487) and were composed predominantly of White Ibises and Great Egrets. During the 1996 survey, wading bird estimated abundances were highest during March (1,393) and April (2,600) and were composed predominantly of White Ibises. During the 1995 survey wading birds were at their highest estimated abundances during May (1,060) and June (1,666) and consisted of predominantly small white herons (Sawicki et al, 1995). The mean monthly estimated abundance of wading birds for was higher in 2002 (769) than 2001 (760), 1999 (431), 1998 (452), and 1995 (538) surveys. The mean monthly estimated abundance of wading birds in 2002 was lower than 2000 (858), 1997 (1,007), and 1996 (938).

In 2002, the Everglades Nutrient Removal Area was not surveyed in January. During 2002 wading bird numbers were generally very low from February (10) to June (21). This was probably attributable to high water conditions maintained in the area. During the 2001 survey wading bird numbers in the Everglades Nutrient Removal Area (ENR) were highest in June (1425) and were predominantly Great Egrets, small white herons and White Ibises. During the 2000 survey wading bird numbers in the Everglades Nutrient Removal Area (ENR) were highest in January (112) and were predominantly Great Egrets and White Ibises. During the 1999 survey wading bird numbers were highest in July (257) and were predominantly Great Egrets and White Ibises. During the 1998 survey wading bird numbers were highest in January (668) and were predominantly White Ibises. During the 1997 survey, wading birds were highest in June (122) and were predominantly White Ibises. During the 1996 survey, wading bird numbers were highest during March (229) and April (564) and were predominantly small white herons, White Ibises, and Great Egrets. During the 1995 survey wading bird numbers were at their highest numbers during June (187) and consisted of predominantly small white herons (Sawicki et al, 1995). The mean monthly number of wading birds in the ENR was lower in 2002 (10) than for 1995 (82), 1996 (174), 1997 (73), 1998 (234), 1999 (72) 2000 (37) and 2001 (348).

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	i
LIST OF TABLES.....	v
LIST OF FIGURES.....	vi
LIST OF APPENDICES.....	ix
ACKNOWLEDGMENTS.....	viii
INTRODUCTION.....	1
BACKGROUND.....	2
METHODS.....	5
RESULTS.....	14
DISCUSSION.....	27
LITERATURE CITED.....	31
APPENDICES.....	33

LIST OF TABLES

1. Dates and completed transects for 2002.
2. Number of transects and areas for the Water Conservation Areas and the Holey Land.
3. Estimated abundance of wading birds in the Water Conservation Areas, 2002.
4. Estimated abundance of wading birds (species combined) in the Water Conservation Areas, 2002.

LIST OF FIGURES

1. Afternoon thunderstorms provide water to the Water Management Areas and may cause minor course deviations during the survey.
2. Cessna 182 aircraft flown at 60 m elevation for the systematic aerial surveys.
3. Wading birds counted along transects out of each side of the aircraft.
4. A mixed species group of wading birds feeding in the shallows of the water management areas.
5. Great Egret feeding in the shallows of the water management areas.
6. A large flock of White Ibis in the water management areas.
7. Study areas and transects.
8. Mean water levels for Gauges WCA 1-7, WCA 2A-17, and WCA 3A-4 within the Water Conservation Areas from June 2002 through June 2002.
9. Estimated abundance of wading birds (species combined) in the Water Conservation Areas, 2002.
10. Estimated abundance of wading birds (species combined) in each of the Water Conservation Areas, 2002.

LIST OF APPENDICES

APPENDIX A: Transect latitudes and west and east boundary latitudes in the Water Conservation Areas, 2002.

APPENDIX B: Estimated abundance for wading birds, 2002.

APPENDIX C: Densities of wading birds, 2002.

APPENDIX D: Wading Bird Estimated Abundance in the Water Conservation Areas, 1985-2002.

APPENDIX E: Estimated abundance of each wading bird species in the Water Conservation Areas, February to June 2002.

APPENDIX F: Estimated abundance of each wading bird species for each impoundment within the Water Conservation Area, February to June 2002.

APPENDIX G: Mean, minimum, and maximum water levels for Gages WCA 1-7, WCA 2A-17, and WCA 3A-4 within the Water Conservation Areas, June 2001 to June 2002.

APPENDIX H: Comparisons of estimated abundance of each wading bird species in the Water Conservation Areas for January to June 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

APPENDIX I: Comparison of estimated abundance of each wading bird species in the

Water Conservation Areas for 1985 to 2002.

APPENDIX J: Monthly density maps of wading birds (species combined) in the Water Conservation Areas, February to June 2002.

APPENDIX K: Monthly density maps of Great Blue Herons in the Water Conservation Areas, February to June 2002.

APPENDIX L: Monthly density maps of Great Egrets in the Water Conservation Areas, February to June 2002.

APPENDIX M: Monthly density maps of small dark herons in the Water Conservation Areas, February to June 2002.

APPENDIX N: Monthly density maps of small white herons in the Water Conservation Areas, February to June 2002.

APPENDIX O: Monthly density maps of White Ibises in the Water Conservation Areas, February to June 2002.

APPENDIX P: Monthly density maps of Glossy Ibises in the Water Conservation Areas, February to June 2002.

APPENDIX Q: Monthly density maps of Wood Storks in the Water Conservation Areas, February to June 2002.

APPENDIX R: Monthly density maps of wading birds in the Holey Land, February to June 2002.

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INTRODUCTION

Major changes in water management that are currently being proposed or implemented will alter the hydrology of the Water Conservation Areas and, consequently, the use of these areas by wading birds. The Water Conservation Areas support huge concentrations of foraging wading birds (Hoffman et al. 1994) and the largest percentage of the remaining nesting wading birds in the Everglades (Ogden 1994). Since it is critical that we investigate and monitor the relationship between modified hydrologic patterns in the Everglades system and the distribution and abundance of these wading birds, monthly systematic reconnaissance flights (SRF) were conducted in the Water Conservation Areas from February to June 2002. This document presents the results of these surveys. These data, when combined with survey data from other parts of the Everglades/South Florida Ecosystem, will provide a synoptic view of distribution and abundance of wading birds.

BACKGROUND

The Everglades ecosystem originally extended from the southern shore of Lake Okeechobee south and west to the coastal mangrove forests and estuaries of the Gulf of Mexico and Florida Bay, and consisted of a complex vegetation mosaic (Davis et al. 1994). Water levels within this marsh system rose and fell with the annual rain cycle (Walters et al. 1992). The majority of rain in this ecosystem generally occurs between late May and early November (Bancroft 1989, Duever et al. 1994)(Figure 1).

The original Everglades marsh ecosystem provided abundant primary and secondary production during the wet summer and fall months (Holling et al. 1994), and this productivity was concentrated during the dry winter and spring when water levels receded. The concentrations of food provided ideal foraging habitats for numerous wetland species, especially large flocks of wading birds (Bancroft 1989, Ogden 1994). However, the hydrology of the Everglades has been severely altered (Light and Dineen 1994) by extensive draining and the construction of canals and levees. The resulting system is not only spatially smaller, but also drier than historical levels (Walters et al. 1992). Moreover, the timing and distribution of water flow have been highly altered.

Breeding populations of wading birds have responded negatively to altered hydrology (Ogden 1994, Bancroft 1989, Kushlan and Fohring 1986) as numbers of breeding wading birds in the Everglades have decreased by more than 90%. During favorable years in the 1930s, up to 250,000 wading birds, including White Ibises (*Eudocimus albus*), Wood Storks (*Mycteria americana*), Great Egrets (*Casmerodius albus*), Snowy Egrets (*Egretta thula*), and Tricolored Herons (*E. tricolor*) nested in the central and southern Everglades (Ogden 1994). Maximum numbers had decreased to

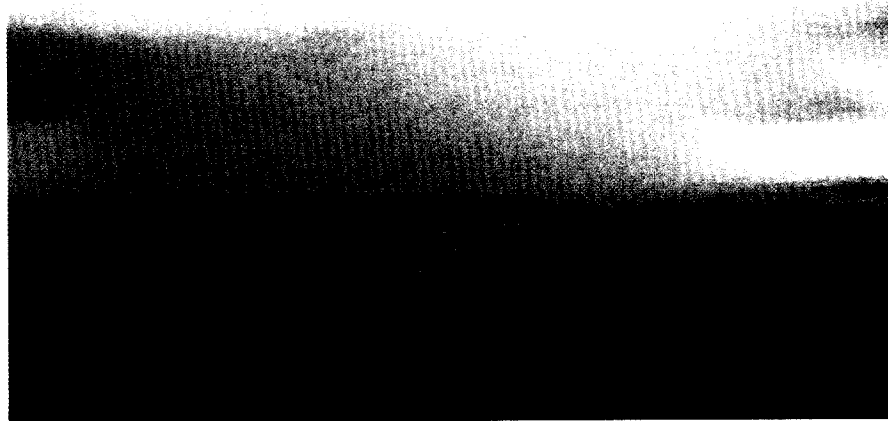


Figure 1. Afternoon thunderstorms provide water to the Water Management Areas and may cause minor coarse deviations during the survey.

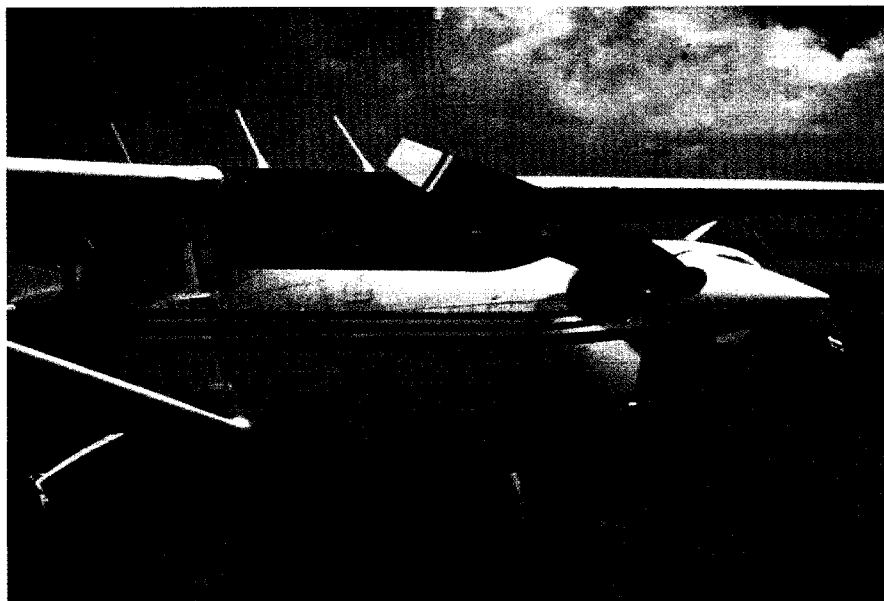


Figure 2. Cessna 182 aircraft flown at 60 m elevation for the systematic aerial surveys. 54,000 by the 1970's and further to 22,000 by the 1980's (Ogden 1994). During the 1930s

54,000 by the 1970's and further to 22,000 by the 1980's (Ogden 1994). During the 1930s approximately 90% of the wading birds nested along the interfaces between the freshwater Everglades and the mangrove-estuaries (Ogden 1994). By the 1980s, the majority of nesting wading birds had shifted to nesting in the interior freshwater Everglades, principally in the Water Conservation Areas (WCA) (Ogden 1994). These changes were presumably the result of extensive hydrological alterations (water flow and volume) in the Everglades system (Ogden 1994, Bancroft 1989).

Significant declines in the numbers of wading birds have contributed to the movement toward restoring the hydrologic conditions of the Everglades to more historic patterns. The South Florida Water Management District (SFWMD) and the U.S. Army Corps of Engineers (USACE) are currently evaluating and implementing water requirements that would restore the Water Conservation Areas (WCA) and Everglades National Park (ENP) in ways that improve and restore the natural conditions of south Florida's Everglades. One goal of this process is to improve conditions for wading birds within the remaining Everglades system.

In 1993, the Florida Legislature passed the Everglades Forever Act which calls for the construction of 34,000 acres of wetland treatment marshes along the northern edge of the Water Conservation Areas. Loxahatchee National Wildlife Refuge has proposed increasing water depths and hydro-periods within the refuge. The US Army Corps of Engineers, South Florida Water Management District, and Everglades National Park are initiating modified water deliveries for Northeast Shark Slough and Shark Slough in Everglades National Park, and the South Florida Water Management District is attempting to restore natural hydrologic conditions within the Water Conservation Areas.

METHODS

Systematic Reconnaissance Flights

Similar to Bancroft and Sawicki (1995), we examined the effect that changes in hydrology in the WCA's may have on the distribution and abundance of wading birds. We estimated the number and distribution of foraging wading birds using a systematic aerial transect method (Norton-Griffiths 1978) as modified by the National Audubon Society (Bancroft and Sawicki 1995). Using identical survey parameters (height, ground speed, strip width, transect spacing) as Bancroft and Sawicki (1995), we flew surveys in the areas consisting of east-west transects spaced at 2 km intervals. Transects were flown in a Cessna 182 at 61 m (200 ft) altitude and a ground speed of 145-185 km/h (80-100 nautical mph)(Figure 2). Two observers, one on each side of the airplane recorded all wading birds observed within 150 m wide strips paralleling the path of the plane (Figure 3). When birds were sighted in the strips, the longitude was recorded from a Global Positioning System receiver. The species, number, behavior, and longitude were recorded for all sightings within the strips.

We identified to species Great Blue Herons (*Ardea herodias*), Great Egrets, Wood Storks, White Ibises, and Glossy Ibises (*Plegadis falcinellus*)(Figure 4-6). Because of the difficulty of identifying Tricolor herons (*Egretta tricolor*) and Little blue herons (*Egretta caerulea*) within a large mix flock, these species were identified as "small dark herons". Snowy Egrets (*Egretta thula*) and first-year Little Blue Herons that could not be correctly identified were classified into a group called "small white herons" (Bancroft and Sawicki 1995). Small white herons and small dark herons were then grouped together into a third category called "small herons". The small heron category was used to compare estimated abundance to past surveys (Appendices D, H, and I). We grouped these species because it

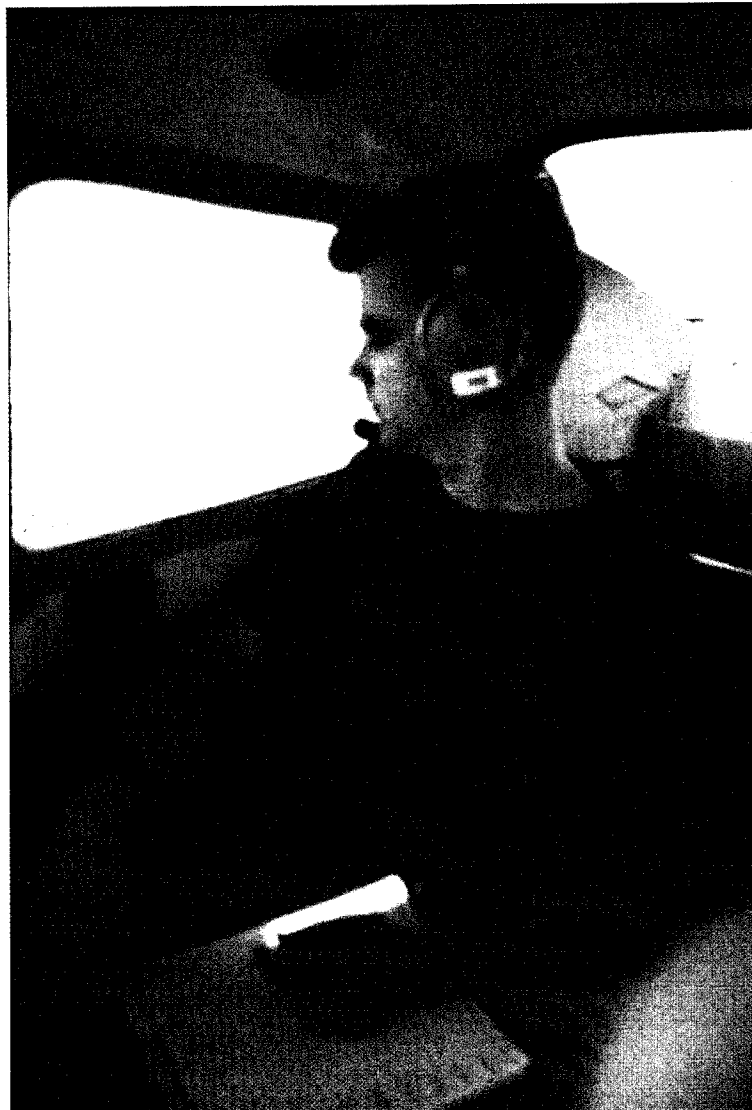


Figure 3. Wading birds counted along transects out of each side of the aircraft.



Figure 4. A mixed species group of wading birds feeding in the shallows of the water management areas.

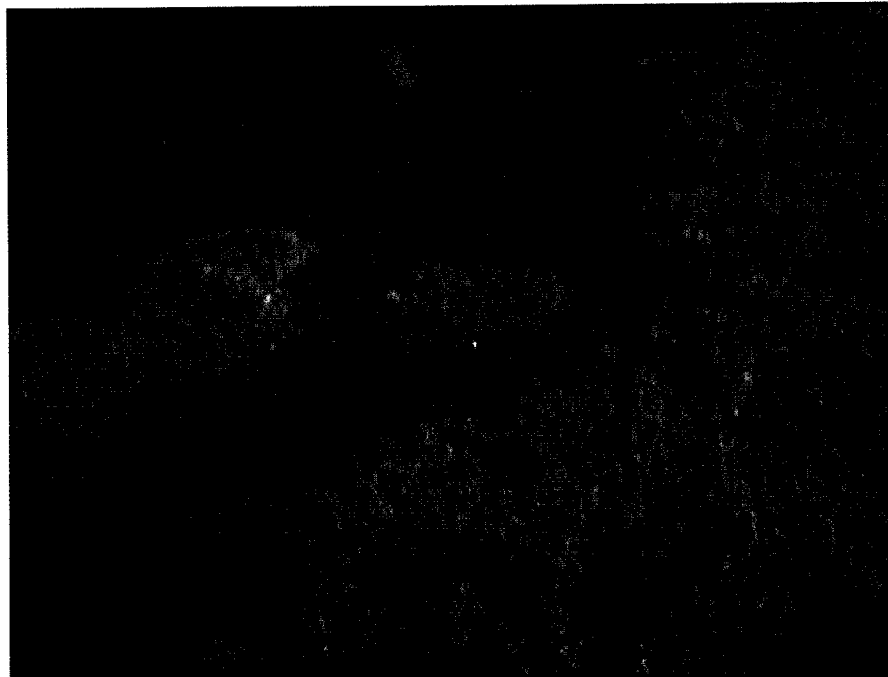


Figure 5. Great Egret feeding in the shallows of the water management areas.

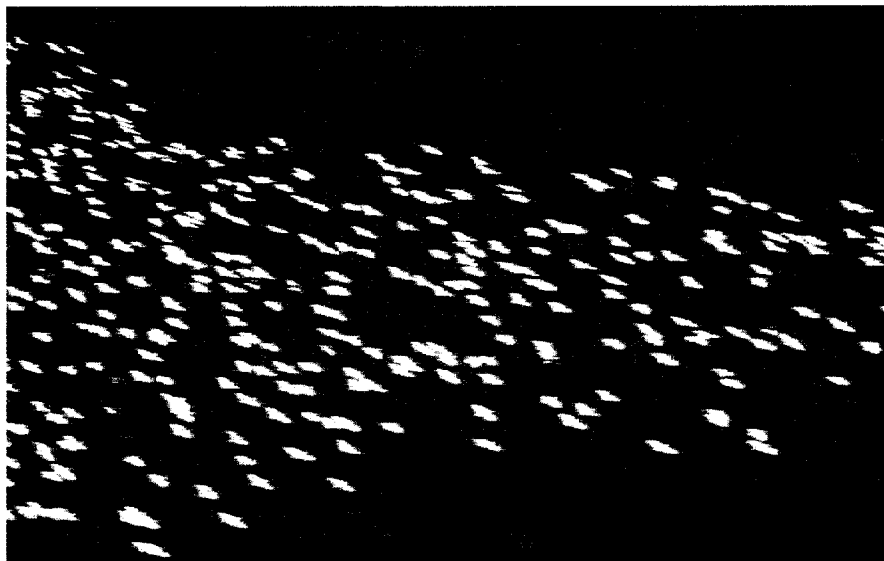


Figure 6. A large flock of White Ibis in the water management areas.

was difficult at times to identify them to species from a moving airplane. In addition, small herons usually are seen in low numbers and would not show a pattern when analyzed and mapped as separate species (Bancroft and Sawicki 1995).

Water Analyses

During the surveys, surface water coverage was recorded. Bancroft and Sawicki (1995) classified water coverage into four categories; (1) *wet* conditions were defined as having water completely covering the ground surface, (2) *wet transitional* conditions had partially exposed ground, but more than 50% of the ground surface flooded, (3) *dry transitional* conditions for areas less than 50% flooded, and (4) *dry conditions* where surface water appeared only in ponds, canals, and alligator holes. These water conditions were recorded on a broad scale, such that each 2-km x 2-km cell was assigned a single value in a given month. The water data recorded during the surveys was coded numerically and transferred to computer files for mapping.

Study Areas

During 2002 systematic transects were again flown in three main areas, the Water Conservation Areas, the Holey Land, and the Everglades Nutrient Removal Area (ENR) (Figure 7). The Water Conservation Areas are divided by canals and levees into five water level control impoundments ranging in sized from 124 km² to 2040 km². The five Water Conservation Areas are WCA 1(620 km²), WCA 2A (384 km²), WCA 2B (124 km²), WCA 3A (2040 km²), and WCA 3B (364 km²) (Tables 1 and 2). The Holey Land is 172 km² and the Everglades Nutrient Removal Area is approximately 40 km². The dominant vegetation in the Water Conservation Areas is native species sawgrass (*Cladium jamaicense*), spikerush (*Eleocharis cellulosa*), water lily (*Nymphaea odorata*), cypress tree (*Taxodium ascendens*) and the introduced species melaleuca tree (*Melaleuca quinquenervia*), Australian pine tree (*Casuarina* sp.), Brazilian pepper tree (*Schinus*

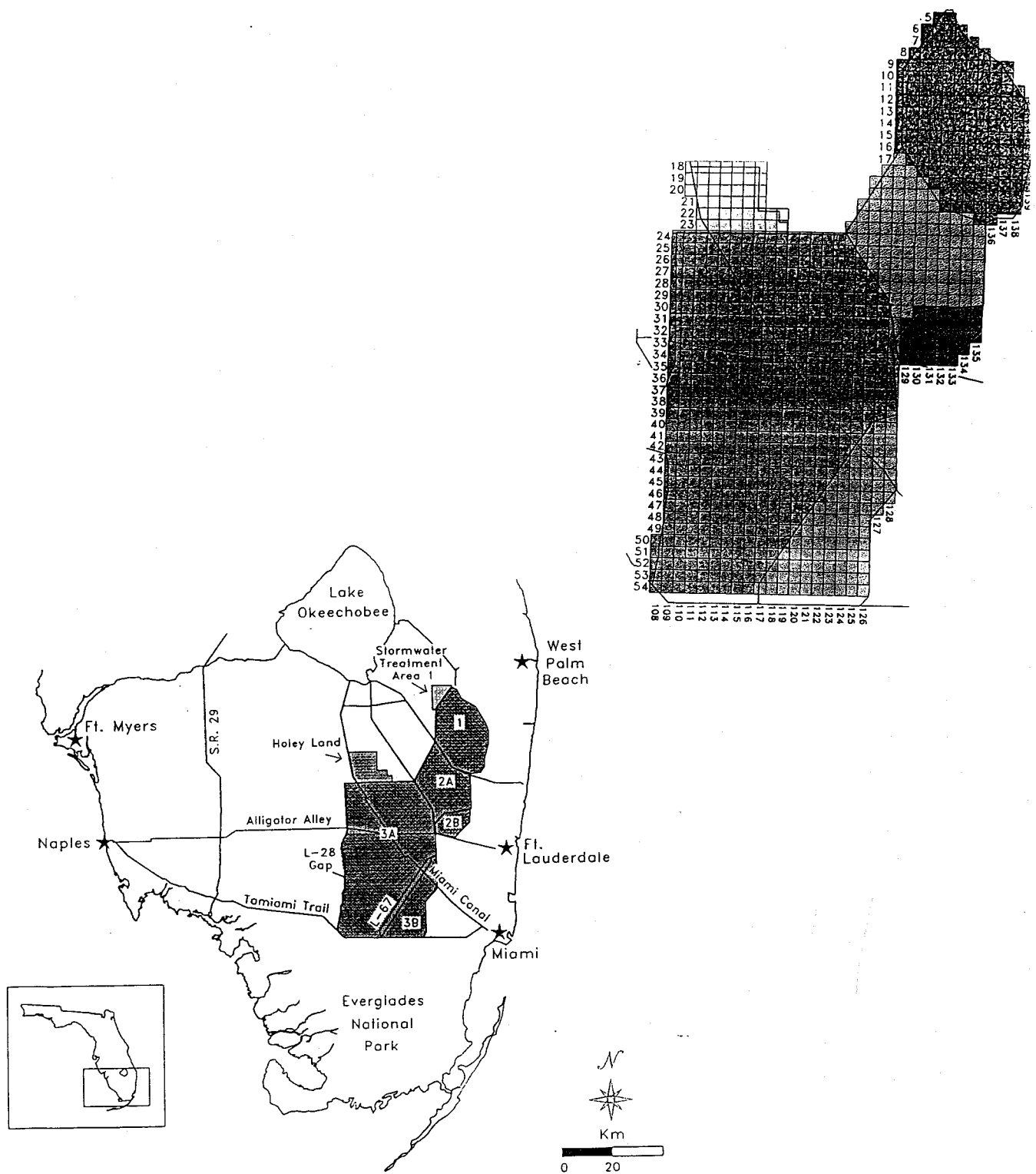


Figure 7. Study areas and transects (adapted from Sawicki et al. 1995).

Table 1. Dates and completed transects for 2002.

Month	Dates WCAs/ Holey Land	Transects WCAs	Transects Holey Land	Dates Big Cypress	Transects Big Cypress
Feb	11-13	5-54	18-23	13-15	26-54
Mar	20-25	5-54	18-23	25-27	26-54
Apr	4/30-5/3	5-54	18-23	5/3-5/5	26-54
May	21-23	5-54	18-23	23-25	26-54
Jun	19-25	5-54	18-23	26-28	26-54

Table 2. Number of transects and areas for the Water Conservation Areas and the Holey Land.

Areas	Transects	Number Cells (4 km ²)	Square Kilometers	Hectares	Acres
1	5-22	155	620	62,000	153,202
2A	17-31	106	424	42,400	104,770
2B	30-34	31	124	12,400	30,640
3A	24-54	500	2,000	200,000	494,200
3B	39-54	91	364	36,400	89,944
Holey Land	18-23	43	172	17,200	42,501

terebinthifolins), and water hyacinth (*Eichornia crassipes*). The Holey Land dominant vegetation is sawgrass, southern bayberry shrubs (*Myrica cerifera*), and cattail (*Typha*

domingensis). For a more detailed description of the vegetation and vegetation associations see Bancroft and Sawicki (1995), Davis and Ogden (1994), and Sawicki et al. (1995).

Survey Personnel

In 2002, Dr. Dave Nelson occupied the right front seat of the airplane, counted birds, and recorded water conditions on the right side of the plane. Mr. Bob Metzger occupied the left rear seat and counted birds on the left side of the plane. The pilot for the surveys was Mr. Kenneth Poteet.

Data Management

Data were entered into handheld computers during the flights. The data was then entered from the computer into spreadsheet software and corrected for entry errors. The data was then entered into a data management system developed by Mr. Chuck Dickerson and Mr. Craig Theriot. A video recording with the position from the GPS overlaid on the image was made of each transect, each month and archived for future reference.

Data Analysis

We used the database analysis program developed by Dave Buker and modified by Mr. Chuck Dickerson and Mr. Craig Theriot. Each observation was sorted by species and assigned to the correct 4 km² cell. Total population estimates of each species were tabulated for each area and each cell. The density data for each 4 km² cell was stored in a dBase file format and transferred to the ARCINFO Geographic Information System for plotting of density maps.

Map Production

ARCINFO Geographic Information System was used to produce maps of the relative density for each species/species category and for all species combined. The relative density categories were scaled from five categories: 1) 1.67 birds per km² (one bird observed); 2) greater than 1.67 birds per km² but less than 1/10 of the overall (6 month) maximum density; 3) 1/10 to 3/10 maximum density; 4) 3/10 to 7/10 maximum density; and 5) 7/10 to maximum density (Sawicki et al., 1995). These density categories were represented on the maps by dots that increased in size with density. Water maps for each group were calculated by coding the water data from 1 to 4, where 1 was wet and 4 was dry.

RESULTS

Water Conditions for the Water Conservation Areas

During 2002 the water conditions for the water conservation areas decreased from 99 % wet cells during February and March to 70 % in April and 67 % in May. The percent of wet cells then increased June to 97 %. WCA 2B remained completely wet during all survey months. WCA 3B was completely wet during all months except April when it was 98 % wet. WCA 1 was 100 % wet during February and March then dryer in April (68 % wet) and May (66 % wet) then very wet again in June (97 % wet). WCA 2A nearly 100 % wet in February, March and June and was dryer in April (55 % wet) and May (36 %). WCA 3A was nearly 100 % wet in February, March and June and was dryer in April (68 % wet) and May (66 % wet).

Water Levels for the Water Conservation Areas

Water level data were obtained from the South Florida Water Management District for 3 water level gauges. Gauge 1-7 is located in central WCA 1, Gauge 2A-17 in central WCA 2A, and Gauge 3A-4 in south central WCA 3A. Monthly means, minimum and maximum water levels were plotted from June 2001 to June 2002 for the 3 gauges (Figure 8, Appendix G).

Mean water levels for Gauge 1-7 increased from June 2001 (mean difference from mean sea level, msl, 21.74 cm) to a maximum in November 2001 (mean difference in msl 65.89 cm), then decreased each month to a low May 2002 (mean difference in msl 22.46 cm). Mean water levels increased in Jun 2001 (mean difference from msl 33.04 cm).

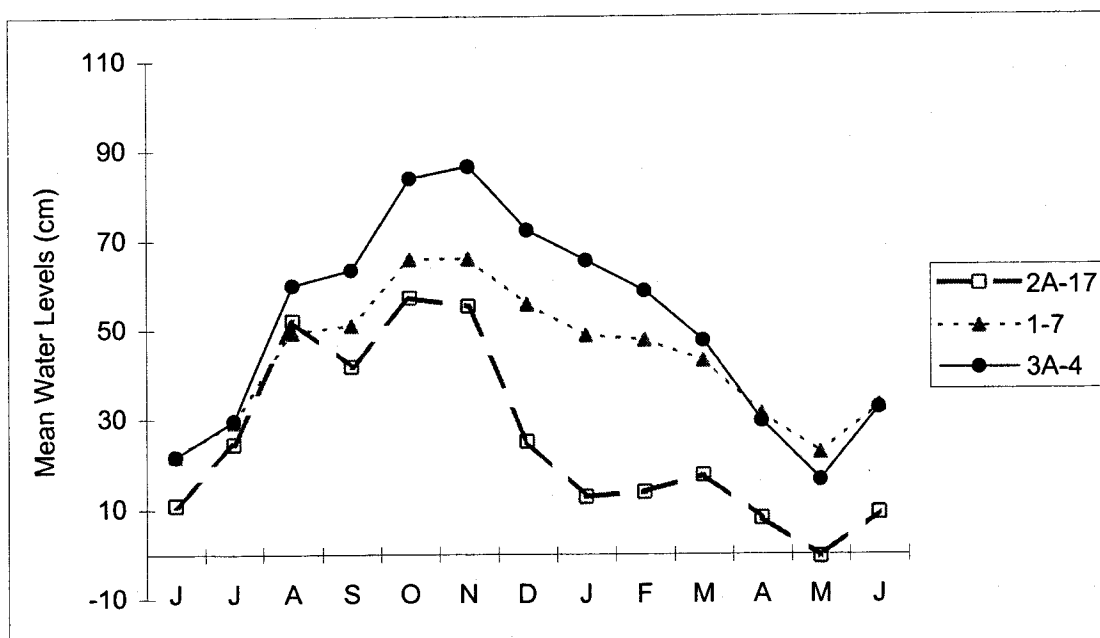


Figure 8. Mean water levels above mean sea level for Gauges WCA 1-7, WCA 2A-17, and WCA 3A-4 within the Water Conservation Areas, June 2001 to June 2002 (0 = mean sea level).

Water levels for Gauge 1-7 were high and variable during the months from July 2001 to November 2001. Water levels declined from November 2001 to May 2002 and varied little on a daily basis. During June 2002 water levels were higher and more variable than the previous month (Appendix G1).

Mean water levels for Gauge WCA 2A-17 increased from June 2001 (mean difference from msl 10.80 cm) to October 2001 (mean difference from msl 57.15 cm). Water levels decreased from October 2001 to January 2002 (mean difference from msl 12.65 cm). Water levels increased in February 2002 and March 2002 then decreased in April 2002 and May 2002 (mean difference from msl -0.52 cm). Water levels increased from in June 2002 (mean difference from msl 9.11 cm).

Mean water levels for Gauge WCA 2A-17 were increasing and variable from June 2001 to October 2001. From December 2001 to May 2002 water levels decreased and became less variable. During June 2001 water levels became higher and more variable (Appendix G2).

Mean water levels for Gauge 3A-4 increased from June 2001 (mean difference from mean sea level, msl, 25.91 cm) to a maximum in October 2001 (mean difference in msl 90.22 cm), then decreased each month to a low May 2002 (mean difference in msl 21.34 cm). Mean water levels increased in June 2002 (mean difference from msl 54.56 cm)(Appendix G3). The mean water levels and variability followed a pattern similar to the other two gauges.

Table 3. Estimated abundance of wading birds in the Water Conservation Areas, 2002

Species	Feb	Mar	Apr	May	Jun
Great Blue Herons	633	387	613	660	320
Great Egrets	26,607	7,140	17,500	31,900	16,440
Small Dark Herons	347	73	87	207	87
Small White Herons	1,113	373	1533	1840	300
White Ibises	61,900	39,047	36,193	38,747	2,233
Glossy Ibises	313	1,220	433	313	0
Wood Storks	2,007	667	1827	5,333	220
Other*	500	313	407	640	513
Total Abundance	93,420	49,220	58,593	79,640	20,113

* OTHERS GWH, RS, CE

Table 4. Estimated abundance of all wading birds (species combined) in the Water Conservation Areas, 2002

Month	1	2A	2B	3A	3B	Total
Feb	9,887	14,707	13,267	51,787	3,773	93,420
Mar	2,773	22,033	127	23,913	373	49,220
Apr	19,993	7,467	1,220	28,167	1,747	58,593
May	23,647	5,807	2,087	44,987	3,113	79,640
Jun	7,487	1,260	913	9,440	1,013	20,113

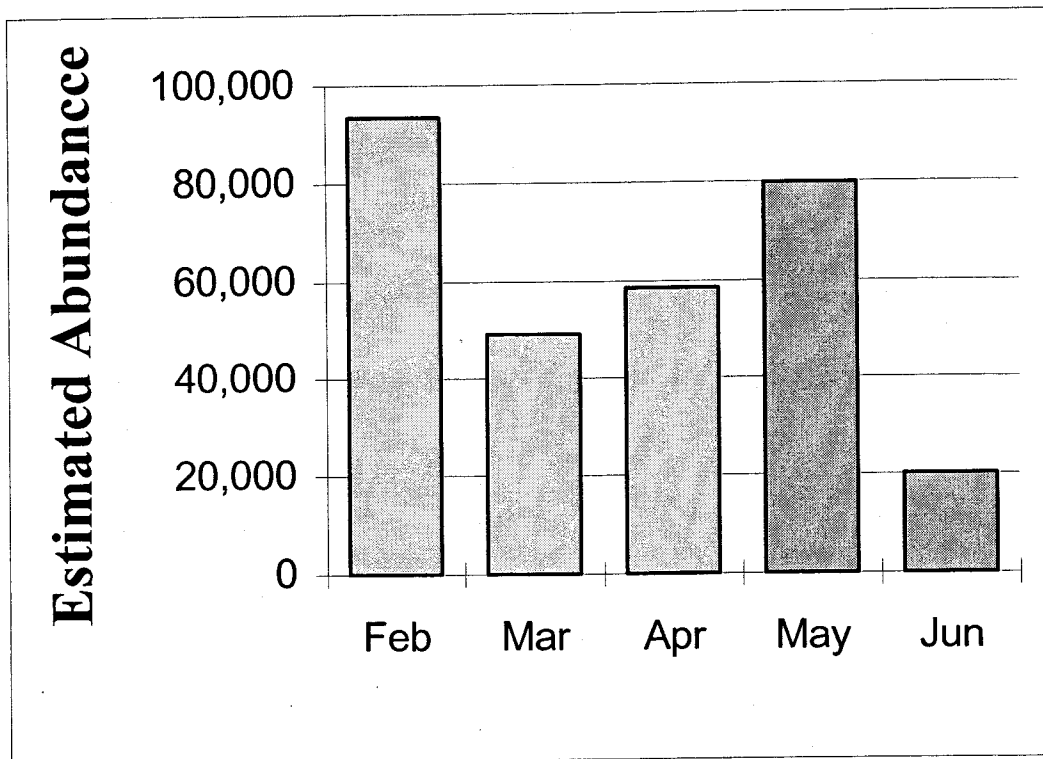


Figure 9. Estimated abundance of wading birds (species combined) in the Water Conservation Areas, 2002.

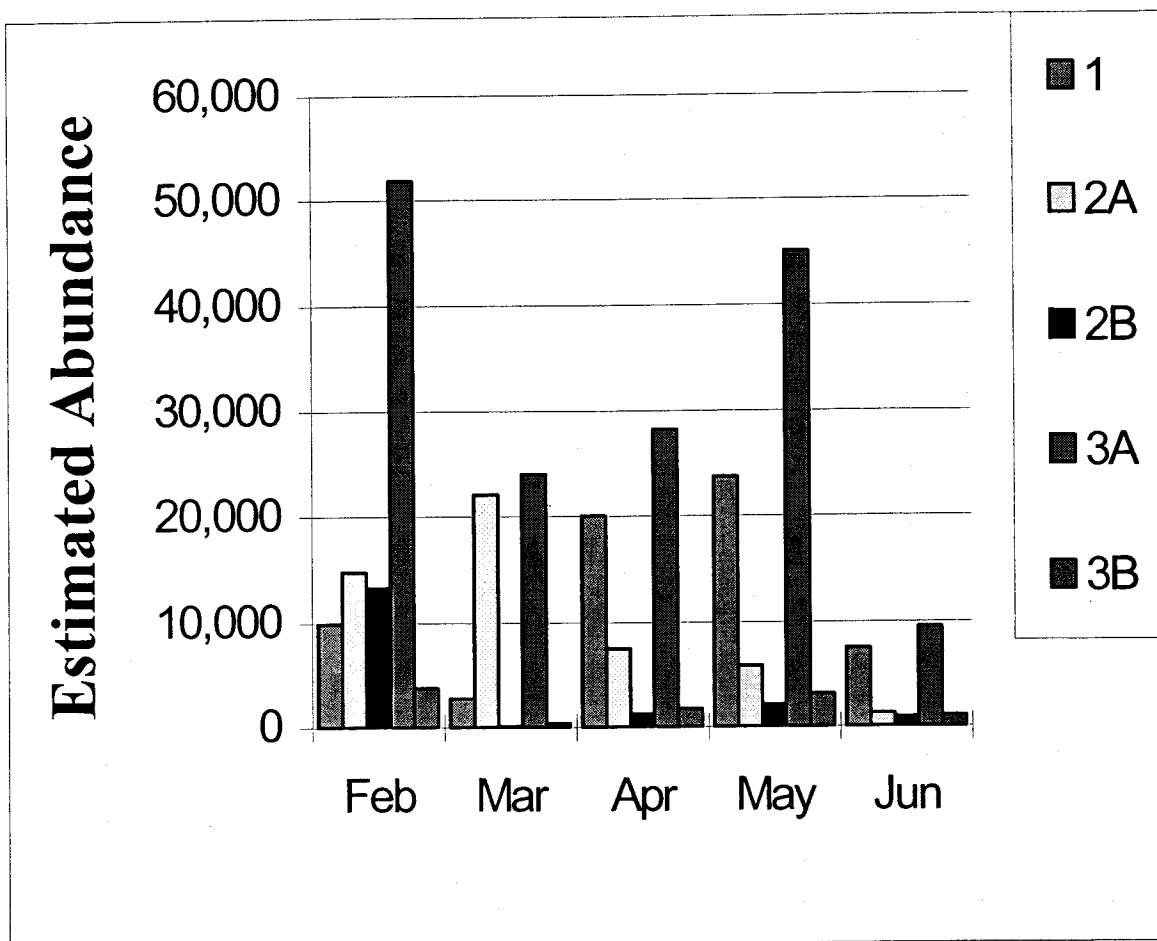


Figure 10. Estimated abundance of wading birds (species combined) in each of the Water Conservation Areas, 2002.

Wading Bird Abundance and Distribution for the Water Conservation Areas

The population estimates for wading birds (all species combined) in the Water Conservation Areas for 2002 decreased from February (93,420) to March (49,220) then increased in April (58,593) and May (79,640) and decreased in June (20,113) (Table 3 and Figure 9). The areas with the highest population estimates of wading birds compared monthly were WCA 3A for February (63,380) to June (9,440) (Table 4 and Figure 10). With the population estimates adjusted for area (relative densities), WCA 2A and WCA 2B had the highest average monthly density of wading birds. WCA 3B had the lowest average monthly density. The areas with the highest density each month were WCA 2B for February, WCA 2A for March, and WCA 1 for April, May and June. The area with the lowest density each month was WCA 2B for February to June (Appendix C).

Wading bird distribution maps were scaled to a maximum 3417 birds per square km which provided the highest density category of 2393 to 3417 birds per km² (Appendix J). The highest density category was observed in north-central WCA 3A during February.

Relative Abundance for Each Species

Great Blue Heron (*Ardea herodias herodias*). Great Blue Herons were generally observed singularly when feeding and nesting. The population estimates for Great Blue Herons in the Water Conservation Areas generally decreased from February (633) to March (387), increased in April (613) and May (660) then decreased to a low in June (320). The highest population estimates for Great Blue Herons were observed in WCA 1 for February. The highest population estimates for Great Blue Herons were observed in WCA 3A for March to June (Appendices B1 and F1). When the population estimates were adjusted for area (relative densities), WCA 1 had the highest average density of Great Blue Herons. WCA 2A and WCA 3B generally had the lowest relative average densities of Great Blue Herons each month (Appendix C2).

Great Blue Heron distribution maps were scaled to a maximum 17 birds per square km which provided the highest density category of 13-17 birds per km² (Appendix K). The highest density category was observed in north-central the WCA 2B and southwest WCA 3 A during May.

Great Egret (*Casmerodius albus*). Great Egrets were the most commonly observed individual bird and the second most abundant bird observed. White ibis were more abundant but were usually observed in large flocks. While Great Egrets were often observed singularly when feeding. Groups of 3 or more individuals were also observed feeding, at times, in close proximity to each other. The population estimates for Great Egrets in the Water Conservation Areas decreased from February (26,607) to a low in March (7,140), increased from March to a high in May (31, 900) and then decreased again in June (16,440) (Appendices B2 and E2). The highest population estimates for Great Egrets were observed in WCA 1 for April. The highest population estimates for Great Egrets were observed in WCA 3A for February, March, May and June (Appendices B2 and F2). When the population estimates were adjusted for area (relative densities), WCA 2B had the highest average density of Great Egrets (Appendix C3). WCA 3B had the lowest relative density most months (February, March, March and May).

Great Egret distribution maps were scaled to a maximum 847 birds per square km which provided the highest density category of 594-847 birds per km² (Appendix L). The highest density category for Great Egrets was observed in central WCA 3A and southeast WCA 2A in February; east-central WCA 3A in May; and southwest WCA 1 in June.

Small Dark Herons. Small dark herons included Tricolored Herons (*Egretta tricolor*) and dark colored Little Blue Herons (*E. caerulea*). These herons sometimes were not distinguishable from each other when observed from an airplane. This was particularly true if the birds were standing. These two species were observed singularly and in mixed flocks with other individuals and species when feeding and flying.

The population estimates for the small dark herons in the Water Conservation Areas decreased from February (347) to a low in March (73). Small dark heron relative abundance increased in April (87) and May (207) then decreased in June (87) (Appendices B3 and E3). The highest population estimates for small dark herons were observed in WCA 3A for February and May. During March, April, and June WCA1 had the highest relative abundance of small dark herons (Appendices B3 and F3). When the population estimates were adjusted for area (relative densities), WCA 1 had the highest average density of small dark herons. WCA 2B and WCA 3B had the lowest relative average densities each month (Appendix C4).

Small dark heron distribution maps were scaled to a maximum 33 birds per square km which provided the highest density category of 24-33 birds per km² (Appendix M). The highest density category was observed in west-central WCA 3A during February.

Small White Herons. Small white herons included Snowy Egrets (*Egretta thula*) and white (immature) Little Blue Herons (*E. caerulea*). These two smaller, white herons sometimes were not distinguishable from each other when observed from an airplane. This was particularly true if the birds were standing. These birds were observed singularly and in mixed flocks with other individuals and species when flying and feeding.

The population estimates for the small white herons in the Water Conservation Areas decreased from February (1113) to March (373), increased during April (1533) and May (1840), and declined to a low in June (300) (Appendices B4 and E4). The highest population estimates for small white herons were observed in WCA 3A in February and April. During May and June the highest populations estimated were in WCA 1. During March the highest populations estimated were in WCA 2A (Appendices B4 and F4). When the population estimates were adjusted for area (relative densities), WCA 1 had the highest average density of small white herons. WCA 2B and WCA 3B had the lowest

relative average densities (Appendix C5).

Small white heron distribution maps were scaled to a maximum 200 birds per square km which provided the highest density category of 141-200 birds per km² (Appendix N). The highest density category was observed in south-central WCA 1 during May.

White Ibis (*Eudocimus albus*). White ibises were most commonly observed in large flocks feeding and flying. These birds were commonly observed in mixed flocks with Glossy Ibises, Little Blue Herons, and/or Tricolored Herons. White ibises were the most abundant birds observed during the surveys.

The population estimates for White Ibises in the Water Conservation Areas generally decreased from a maximum in February (61,900) then declined to a low in June (2,233)(Appendices B5 and E5). The highest population estimates for White Ibis were observed in WCA 1 for June and WCA 2A for March and in WCA 3A for the other three months (Appendices B5 and F5). When the population estimates were adjusted for area (relative densities), WCA 2A had the highest average density of White Ibises (Appendix C6). WCA 3B had the lowest relative average densities each month.

White Ibis distribution maps were scaled to a maximum 3333 birds per square km which provided the highest density category of 2334-3333 birds per km² (Appendix O). The highest density category was observed in north-central WCA 3A.

Glossy Ibis (*Plegadis facinellus*). Glossy ibises were most commonly observed in small groups of 3 to 10 individuals feeding and flying. These birds were most often observed in mixed flocks with White Ibises, Little Blue Herons, and/or Tricolored Herons.

The population estimates for Glossy Ibises in the Water Conservation Areas

increased from February (313) to a maximum in March (1,220) then decreased to a low in June (0)(Appendices B6 and E6). The highest population estimates for Glossy Ibises were observed in WCA 3B for February; WCA 2A in March and April; and in WCA 3A for May (Appendices B6 and F6). When the population estimates were adjusted for area (relative densities), WCA 2A had the highest average density of Glossy Ibises. WCA 2B and WCA 1 had very few Glossy Ibises observed throughout the study (Appendix C7).

Glossy Ibis distribution maps were scaled to a maximum 77 birds per square km which provided the highest density category of 55-77 birds per km² (Appendix P). The highest density category was observed in west-central WCA 2A in March and east-central WCA 3A during May.

Wood Stork (*Mycteria americana*). Wood storks were observed roosting and feeding singularly or in small groups and sometimes flying in mixed flocks with other individuals and species.

The population estimates for the Wood Storks in the Water Conservation Areas decreased from February (2,007) to March (667) then increased to a maximum in May (5,333)(Appendices B7 and E7). The highest population estimates for Wood Storks were observed in WCA 3A for February, April, May and June; and in WCA 1 for March (Appendices B7 and F7). When the population estimates were adjusted for area (relative densities), WCA 2A had the highest average density of Wood Storks. WCA 3B generally had the lowest relative average densities (Appendix C8).

Wood Stork distribution maps were scaled to a maximum 417 birds per square km which provided the highest density category of 293-417 birds per km² (Appendix Q). The highest density category was observed in south-central WCA 3A during May.

Other Species of Wading Birds (counts). Great White Herons (*Ardea herodias*

occidentalis) counts were recorded each month (67 in February, 46 in March, 55 in April, 72 in May, and 75 in June). Great White Herons are difficult to distinguish from Great Egrets when observed from an airplane since both birds are large and white. If the individuals are seen clearly the two can be separated by the larger size and more massive bill of the Great White Herons and the yellowish legs of the Great White Herons compared to the blackish legs of the Great Egret. A total of 35 Roseate Spoonbills (*Ajaia ajaja*) were counted during the survey. The Roseate Spoonbills were observed during February to May (8 in February, 1 in March, 2 in April, and 124 in May). A total of 6 sightings of Cattle Egrets were recorded (4 in April and 2 in June).

The Holey Land

The Holey Land was flown monthly from February to June 2002 coincident with the Water Conservation Area Surveys. Estimated abundance of all species combined decreased from a maximum February (2,607) to a low in June (33) (Appendix B8). The estimated abundance of most species followed a similar monthly pattern. Great Egrets and White Ibises were the most abundant species. Wood Storks were observed during April. No Glossy Ibis, Great White Herons, Roseate Spoonbills, Cattle Egrets nor Reddish Egrets were seen in the Holey Land during 2002 surveys. Birds were often associated with the canal and levee areas on the north and eastern boundaries of the Holey Land. Wading bird use was very light over much of the remaining part of the area.

The density category for each species was scaled into the same categories as those for the Water Conservation Area maps. Each square represents 4 km² in the Holey Land Maps as in the Water Conservation Area maps. Distribution maps were scaled to match the Water Conservation Area maps to a maximum 3417 birds per square km which provided the highest density category of 2393-3417 birds per km² for the Holey Land (Appendix R). The highest density category observed was 138-410 birds per km² for the Holey land. This category was observed in the northern and eastern boundaries of the

Holey Land. Water conditions were dry over most of the Holey Land in January (47 % wet) and March (19 % wet). The Holey Land was 100 percent dry in February, April, May and June (Appendix R).

Everglades Nutrient Removal Area

The Everglades Nutrient Removal Area was flown in adjacent parallel transects such that 100 percent of the area was visually surveyed from the plane. The Everglades Nutrient Removal Area was wet during all months. The abundance values for the Everglades Nutrient Removal Area represent actual counts and not relative abundance as in the Holey Land and Water Management Areas. The number of wading birds was very low from February to June (10-21 total birds)(Appendix B9). The most numerically abundant wading birds were Great Egrets and White Ibis. Great Egrets were observed each month. Great Blue Herons, small dark herons, Glossy Ibis, Wood Storks, Roseate Spoonbills and Great White Herons were not observed in the ENR during 2002. White Ibises were observed during February (2), April (7), May (2) and June (4). Small white herons were observed during March (5), May (1) and June (7). One Cattle Egret was observed in April.

DISCUSSION

Water levels rose from June 2001 to November 2001, declined from November 2001 until May 2002 then began to increase again in June 2002. Decreasing water levels allow wading birds to take advantage of the drying conditions that concentrate prey and allow water depths that can be waded by the birds. In 2002, the monthly percent of wet cells ranged from 99 % in February to 67 % in May. In 2002 and 2000, water levels declined to 20 cm for Gauges 1-7 and 3A4 by May and June while in 2001 they reached this level by March. Gauge 2A-17 had already declined to 20 cm by January 2001 and January 2002 but did not reach that level until March 2000. Conditions were dryer in 2001 than in 2002 and 2000. In 2001, the monthly percent of wet cells ranged from 85 % in January to 31 % in April which was much dryer than for 2000 (100% in January to 91 % in June). Based on water levels and percent wet cells the 2002 survey period started as mostly wet in the fall becoming dryer from winter into early spring then less dry in summer. The 2001 survey period started as mostly wet in the winter becoming dry in the early spring then less dry in late spring. The 2000 survey period started as wet then less wet during late winter and early spring then became wetter in early spring then less wet again in late spring and summer. The 1999 survey period started as wet and then became dry in early spring then back to wet in late spring and summer. The 1996, 1997, and 1999 survey had water conditions that were considered wet and the 1995 and 1998 survey water conditions were extremely wet (flood).

In 2002, wading bird numbers peaked in February and May. In 2001, wading bird numbers peaked in January and February. In 2000, wading bird numbers peaked in May and June. The difference in water conditions was reflected in a large increase in numbers of wading birds in February 2001 then a rapid decline in wading bird numbers coincident

with decreasing water levels through June 2001.

The mean monthly estimated abundances in 2002 were lower than in 2001 for all species except White Ibis (Appendices D, H and I). White Ibis mean monthly estimated abundance was slightly higher for 2002 than 2001. The mean monthly estimated abundances in 2001 were higher than in 2000 for all species except White Ibis and Glossy Ibis (Appendices D, H and I). White Ibis and Glossy Ibis had mean monthly estimated abundances close to the same levels for 2000 and 2001. The mean monthly estimated abundance was used as an index of long term trends to compare each respective species/species group mean monthly estimated abundance in 2002 with the overall mean monthly estimated abundance. The monthly estimated abundance in 2002 for Great Blue Herons, Glossy Ibises and small herons was lower than the 11-year monthly mean estimated abundance(1985-1995). Great Egret mean monthly estimated abundance exceeded its 11-year mean during all months except March 2002. White Ibis monthly estimated abundance exceeded its respective 11-year mean during February, April, and June. Wood Storks mean monthly estimated abundance exceeded its respective 11-year mean only in May 2002. While the values of the estimated numbers for the comparison of long term trends should be viewed with caution (because they are estimates extrapolated from counts), the numbers do serve as an index for examining changes in estimated abundance for the survey area.

During the 2002 survey year January was wet and became less wet until June 2002 when water levels began to increase again. In 2001, the survey area was already beginning to dry in January and became dryer until June 2001. The 2000 survey year was a "dry down" year (water levels dropped from winter to early spring) like 1999 concentrating prey and birds as water levels declined. The 2001 survey represented an early drying year with most species relative abundance estimates close to or exceeding comparable values for the 2000 survey. The 2000 survey and the 1998 "El Nino" year (very wet all months) represents a dramatic contrast in wading bird numbers. The increase of wading bird

numbers in 2000 were similar to the higher abundances in 1996, 1997 and 1999 while 1998 numbers were comparable to the lower abundance, "flood year" survey results as in 1995. These year to year differences demonstrate how wading birds respond in successive years to changing water levels.

In 2002, wading bird estimated abundance in the Holey Land was highest in February (2607) and the species were predominantly Great Egrets and White Ibises. In 2002, wading bird estimated abundance was lowest in June (33). No survey was conducted in the Holey Land for January 2002. For the 2001 survey wading birds in the Holey Land were at their highest estimated abundance during January (4,381) and were predominantly Great Egrets and White Ibises. During the 2000 survey wading birds in the Holey Land were at their highest estimated abundances during February (1947) and were composed mostly of Great Egrets and White Ibises. Estimated abundance was highest during March 1998 (860) and March 1999 (1447) and was composed mostly of Great Egret and White Ibises. During the 1997 survey, wading bird estimated abundances were highest during March (3,487) and were composed predominantly of White Ibises and Great Egrets. During the 1996 survey, wading bird estimated abundances were highest during March (1,393) and April (2,600) and were composed predominantly of White Ibises. During the 1995 survey wading birds were at their highest estimated abundances during May (1,060) and June (1,666) and consisted of predominantly small white herons (Sawicki et al, 1995). The mean monthly estimated abundance of wading birds for was higher in 2002 (769) than 2001 (760), 1999 (431), 1998 (452), and 1995 (538) surveys. The mean monthly estimated abundance of wading birds in 2002 was lower than 2000 (858), 1997 (1,007), and 1996 (938).

In 2002, the Everglades Nutrient Removal Area was not surveyed in January. During 2002 wading bird numbers were generally very low from February (10) to June (21). This was probably attributable to high water conditions maintained in the area. During the 2001 survey wading bird numbers in the Everglades Nutrient Removal Area

(ENR) were highest in June (1425) and were predominantly Great Egrets, small white herons and White Ibises. During the 2000 survey wading bird numbers in the Everglades Nutrient Removal Area (ENR) were highest in January (112) and were predominantly Great Egrets and White Ibises. During the 1999 survey wading bird numbers were highest in July (257) and were predominantly Great Egrets and White Ibises. During the 1998 survey wading bird numbers were highest in January (668) and were predominantly White Ibises. During the 1997 survey, wading birds were highest in June (122) and were predominantly White Ibises. During the 1996 survey, wading bird numbers were highest during March (229) and April (564) and were predominantly small white herons, White Ibises, and Great Egrets. During the 1995 survey wading bird numbers were at their highest numbers during June (187) and consisted of predominantly small white herons (Sawicki et al, 1995). The mean monthly number of wading birds in the ENR was lower in 2002 (10) than for 1995 (82), 1996 (174), 1997 (73), 1998 (234), 1999 (72) 2000 (37) and 2001 (348).

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APPENDICES

APPENDIX A: Transect latitudes and west and east boundary latitudes in the Water Conservation Areas, 2002.

APPENDIX B: Estimated abundance for wading birds, 2002.

- B1. Estimated abundance of Great Blue Herons in the Water Conservation Areas, 2002.
- B2. Estimated abundance of Great Egrets in the Water Conservation Areas, 2002.
- B3. Estimated abundance of small dark herons in the Water Conservation Areas, 2002.
- B4. Estimated abundance of small white herons in the Water Conservation Areas, 2002.
- B5. Estimated abundance of White Ibises in the Water Conservation Areas, 2002.
- B6. Estimated abundance of Glossy Ibises in the Water Conservation Areas, 2002.
- B7. Estimated abundance of Wood Storks in the Water Conservation Areas, 2002.
- B8. Estimated abundance of wading birds in the Holey Land, 2002.
- B9. Estimated abundance of wading birds in the Everglades Nutrient Removal Area for 2002.

APPENDIX C: Densities of wading birds, 2002.

- C1. Densities of wading birds (species combined) in the Water Conservation Areas, 2002.
- C2. Densities of Great Blue Herons in the Water Conservation Areas, 2002.
- C3. Densities of Great Egrets in the Water Conservation Areas, 2002.
- C4. Densities of small dark herons in the Water Conservation Areas, 2002.
- C5. Densities of small white herons in the Water Conservation Areas, 2002.
- C6. Densities of White Ibises in the Water Conservation Areas, 2002.
- C7. Densities of Glossy Ibises in the Water Conservation Areas, 2002.
- C8. Densities Wood Storks in the Water Conservation Areas, 2002.

APPENDIX D: Wading Bird Estimated Abundance in the Water Conservation Areas, 1985-2002.

- D1. Estimated abundance of Great Blue Herons in the Water Conservation Areas, 1985-2002.
- D2. Estimated abundance of Great Egrets in the Water Conservation Areas, 1985-2002.
- D3. Estimated abundance of small herons in the Water Conservation Areas, 1985-2002.
- D4. Estimated abundance of White Ibises in the Water Conservation Areas, 1985-2002.
- D5. Estimated abundance of Glossy Ibises in the Water Conservation Areas, 1985-2002.
- D6. Estimated abundance of Wood Storks in the Water Conservation Areas, 1985-2002.

APPENDIX E: Estimated abundance of each wading bird species in the Water Conservation Area, January to June 2002.

- E1. Estimated abundance of Great Blue Herons in the Water Conservation Areas, February to June 2002.
- E2. Estimated abundance of Great Egrets in the Water Conservation Areas, February to June 2002.
- E3. Estimated abundance of small dark herons in the Water Conservation Areas, February to June 2002.
- E4. Estimated abundance of small white herons in the Water Conservation Areas, February to June 2002.
- E5. Estimated abundance of White Ibises in the Water Conservation Areas, February to June 2002.
- E6. Estimated abundance of Glossy Ibises in the Water Conservation Areas, February to June 2002.
- E7. Estimated abundance of Wood Storks in the Water Conservation Areas, February to June 2002.

APPENDIX F: Estimated abundance of each wading bird species for each impoundment within the Water Conservation Area, February to June 2002.

- F1. Estimated abundance of Great Blue Herons for each impoundment within the Water Conservation Areas, February to June 2002.
- F2. Estimated abundance of Great Egrets for each impoundment within the Water Conservation Areas, February to June 2002.
- F3. Estimated abundance of small dark herons for each impoundment within the Water Conservation Areas for February to June 2002.
- F4. Estimated abundance of small white herons for each impoundment within the Water Conservation Areas for February to June 2002.
- F5. Estimated abundance of White Ibis for each impoundment within the Water Conservation Areas for February to June 2002.
- F6. Estimated abundance of Glossy Ibis for each impoundment within the Water Conservation Areas for February to June 2002.
- F7. Estimated abundance of Wood Storks for each impoundment within the Water Conservation Areas for February to June 2002.

APPENDIX G: Mean, minimum, and maximum water levels for Gauges WCA 1-7, WCA 2A-17, and WCA 3A-4 within the Water Conservation Areas.

- G1. Mean, minimum, and maximum water levels for Gauge WCA 1-7 within Water Conservation Area 1.
- G2. Mean, minimum, and maximum water levels for Gauge WCA 2A-17 within the Water Conservation Area 2A.

G3. Mean, minimum, and maximum water levels for Gage WCA 3A-4 within the Water Conservation Area 3A.

APPENDIX H: Comparison of estimated abundance of each wading bird species in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H1. Comparison of estimated abundance of Great Blue Herons in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H2. Comparison of estimated abundance of Great Egrets in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H3. Comparison of estimated abundance of small herons in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H4. Comparison of estimated abundance of White Ibises in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H5. Comparison of estimated abundance of Glossy Ibises in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H6. Comparison of estimated abundance of Wood Storks in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

APPENDIX I: Comparison of estimated abundance of each wading bird species in the Water Conservation Areas, 1985 to 2002.

I1. Mean estimated abundance January to June of Great Blue Herons in the Water Conservation Areas, 1985 to 2002.

I2. Mean estimated abundance January to June of Great Egrets in the Water Conservation Areas, 1985 to 2002.

I3. Mean estimated abundance January to June of small herons in the Water Conservation Areas, 1985 to 2002.

I4. Mean estimated abundance January to June of White Ibises in the Water Conservation Areas, 1985 to 2002.

I5. Mean estimated abundance January to June of Glossy Ibises in the Water

Conservation Areas, 1985 to 2002.

- I6. Mean estimated abundance January to June of Wood Storks in the Water Conservation Areas, 1985 to 2002.

APPENDIX J: Monthly density maps of wading birds (species combined) in the Water Conservation Areas, February to June 2002.

- J1. Density maps of wading birds (species combined) in the Water Conservation Areas, February 2002.
J2. Density maps of wading birds (species combined) in the Water Conservation Areas, March 2002.
J3. Density maps of wading birds (species combined) in the Water Conservation Areas, April 2002.
J4. Density maps of wading birds (species combined) in the Water Conservation Areas, May 2002.
J5. Density maps of wading birds (species combined) in the Water Conservation Areas, June 2002.

APPENDIX K: Monthly density maps of Great Blue Herons in the Water Conservation Areas, February to June 2002.

- K1. Density maps of Great Blue Herons in the Water Conservation Areas, February 2002.
K2. Density maps of Great Blue Herons in the Water Conservation Areas, March 2002.
K3. Density maps of Great Blue Herons in the Water Conservation Areas, April 2002.
K4. Density maps of Great Blue Herons in the Water Conservation Areas, May 2002.
K5. Density maps of Great Blue Herons in the Water Conservation Areas, June 2002.

APPENDIX L: Monthly density maps of Great Egrets in the Water Conservation Areas, February to June 2002.

- L1. Density maps of Great Egrets in the Water Conservation Areas, February 2002.
L2. Density maps of Great Egrets in the Water Conservation Areas, March 2002.
L3. Density maps of Great Egrets in the Water Conservation Areas, April 2002.
L4. Density maps of Great Egrets in the Water Conservation Areas, May 2002.
L5. Density maps of Great Egrets in the Water Conservation Areas, June 2002.

APPENDIX M: Monthly density maps of small dark herons in the Water Conservation Areas, February to June 2002.

- M1. Density maps of small dark herons in the Water Conservation Areas, February 2002.
M2. Density maps of small dark herons in the Water Conservation Areas, March 2002.
M3. Density maps of small dark herons in the Water Conservation Areas, April 2002.
M4. Density maps of small dark herons in the Water Conservation Areas, May 2002.

M5. Density maps of small dark herons in the Water Conservation Areas, June 2002.

APPENDIX N: Monthly density maps of small white herons in the Water Conservation Areas, February to June 2002.

- N1. Density maps of small white herons in the Water Conservation Areas, February 2002.
- N2. Density maps of small white herons in the Water Conservation Areas, March 2002.
- N3. Density maps of small white herons in the Water Conservation Areas, April 2002.
- N4. Density maps of small white herons in the Water Conservation Areas, May 2002.
- N5. Density maps of small white herons in the Water Conservation Areas, June 2002.

APPENDIX O: Monthly density maps of White Ibises in the Water Conservation Areas, February to June 2002.

- O1. Density maps of White Ibises in the Water Conservation Areas, February 2002.
- O2. Density maps of White Ibises in the Water Conservation Areas, March 2002.
- O3. Density maps of White Ibises in the Water Conservation Areas, April 2002.
- O4. Density maps of White Ibises in the Water Conservation Areas, May 2002.
- O5. Density maps of White Ibises in the Water Conservation Areas, June 2002.

APPENDIX P: Monthly density maps of Glossy Ibises in the Water Conservation Areas, February to June 2002.

- P1. Density maps of Glossy Ibises in the Water Conservation Areas, February 2002.
- P2. Density maps of Glossy Ibises in the Water Conservation Areas, March 2002.
- P3. Density maps of Glossy Ibises in the Water Conservation Areas, April 2002.
- P4. Density maps of Glossy Ibises in the Water Conservation Areas, May 2002.
- P5. Density maps of Glossy Ibises in the Water Conservation Areas, June 2002.

APPENDIX Q: Monthly density maps of Wood Storks in the Water Conservation Areas, February to June 2002.

- Q1. Density maps of Wood Storks in the Water Conservation Areas, February 2002.
- Q2. Density maps of Wood Storks in the Water Conservation Areas, March 2002.
- Q3. Density maps of Wood Storks in the Water Conservation Areas, April 2002.
- Q4. Density maps of Wood Storks in the Water Conservation Areas, May 2002.
- Q5. Density maps of Wood Storks in the Water Conservation Areas, June 2002.

APPENDIX R: Monthly density maps of wading birds in the Holey Land, February to June 2002.

- R1. Density maps of wading birds (combined species) in the Holey Land, February to June 2002.

- R2. Density maps of Great Blue Heron in the Holey Land, February to June 2002.
- R3. Density maps of Great Egret in the Holey Land, February to June 2002.
- R4. Density maps of small dark herons in the Holey Land, February to June 2002.
- R5. Density maps of small white herons in the Holey Land, February to June 2002.
- R6. Density maps of White Ibises in the Holey Land, February to June 2002.
- R7. Density maps of Glossy Ibises in the Holey Land, February to June 2002.
- R8. Density maps of Wood Storks in the Holey Land, February to June 2002.

APPENDIX H: Comparison of estimated abundance of each wading bird species in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H1. Comparison of estimated abundance of Great Blue Herons in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H2. Comparison of estimated abundance of Great Egrets in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H3. Comparison of estimated abundance of small herons in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H4. Comparison of estimated abundance of White Ibises in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H5. Comparison of estimated abundance of Glossy Ibises in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H6. Comparison of estimated abundance of Wood Storks in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

**APPENDIX A: Transect latitudes and west and
east boundary latitudes in the Water
Conservation Areas, 2002.**

Appendix A. Transect latitudes, western-and eastern-most transect longitudes^a
(see Fig. 7).

Transect	Latitude ^b (Min)	W. Longitude ^c (Min)	E. Longitude ^c (Min)
5	26° 40.15	80° 23.87	80° 21.46
6	39.06	25.08	20.26
7	37.98	25.08	19.05
8	36.90	26.29	17.86
9	35.81	27.50	15.45
10	34.73	27.51	15.47
11	33.65	27.51	14.26
12	32.56	27.52	13.07
13	31.48	27.52	13.07
14	30.40	27.53	13.09
15	29.31	27.53	13.09
16	28.23	27.54	13.10
17	27.15	27.54	13.10
18	26.06	28.75	13.11
19	24.98	29.96	13.12
20	23.90	29.96	14.33
21	22.81	31.17	14.34
22	21.73	31.17	16.75
23	20.65	32.38	17.96
24	19.56	50.41	17.97
25	18.48	50.41	17.97
26	17.40	50.41	17.98
27	16.31	50.42	17.99
28	15.23	50.42	18.00
29	14.15	50.42	18.00
30	13.06	50.42	18.01
31	11.98	50.42	18.01
32	10.90	50.42	18.02
33	09.81	50.43	19.23
34	08.73	50.43	20.44
35	07.65	50.43	26.44
36	06.56	50.43	26.44
37	05.48	50.43	26.45
38	04.40	50.43	26.45
39	03.31	50.43	26.46
40	02.23	50.44	26.47
41	01.15	50.44	26.47
42	00.06	50.44	26.48

Appendix A. Transect latitudes, western-and eastern-most transect longitudes^a
(see Fig. 7).

Transect	Latitude ^b (Deg/Min)	W. Longitude ^c (Deg/Min)	E. Longitude ^c (Deg/Min)
43	25° 58.98	80° 50.44	80° 26.48
44	57.90	50.44	26.49
45	56.81	50.44	26.49
46	55.73	50.44	26.49
47	54.65	50.45	27.70
48	53.56	50.45	28.91
49	52.48	50.45	28.91
50	51.40	51.65	28.92
51	50.31	51.65	28.92
52	49.23	51.65	28.92
53	48.15	51.65	28.93
54	47.06	51.65	28.93

^a Longitudes listed are western edge of the western-most cell and eastern edge of the eastern-most cell. It should be noted that only birds within the perimeter levees of the WCAs were counted (see Fig. 7).

^b Transect latitudes pass through the center of each cell.

^c All longitudes contained within the 80° meridian.

APPENDIX B: Estimated abundance for wading birds, 2002.

- B1. Estimated abundance of Great Blue Herons in the Water Conservation Areas, 2002.
- B2. Estimated abundance of Great Egrets in the Water Conservation Areas, 2002.
- B3. Estimated abundance of small dark herons in the Water Conservation Areas, 2002.
- B4. Estimated abundance of small white herons in the Water Conservation Areas, 2002.
- B5. Estimated abundance of White Ibises in the Water Conservation Areas, 2002.
- B6. Estimated abundance of Glossy Ibises in the Water Conservation Areas, 2002.
- B7. Estimated abundance of Wood Storks in the Water Conservation Areas, 2002.
- B8. Estimated abundance of wading birds in the Holey Land, 2002.
- B9. Estimated abundance of wading birds in the Everglades Nutrient Removal Area for 2002.

Table B1. Estimated abundance of Great Blue Herons in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B	Month Total
Feb	367	73	20	147	27	633
Mar	133	7	0	193	53	387
Apr	260	27	0	287	40	613
May	167	0	73	367	53	660
Jun	40	20	0	240	20	320

Table B2. Estimated abundance of Great Egrets in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B	Month Total
Feb	3093	3273	7613	11793	833	26607
Mar	1487	1040	127	4233	253	7140
Apr	7280	1733	980	7180	327	17500
May	9180	2907	627	17853	1333	31900
Jun	5980	707	600	8333	820	16440

Table B3. Estimated abundance of small dark herons in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B	Month Total
Feb	20	80	0	247	0	347
Mar	33	20	0	20	0	73
Apr	47	0	0	33	7	87
May	73	20	0	107	7	207
Jun	40	0	7	27	13	87

Table B4. Estimated abundance of small white herons in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B	Month Total
Feb	80	180	0	853	0	1113
Mar	127	227	0	20	0	373
Apr	507	373	27	613	13	1533
May	1433	20	20	353	13	1840
Jun	153	33	20	73	20	300

Table B5. Estimated abundance of White Ibises in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B	Month Total
Feb	6093	10520	4840	37733	2713	61900
Mar	427	19513	0	19107	0	39047
Apr	11467	5007	200	18373	1147	36193
May	12360	1920	733	22160	1573	38747
Jun	1240	467	240	267	20	2233

Table B6. Estimated abundance of Glossy Ibises in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B	Month Total
Feb	0	140	0	13	160	313
Mar	27	1113	0	80	0	1220
Apr	13	267	7	147	0	433
May	0	0	0	313	0	313
Jun	0	0	0	0	0	0

Table B7. Estimated abundance of Wood Storks in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B	Month Total
Feb	7	333	787	880	0	2007
Mar	453	100	0	93	20	667
Apr	420	47	0	1220	140	1827
May	407	880	573	3467	7	5333
Jun	7	13	33	197	0	220

Table B8. Estimated abundance of Great White Herons in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B	Month Total
Feb	227	53	7	120	40	447
Mar	87	7	0	167	47	307
Apr	0	7	7	280	73	367
May	27	0	20	313	120	480
Jun	27	7	13	333	120	500

Table B9. Estimated abundance of Cattle Egrets in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B	Month Total
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	27	0	27
May	0	0	0	0	0	0
Jun	0	13	0	0	0	27

Table B10. Estimated abundance of wading birds in the Holey Land, 2002.

Species	Feb	Mar	Apr	May	Jun
GBH	0	0	13	0	0
GE	93	120	93	0	20
SDH	27	7	0	0	0
SWH	53	0	0	0	0
WI	2433	293	527	147	13
GI	0	0	0	0	0
WS	0	0	7	0	0
Month Total	2607	420	640	147	33

Table B11. Counts of wading birds in the Everglades Nutrient Removal Area for 2002.

Species	Feb	Mar	Apr	May	Jun
Great Blue Heron	0	0	13	0	0
Great Egret	93	120	93	0	20
Small Dark Herons	33	0	0	0	0
Small White Herons	53	0	0	0	0
White Ibises	2433	293	527	147	13
Roseate Spoonbill	0	7	0	0	0
Glossy Ibises	0	0	0	0	0
Cattle Egrets	0	0	0	0	0
Wood Stork	0	0	7	0	0
All Species	2613	420	633	147	33

APPENDIX C: Densities of wading birds, 2002.

- C1. Densities of wading birds (species combined) in the Water Conservation Areas, 2002.
- C2. Densities of Great Blue Herons in the Water Conservation Areas, 2002.
- C3. Densities of Great Egrets in the Water Conservation Areas, 2002.
- C4. Densities of small dark herons in the Water Conservation Areas, 2002.
- C5. Densities of small white herons in the Water Conservation Areas, 2002.
- C6. Densities of White Ibises in the Water Conservation Areas, 2002.
- C7. Densities of Glossy Ibises in the Water Conservation Areas, 2002.
- C8. Densities Wood Storks in the Water Conservation Areas, 2002.

Table C1. Densities of wading birds (species combined) in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B
Feb	15.95	38.30	106.99	25.39	10.37
Mar	4.47	57.38	1.02	11.72	1.03
Apr	32.25	19.44	9.84	13.81	4.80
May	38.14	15.12	16.83	22.05	8.55
Jun	12.08	3.28	7.37	4.63	2.78

Table C2. Densities of Great Blue Herons in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B
Feb	0.59	0.19	0.16	0.07	0.07
Mar	0.22	0.02	0.00	0.09	0.15
Apr	0.42	0.07	0.00	0.14	0.11
May	0.27	0.00	0.59	0.18	0.15
Jun	0.06	0.05	0.00	0.12	0.05

Table C3. Densities of Great Egrets in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B
Feb	4.99	8.52	61.40	5.78	2.29
Mar	2.40	2.71	1.02	2.08	0.70
Apr	11.74	4.51	7.90	3.52	0.90
May	14.81	7.57	5.05	8.75	3.66
Jun	9.65	1.84	4.84	4.08	2.25

Table C4. Densities of small dark herons in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B
Feb	0.03	0.21	0.00	0.12	0.00
Mar	0.05	0.05	0.00	0.01	0.00
Apr	0.08	0.00	0.00	0.02	0.02
May	0.12	0.05	0.00	0.05	0.02
Jun	0.06	0.00	0.05	0.01	0.04

Table C5. Densities of small white herons in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B
Feb	0.13	0.47	0.00	0.42	0.00
Mar	0.20	0.59	0.00	0.01	0.00
Apr	0.82	0.97	0.22	0.30	0.04
May	2.31	0.05	0.16	0.17	0.04
Jun	0.25	0.09	0.16	0.04	0.05

Table C6. Densities of White Ibises in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B
Feb	9.83	27.40	39.03	18.50	7.45
Mar	0.69	50.82	0.00	9.37	0.00
Apr	18.49	13.04	1.61	9.01	3.15
May	19.94	5.00	5.91	10.86	4.32
Jun	2.00	1.22	1.94	0.13	0.05

Table C7. Densities of Glossy Ibises in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B
Feb	0.00	0.36	0.00	0.01	0.44
Mar	0.04	2.90	0.00	0.04	0.00
Apr	0.02	0.69	0.05	0.07	0.00
May	0.00	0.00	0.00	0.15	0.00
Jun	0.00	0.00	0.00	0.00	0.00

Table C8. Densities Wood Storks in the Water Conservation Areas, 2002.

Month	1	2A	2B	3A	3B
Feb	0.01	0.87	6.34	0.43	0.00
Mar	0.73	0.26	0.00	0.05	0.05
Apr	0.68	0.12	0.00	0.60	0.38
May	0.66	2.29	4.62	1.70	0.02
Jun	0.01	0.03	0.27	0.08	0.00

APPENDIX D: Wading Bird Estimated Abundance in the Water Conservation Areas, 1985-2002.

D1. Estimated abundance of Great Blue Herons in the Water Conservation Areas, 1985-2002.

D2. Estimated abundance of Great Egrets in the Water Conservation Areas, 1985- 2002.

D3. Estimated abundance of small herons in the Water Conservation Areas, 1985- 2002.

D4. Estimated abundance of White Ibises in the Water Conservation Areas, 1985- 2002.

D5. Estimated abundance of Glossy Ibises in the Water Conservation Areas, 1985- 2002.

D6. Estimated abundance of Wood Storks in the Water Conservation Areas, 1985- 2002.

Table D1. Great Blue Heron estimated abundance in the Water Conservation Areas, 1985-2002 (1985-1994 data from Bancroft and Sawiki, 1995; 1995 data from Sawicki et al. 1995).

	1985	1986	1987	1988	1989	1990
JAN		873	3053	2000	3507	2547
FEB	4513	2267	3093	1887	3580	2127
MAR	5127	2973	2680	1913	5773	2787
APR	1760	1687	2780	2073	2447	1380
MAY	1020	1713	2313	1613	1160	593
JUN	273	2200	2087	1673	580	527
MTN AVG	2538.6	1952.2	2667.7	1859.8	2841.2	1660.2
MTH SD	1931.0	644.8	366.3	165.6	1716.6	892.1

	1991	1992	1993	1994	1995	MEAN 1985-95*	SD 1985-95*
JAN			1760	1333	719	1974.0	941.2
FEB	1533	1893	1667	1380	1421	2305.5	960.1
MAR	1120	1900	1713	1580	1059	2602.3	1476.7
APR	1247	1473	893	920	794	1586.7	615.4
MAY		1320	907	933	707	1227.9	498.2
JUN		1113	847	700	600	1060.0	652.2
MTN AVG	1300.0	1539.8	1297.8	1141.0	883.3	1789.2	623.2
MTH SD	172.7	312.9	416.8	309.1	278.8	655.1	587.9

	1996	1997	1998	1999**	2000	2001	2002
JAN	1893	2120	1133	680	953	1553	
FEB	2727	1573	673	573	1034	1814	633
MAR	1960	1080	473	687	907	1573	380
APR	1207	567	560	907	801	681	613
MAY	460	633	540	407	1307	661	660
JUN	761	573	693	300	640	473	320
MTN AVG	1501.3	1091.0	678.7	592.3	940.3	1125.8	273
MTH SD	773.0	583.7	216.9	198.3	205.8	531.7	159

**1999 data was delayed 1 week, taken Feb to July 1999

Table D2. Great Egret estimated abundance in the Water Conservation Areas, 1985-2002 (1985-1994 data from Bancroft and Sawicki, 1995; 1995 data from Sawicki et al. 1995).

	1985	1986	1987	1988	1989	1990
JAN		9193	11787	15360	19753	20480
FEB	18573	15340	14813	13907	21113	20640
MAR	41154	20860	16920	18953	29660	25667
APR	18447	11980	11653	13867	18140	10080
MAY	5420	12500	11513	18213	11380	6160
JUN	6207	23180	14473	19867	3493	5480
MTH AVG	17960.2	15508.8	13526.5	16694.5	17256.5	14751.2
MTH SD	12914.8	4981.7	2027.2	2415.8	8161.9	7834.1

	1991	1992	1993	1994	1995	MEAN 1985-95*	SD 1985-95*
JAN			10700	9573	4100	12618.3	4956.8
FEB	21680	14213	9487	11807	7574	15377.0	4333.8
MAR	14527	15533	8987	13340	6466	19278.8	9339.4
APR	16500	13833	7773	9853	5728	12532.2	3775.8
MAY		12807	5340	10847	6266	10044.6	4304.2
JUN		18740	5587	16293	9947	12326.7	6399.7
MTH AVG	17569.0	15025.2	7979.0	11952.2	6680.2	14082.1	3498.9
MTH SD	3016.4	2052.3	1975.8	2312.2	1791.3	4498.5	3377.8

	1996	1997	1998	1999**	2000	2001	2002
JAN	10793	12353	8633	10480	18046	30593	
FEB	13666	17140	6833	14653	20327	49906	26607
MAR	10574	15953	7347	13460	18188	36620	7140
APR	10979	17913	7127	18313	16853	23648	17500
MAY	17153	17507	8707	18700	48366	20281	31900
JUN	11307	15587	14033	6320	34466	13486	6120
MTH AVG	12412.0	16075.5	8780.0	13654.3	26041.0	29089.0	9333
MTH SD	2356.7	1856.0	2456.2	4321.8	11633.6	11853.0	11473

**1999 data was delayed 1 week, taken Feb to July 1999

Table D3. Small herons estimated abundance in the Water Conservation Areas, 1985-2002 (1985-1994 data from Bancroft and Sawiki, 1995; 1995 data from Sawicki et al. 1995).

	1985	1986	1987	1988	1989	1990
JAN		4793	6947	10620	15260	8720
FEB	8840	4093	7787	2480	14167	7673
MAR	18240	9653	6460	4320	11653	19467
APR	10667	1920	8280	5333	10207	9520
MAY	2313	2593	12453	5393	6467	4153
JUN	2273	4653	10373	7167	3580	3493
MTH AVG	8466.6	4617.5	8716.7	5885.5	10222.3	8837.7
MTH SD	5945.2	2484.6	2081.0	2538.2	4107.1	5249.3

	1991	1992	1993	1994	1995	MEAN 1985-95*	SD 1985-95*
JAN			1927	2093	467	6353.4	4721.1
FEB	16487	4427	1167	873	1201	6290.5	5054.1
MAR	6253	5353	2580	1153	2398	7957.3	5923.9
APR	9153	6873	1427	1320	4901	6327.4	3407.3
MAY		9413	2007	1673	7093	5355.8	3379.4
JUN		18467	3580	2973	5755	6231.4	4672.3
MTH AVG	10631.0	8906.6	2114.7	1680.8	3635.8	6701.4	3090.9
MTH SD	4306.7	5069.3	793.9	695.3	2434.0	3245.9	1708.4

	1996	1997	1998	1999**	2000	2001	2002
JAN	2993	1840	360	340	1186	1707	
FEB	3433	1533	153	1273	1446	1987	1500
MAR	4567	1847	247	1260	1220	1107	773
APR	3520	1727	580	1520	768	1101	1720
MAY	5641	2253	420	1641	966	3129	2180
JUN	7081	474	1680	720	2101	913	407
MTH AVG	4539.2	1612.3	573.3	1125.7	1281.2	1657.3	688
MTH SD	1433.4	552.7	512.7	455.1	423.2	757.6	754

**1999 data was delayed 1 week, taken Feb to July 1999

Table D4. White Ibises estimated abundance in the Water Conservation Areas, 1985-2002 (1985-1994 data from Bancroft and Sawicki, 1995; 1995 data from Sawicki et al. 1995).

	1985	1986	1987	1988	1989	1990
JAN		47254	10653	88620	65600	88827
FEB	47227	54220	25893	40247	68114	138174
MAR	129614	74634	82094	49734	78240	165214
APR	59814	19747	23593	20300	37494	65707
MAY	15327	22453	22413	25827	28167	23033
JUN	13580	48654	26253	22353	3847	5167
MTH AVG	53112.4	44493.7	31816.5	41180.2	46910.3	81020.3
MTH SD	42243.6	18824.4	23086.1	23631.7	26060.4	57397.5

	1991	1992	1993	1994	1995	MEAN 1985-95*	SD 1985-95*
JAN			15493	19447	440	42041.8	33301.4
FEB	40847	40834	2200	4540	12900	43199.6	35918.5
MAR	57754	45300	8640	13687	5193	64554.9	47516.5
APR	47674	40787	2147	8827	2240	29848.2	21070.2
MAY		48514	5993	8440	3440	20360.7	12487.4
JUN		73400	8060	7180	2539	21103.3	21997.8
MTH AVG	48758.3	49767.0	7088.8	10353.5	4458.7	38087.2	21712.4
MTH SD	6944.7	12169.5	4536.9	4893.3	4033.0	20347.4	15749.1

	1996	1997	1998	1999**	2000	2001	2002
JAN	10840	35347	6540	18280	12800	46308	
FEB	28053	49253	1253	35067	46260	69547	61900
MAR	36627	33440	1413	35287	45107	31900	39047
APR	21094	16680	9620	34807	6580	26241	36193
MAY	21340	19493	12140	11153	73214	20693	38747
JUN	387	5287	20453	1033	36985	6767	2233
MTH AVG	19723.5	26583.3	8569.8	22604.5	36824.3	33576.0	18622
MTH SD	11636.3	14373.7	6632.4	13417.8	22262.7	19988.8	21373

***1999 data was delayed 1 week, taken Feb to July 1999

Table D5. Glossy Ibises estimated abundance in the Water Conservation Areas, 1985-2002 (1985-1994 data from Bancroft and Sawiki, 1995; 1995 data from Sawicki et al. 1995).

	1985	1986	1987	1988	1989	1990
JAN		2640	200	3307	4373	3560
FEB	2620	1820	1267	2473	5533	4380
MAR	5213	2613	3073	3813	3240	9580
APR	3340	580	1660	1787	4787	5920
MAY	367	960	2673	1113	1127	653
JUN	107	573	487	113	0	47
MTH AVG	2329.4	1531.0	1560.0	2101.0	3176.7	4023.3
MTH SD	1908.5	878.7	1050.8	1261.7	1994.7	3214.2

	1991	1992	1993	1994	1995	MEAN 1985-95*	SD 1985-95*
JAN			1820	400	73	2046.6	1569.7
FEB	867	3673	113	473	307	2138.7	1704.4
MAR	4447	2787	120	273	46	3200.5	2615.0
APR	1000	3120	60	200	314	2069.8	1886.6
MAY		1753	133	200	314	929.3	757.0
JUN		1327	193	0	193	304.0	387.7
MTH AVG	2104.7	2532.0	406.5	257.7	207.8	1839.1	1113.5
MTH SD	1657.2	868.5	633.3	152.7	113.3	1248.5	856.6

	1996	1997	1998	1999**	2000	2001	2002
JAN	1314	4380	193	760	460	273	
FEB	5660	4213	47	1453	853	1447	307
MAR	4094	2420	13	693	2220	1313	1220
APR	1260	460	180	160	153	620	433
MAY	360	553	73	107	420	200	313
JUN	27	7	53	0	87	20	0
MTH AVG	2119.2	2005.5	93.2	528.8	698.8	645.5	238
MTH SD	2053.3	1787.7	68.4	504.7	724.0	550.3	457

**1999 data was delayed 1 week, taken Feb to July 1999

Table D6. Wood Storks estimated abundance in the Water Conservation Areas, 1985-2002 (1985-1994 data from Bancroft and Sawiki, 1995; 1995 data from Sawicki et al. 1995).

	1985	1986	1987	1988	1989	1990
JAN		1107	547	1607	4700	913
FEB	5840	1233	1687	560	3560	3180
MAR	5167	1120	1753	1720	7873	6373
APR	820	73	1020	1253	6940	2227
MAY	67	160	733	640	1093	433
JUN	100	747	267	767	67	80
MTH AVG	2398.8	740.0	1001.2	1091.2	4038.8	2201.0
MTH SD	2558.1	466.1	555.8	461.6	2835.4	2146.6

	1991	1992	1993	1994	1995	MEAN 1985-95*	SD 1985-95*
JAN			113	733	13	1216.6	1402.7
FEB	1260	1693	100	393	0	1773.3	1694.9
MAR	1760	400	260	580	40	2458.7	2589.3
APR	4273	1040	180	193	7	1638.7	2051.2
MAY		2187	473	273	33	609.2	610.8
JUN		4593	607	3840	86	1115.4	1581.6
MTH AVG	2431.0	1982.6	288.8	1002.0	29.8	1564.1	1114.7
MTH SD	1318.4	1437.6	189.0	1282.0	28.8	1207.2	923.7

	1996	1997	1998	1999**	2000	2001	2002
JAN	1533	1120	221	853	980	1719	
FEB	1407	620	47	187	2173	1826	2007
MAR	833	867	47	393	267	2961	673
APR	533	1973	20	1400	574	2900	1827
MAY	793	840	40	667	493	3661	5333
JUN	0	80	420	13	847	574	220
MTH AVG	849.8	916.7	132.5	585.5	889.0	2273.5	1052
MTH SD	516.9	570.6	145.1	459.2	619.4	1015.4	2004

**1999 data was delayed 1 week, taken Feb to July 1999

APPENDIX E: Estimated abundance of each wading bird species in the Water Conservation Area, February to June 2002.

- E1. Estimated abundance of Great Blue Herons in the Water Conservation Areas, February to June 2002.
- E2. Estimated abundance of Great Egrets in the Water Conservation Areas, February to June 2002.
- E3. Estimated abundance of small dark herons in the Water Conservation Areas, February to June 2002.
- E4. Estimated abundance of small white herons in the Water Conservation Areas, February to June 2002.
- E5. Estimated abundance of White Ibises in the Water Conservation Areas, February to June 2002.
- E6. Estimated abundance of Glossy Ibises in the Water Conservation Areas, February to June 2002.
- E7. Estimated abundance of Wood Storks in the Water Conservation Areas, February to June 2002.

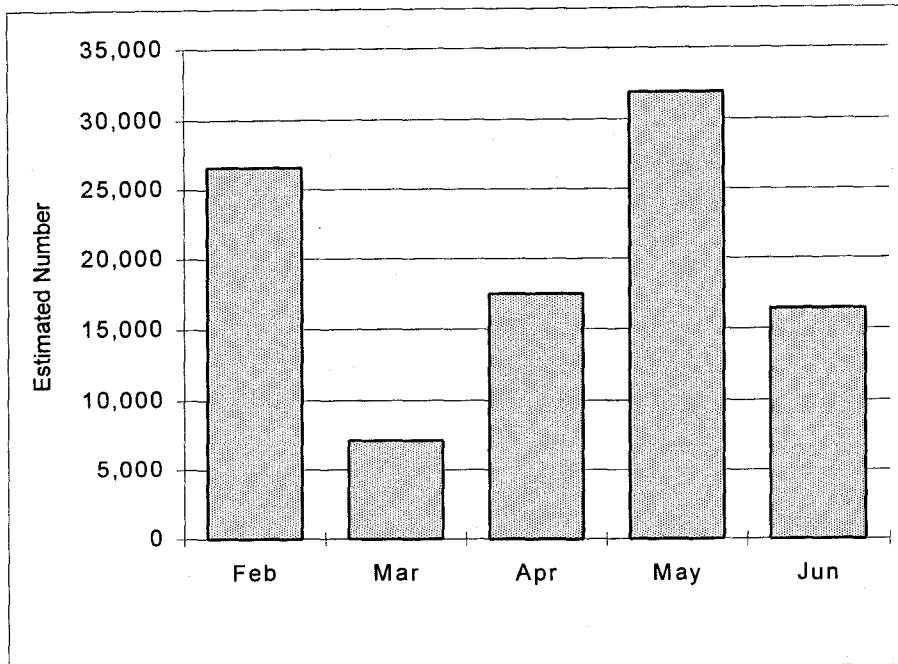


Figure E1. Estimated abundance of Great Blue Herons in the Water Conservation Areas, February to June 2002.

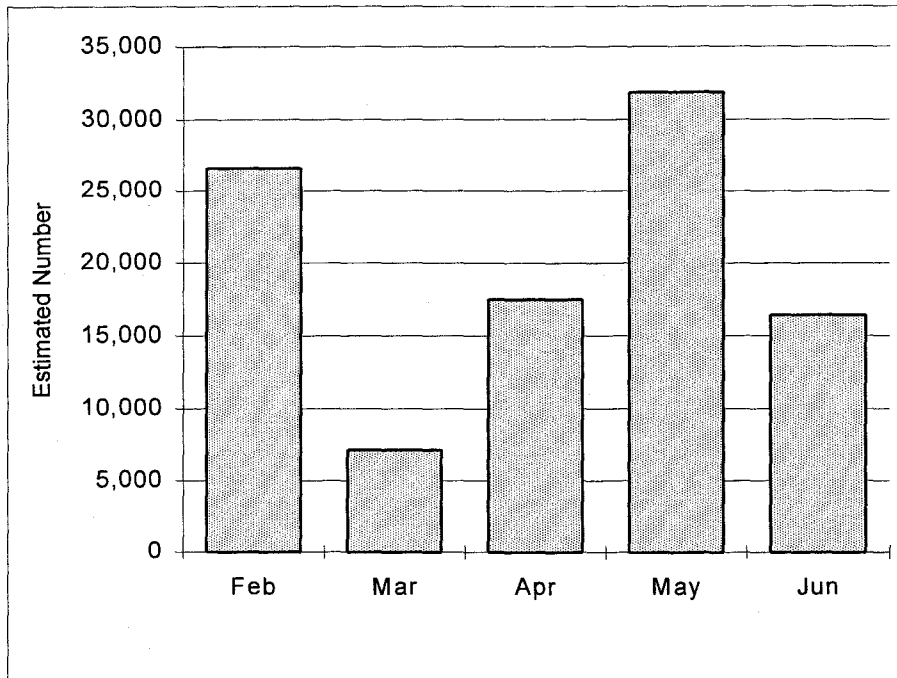


Figure E2. Estimated abundance of Great Egrets in the Water Conservation Areas, February to June 2002.

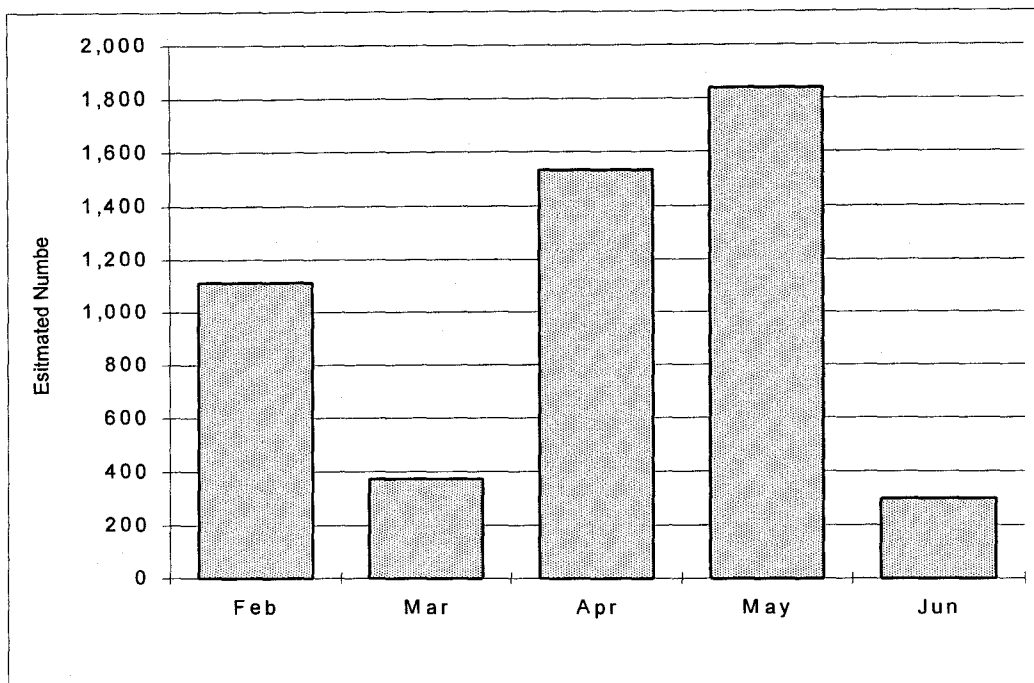


Figure E3. Estimated abundance of small dark herons in the Water Conservation Areas, February to June 2002.

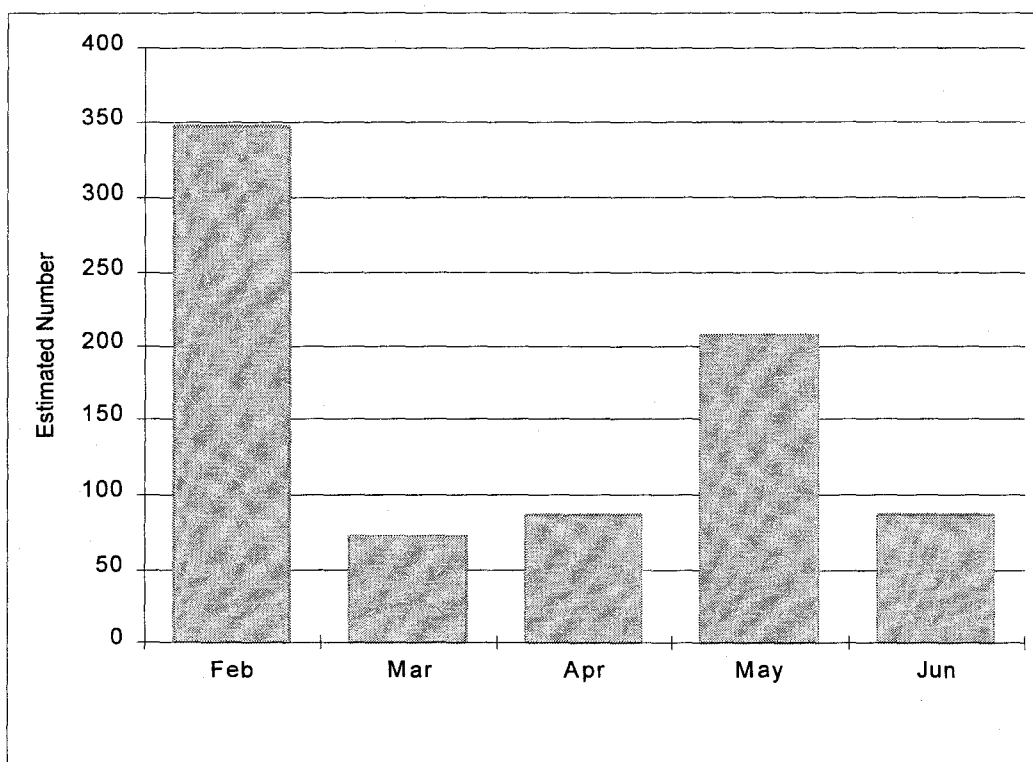


Figure E4. Estimated abundance of small white herons in the Water Conservation Areas, February to June 2002.

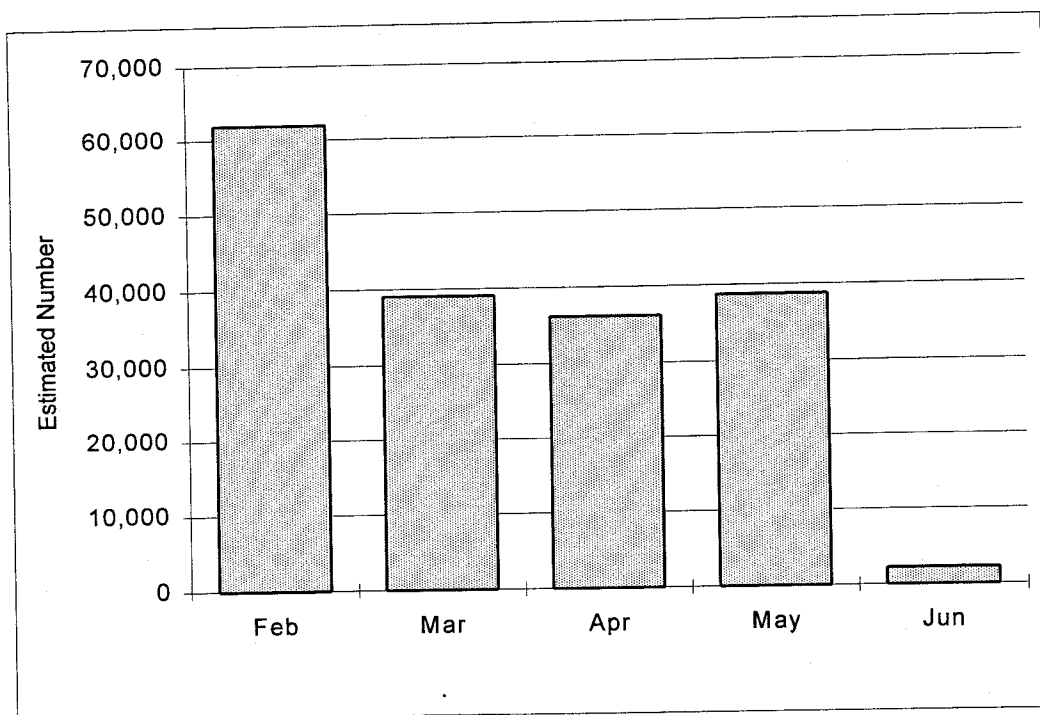


Figure E5. Estimated abundance of White Ibises in the Water Conservation Areas, February to June 2002.

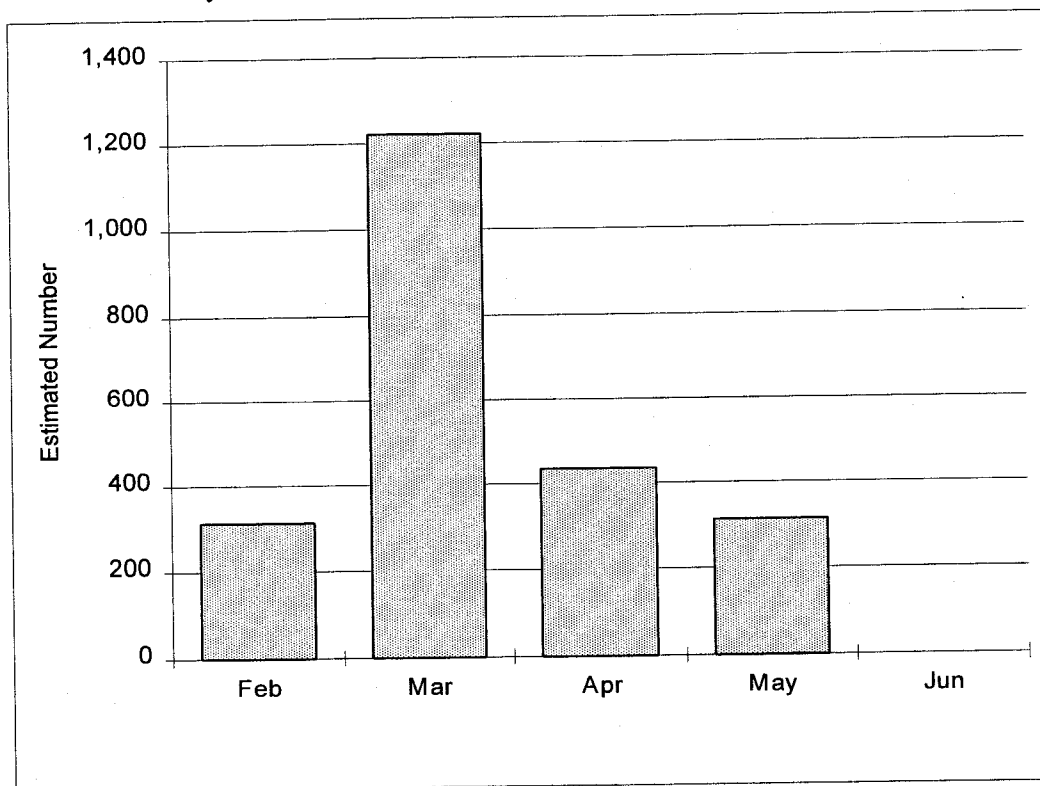


Figure E6. Estimated abundance of Glossy Ibises in the Water Conservation Areas, February to June 2002.

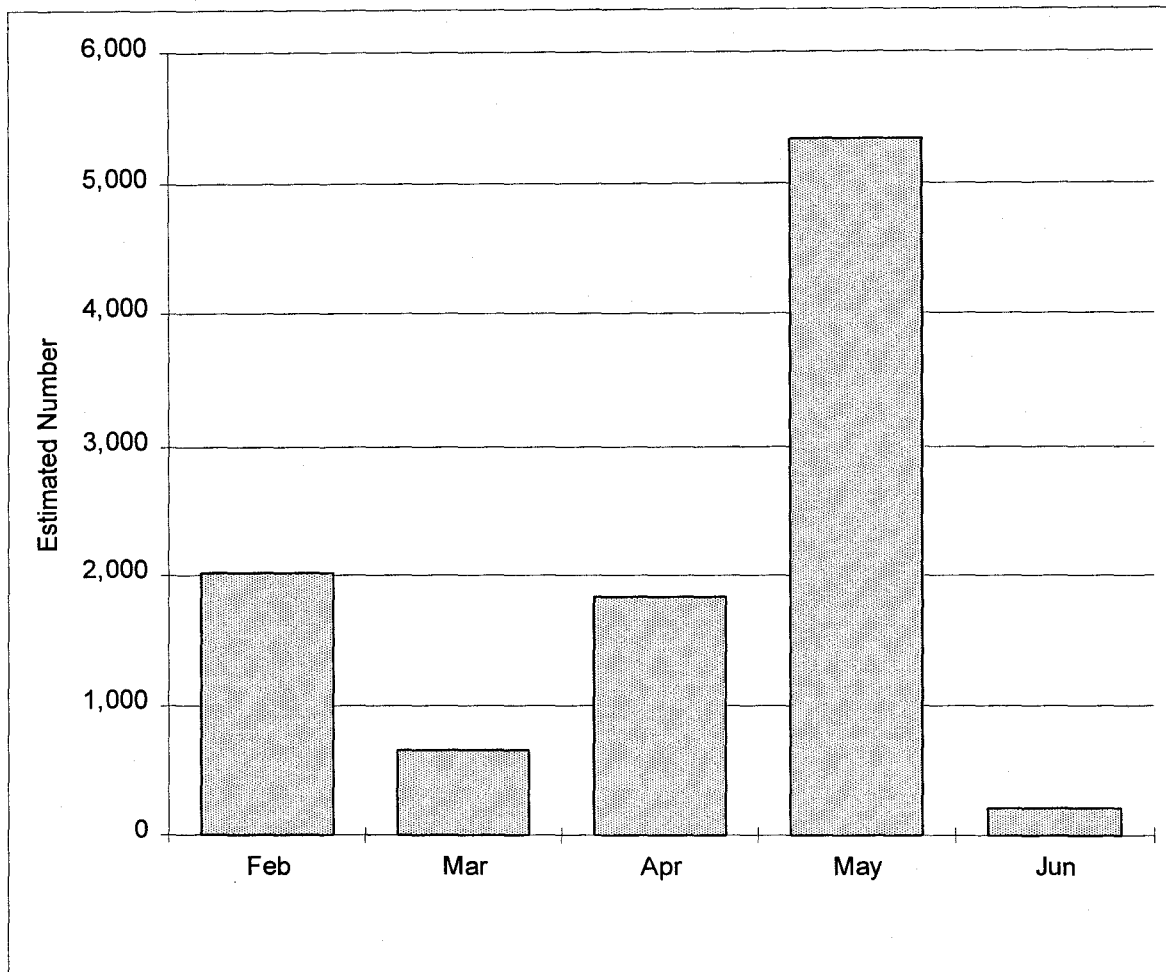


Figure E7. Estimated abundance of Wood Storks in the Water Conservation Areas, February to June 2002.

APPENDIX F: Estimated abundance of each wading bird species for each impoundment within the Water Conservation Area, February to June 2002.

- F1. Estimated abundance of Great Blue Herons for each impoundment within the Water Conservation Areas, February to June 2002.
- F2. Estimated abundance of Great Egrets for each impoundment within the Water Conservation Areas, February to June 2002.
- F3. Estimated abundance of small dark herons for each impoundment within the Water Conservation Areas for February to June 2002.
- F4. Estimated abundance of small white herons for each impoundment within the Water Conservation Areas for February to June 2002.
- F5. Estimated abundance of White Ibis for each impoundment within the Water Conservation Areas for February to June 2002.
- F6. Estimated abundance of Glossy Ibis for each impoundment within the Water Conservation Areas for February to June 2002.
- F7. Estimated abundance of Wood Storks for each impoundment within the Water Conservation Areas for February to June 2002.

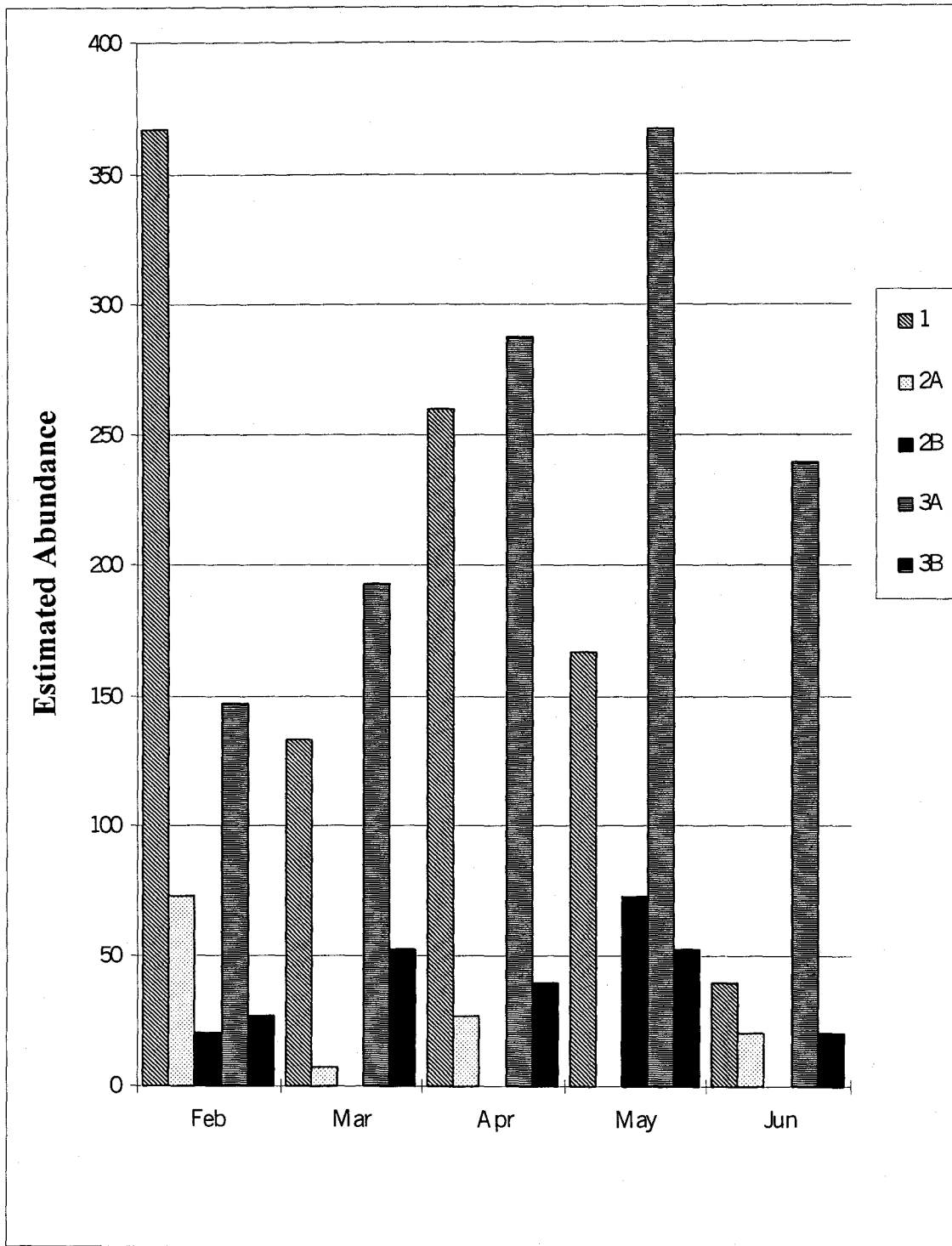


Figure F1. Estimated abundance of Great Blue Herons for each impoundment within the Water Conservation Areas, February to June 2002.

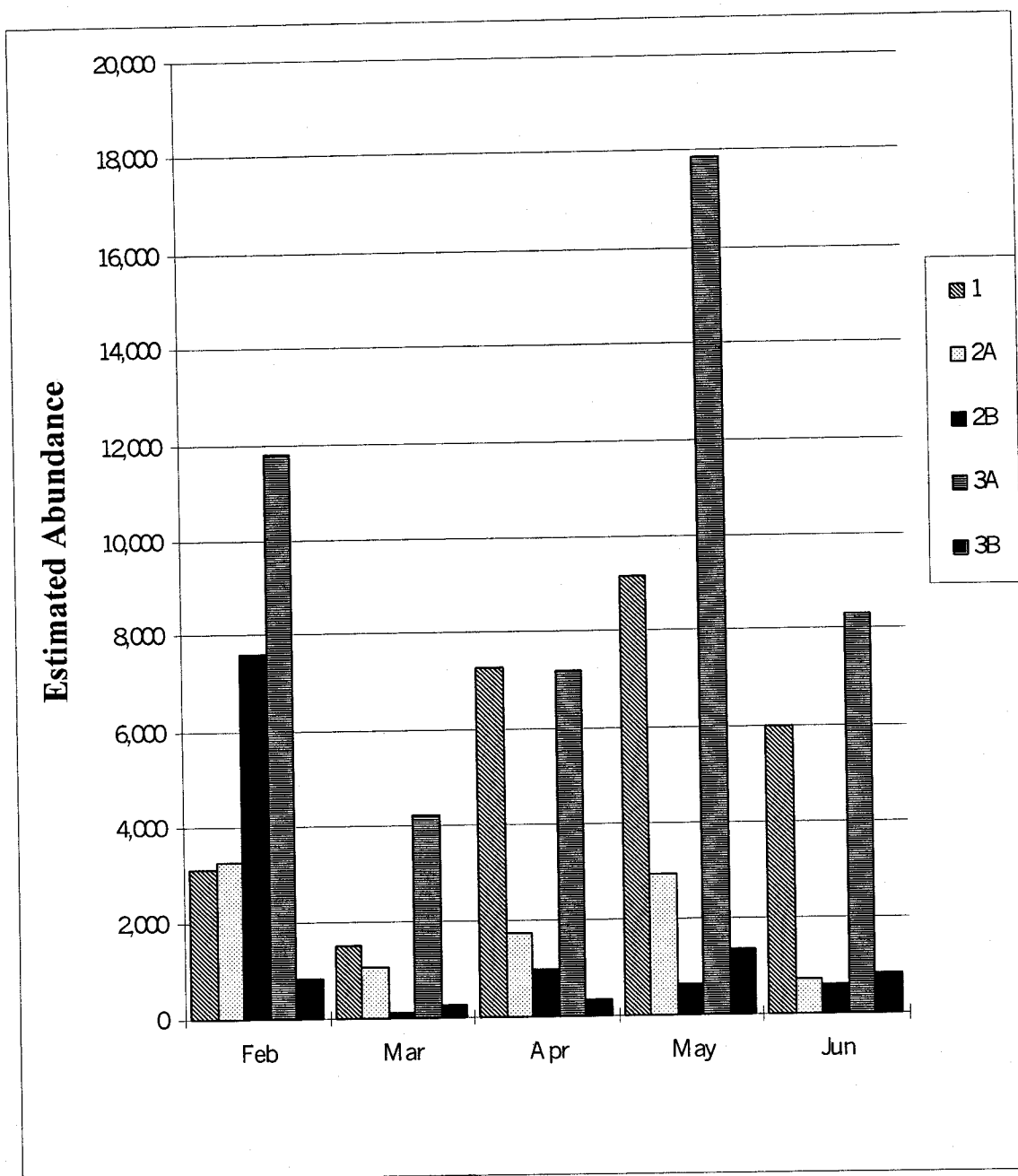


Figure F2. Estimated abundance of Great Egrets for each impoundment within the Water Conservation Areas, January to June 2002.

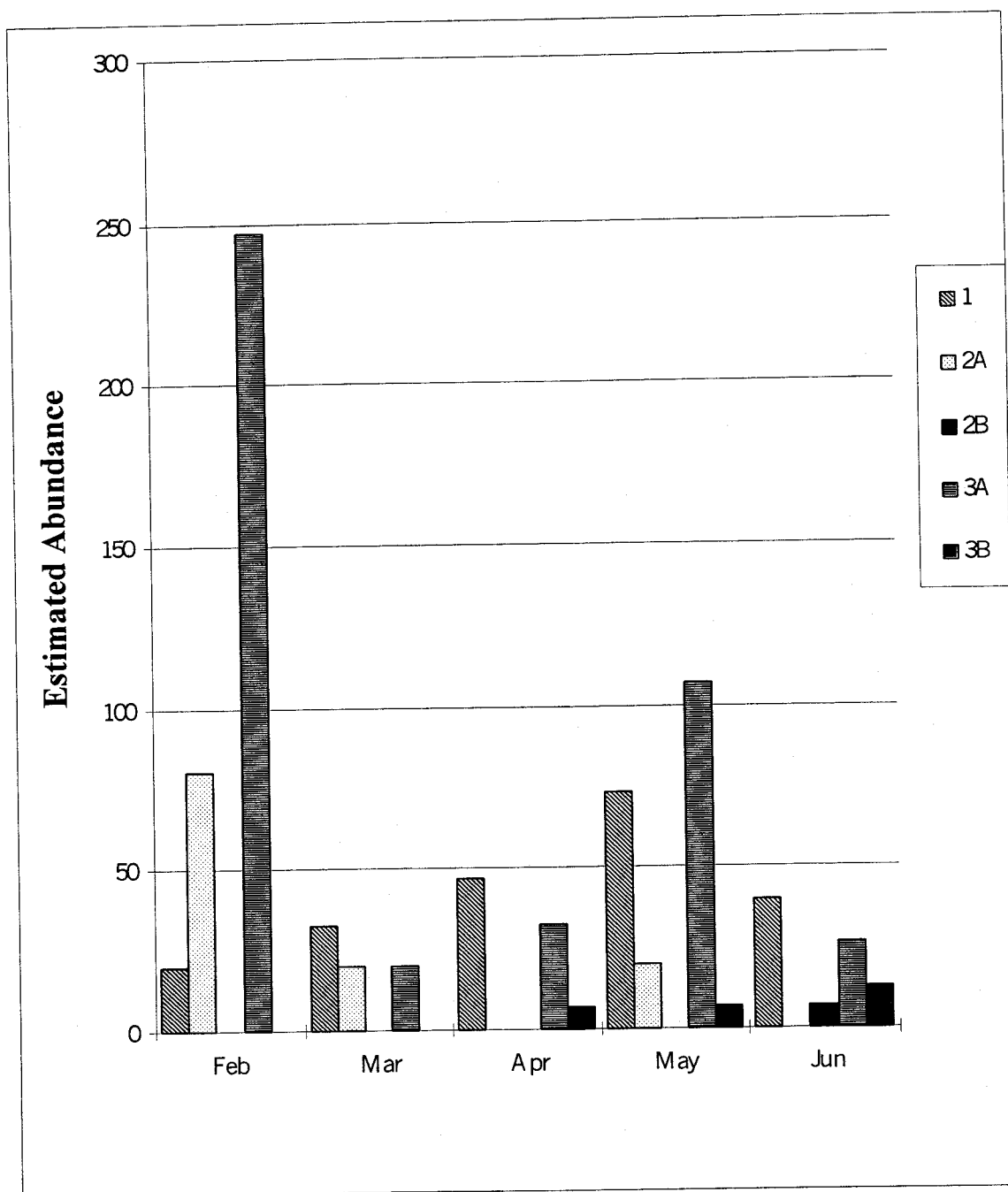


Figure F3. Estimated abundance of small dark herons for each impoundment within the Water Conservation Areas for February to June 2002.

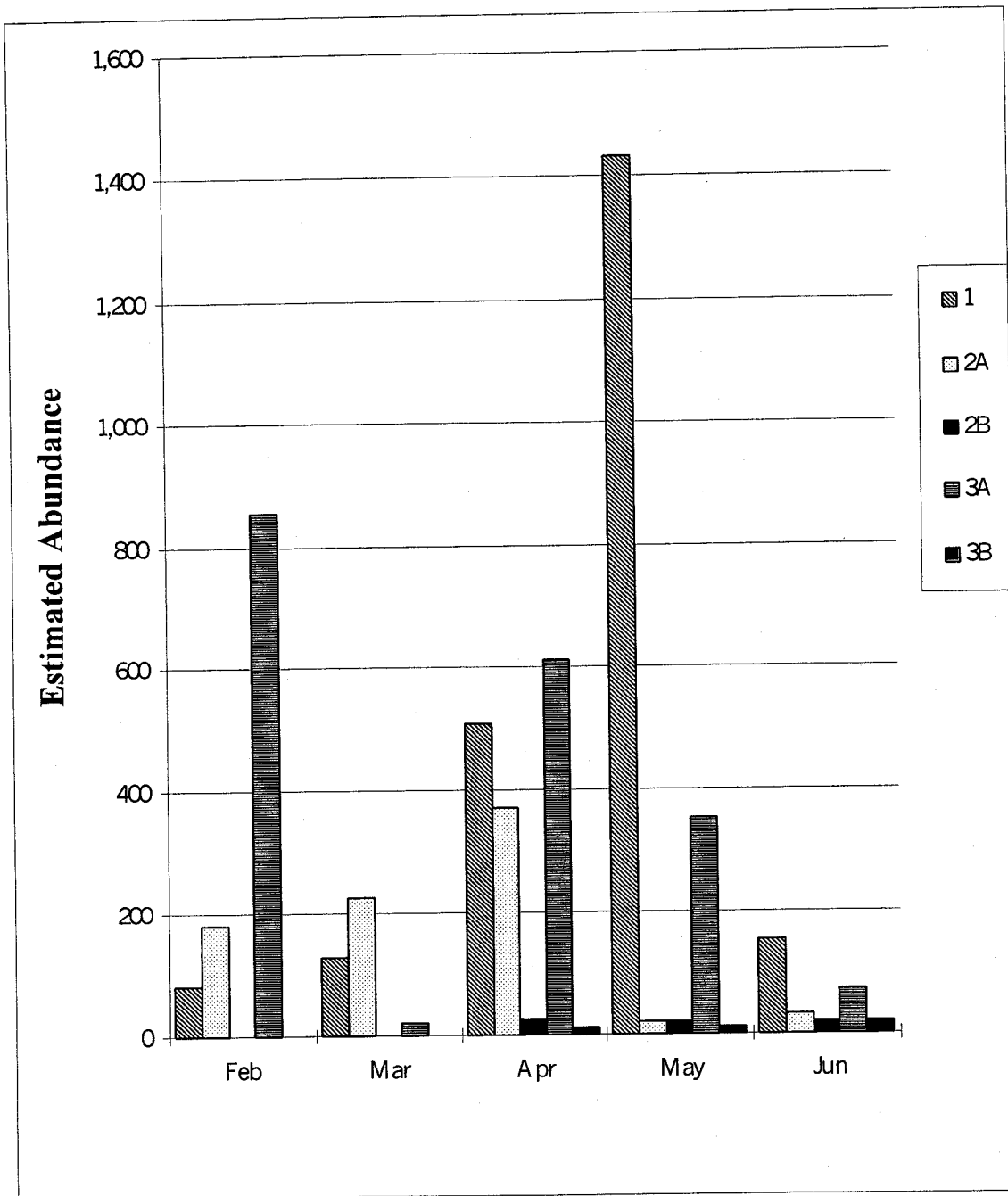


Figure F4. Estimated abundance of small white herons for each impoundment within the Water Conservation Areas for February to June 2002.

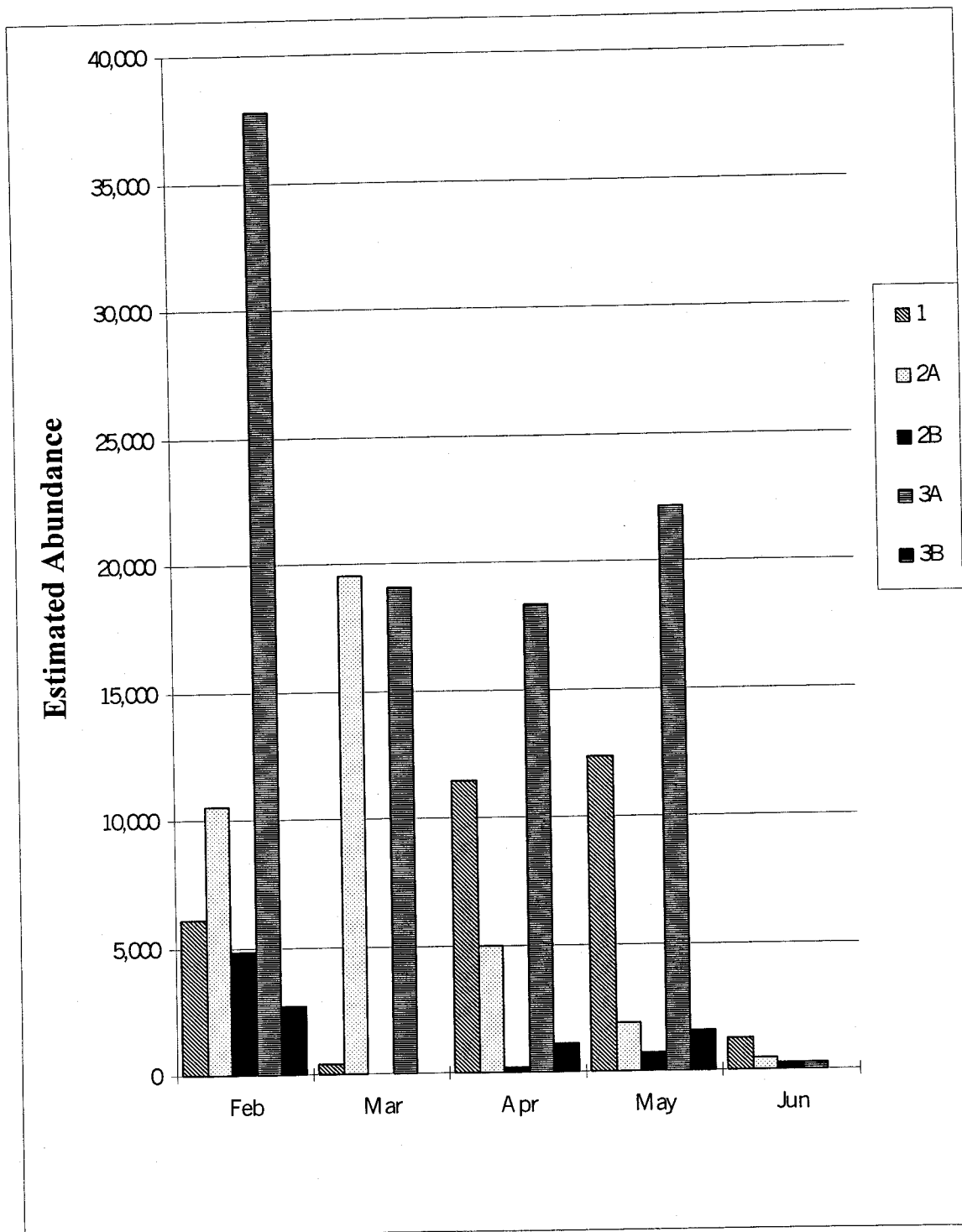


Figure F5. Estimated abundance of White Ibis for each impoundment within the Water Conservation Areas for February to June 2002.

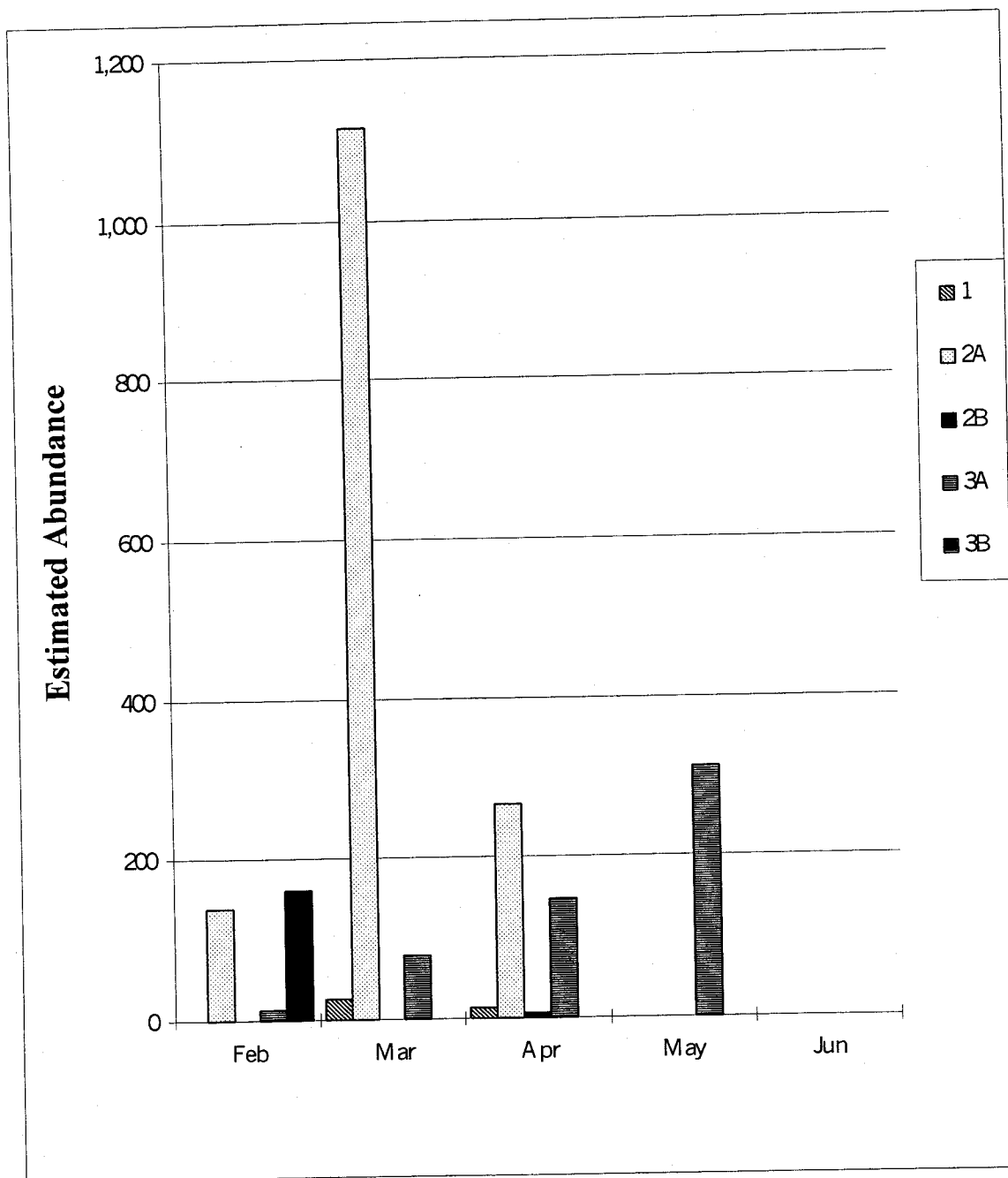


Figure F6. Estimated abundance of Glossy Ibis for each impoundment within the Water Conservation Areas for February to June 2002.

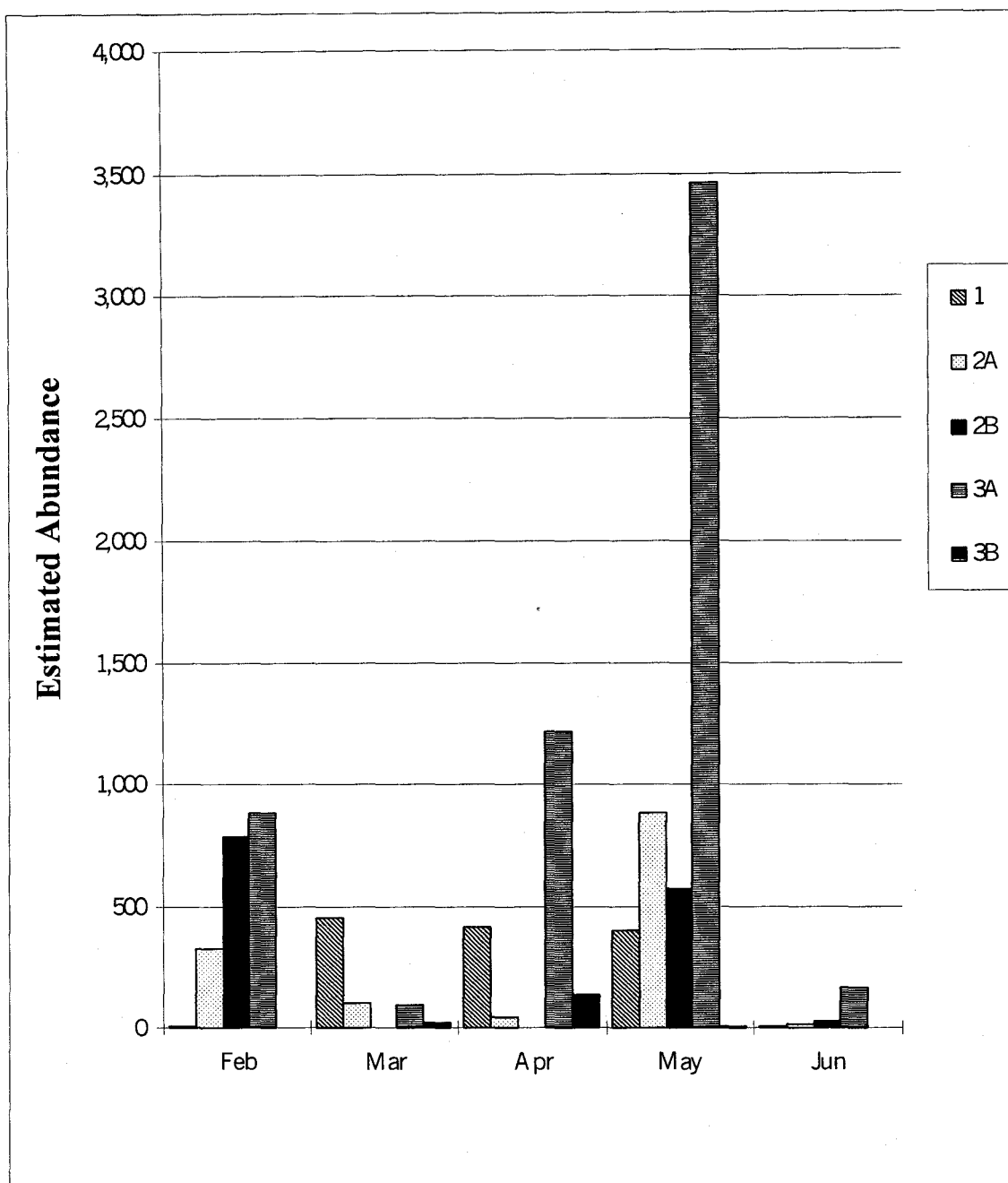


Table F7. Estimated abundance of Wood Storks for each impoundment within the Water Conservation Areas for February to June 2002.

APPENDIX G: Mean, minimum, and maximum water levels for Gauges WCA 1-7, WCA 2A-17, and WCA 3A-4 within the Water Conservation Areas, 2002

- G1. Mean, minimum, and maximum water levels for Gauge WCA 1-7 within Water Conservation Area 1.
- G2. Mean, minimum, and maximum water levels for Gauge WCA 2A-17 within the Water Conservation Area 2A.
- G3. Mean, minimum, and maximum water levels for Gage WCA 3A-4 within the Water Conservation Area 3A.

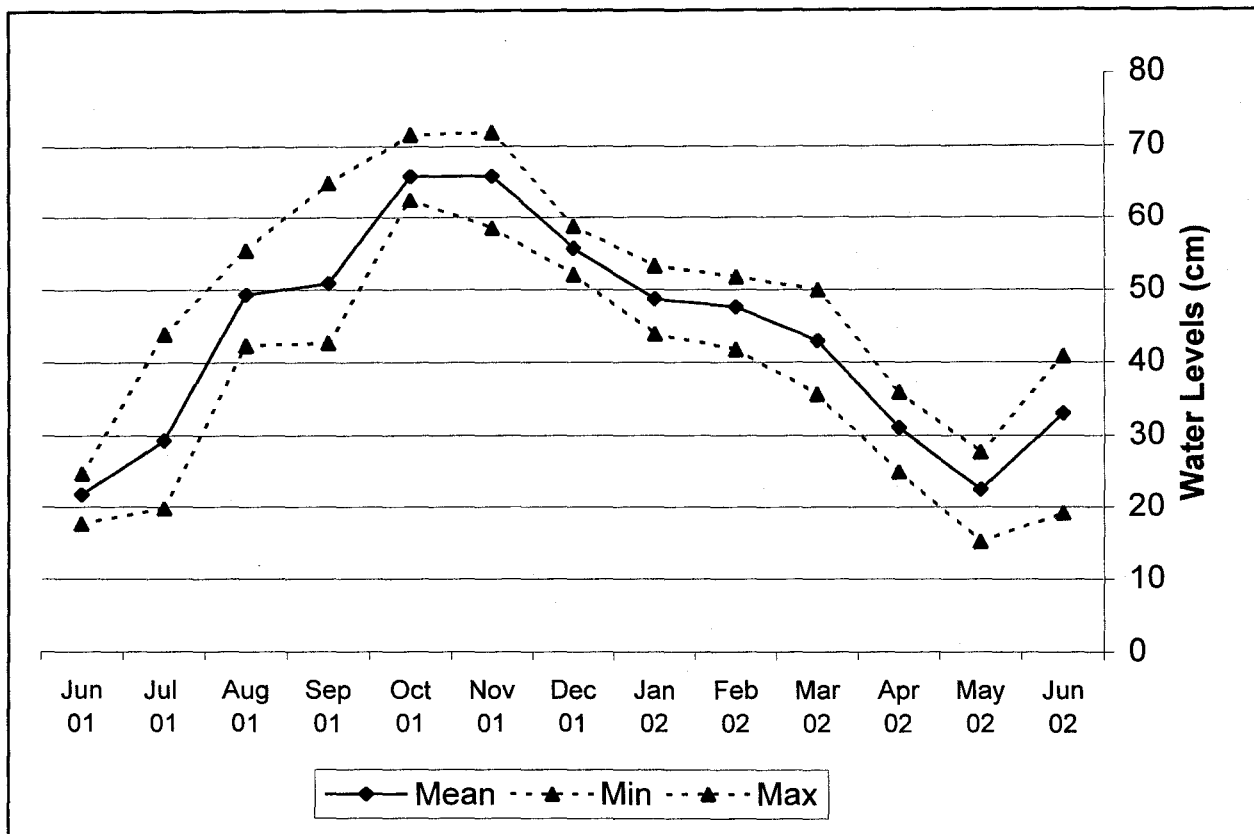


Figure G1. Mean, minimum, and maximum water levels for Guage WCA 1-7 within the Water Conservation Area 1, June 2001 to June 2002.

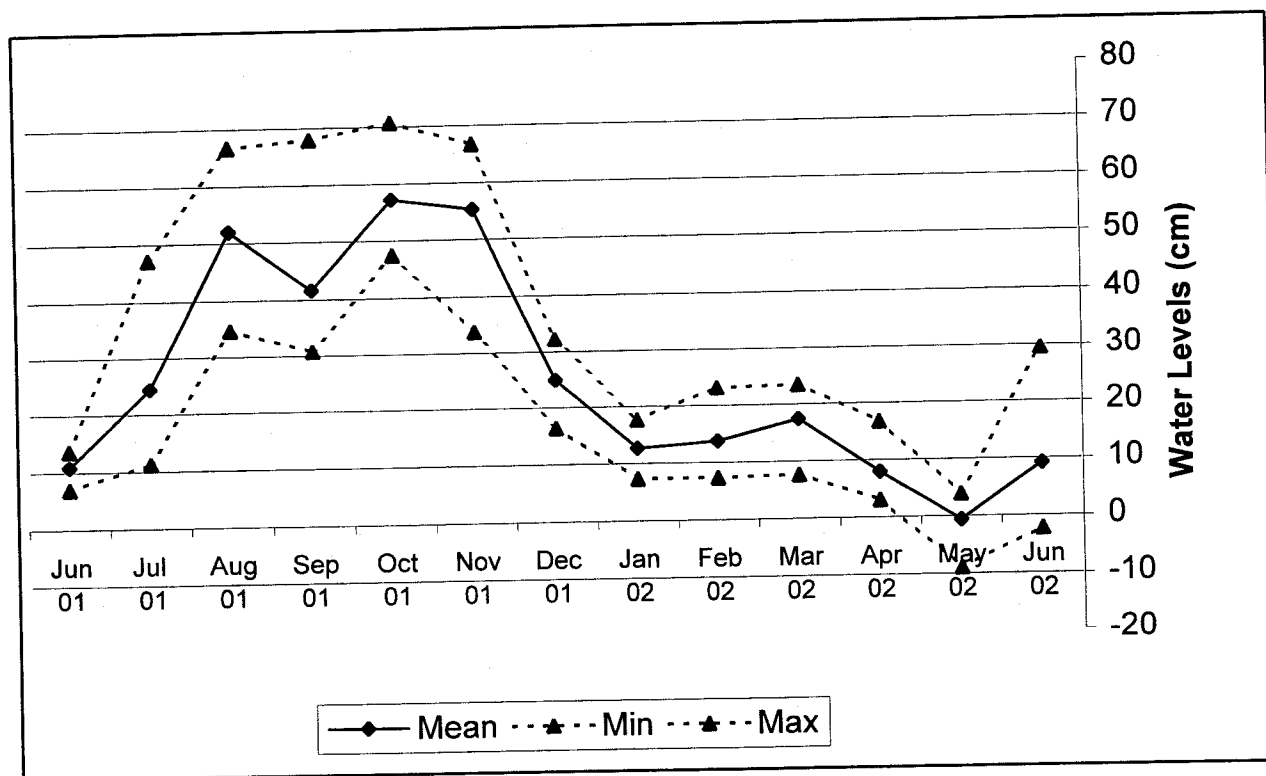


Figure G2. Mean, minimum, and maximum water levels for Guage WCA 2A-17 within the Water Conservation Area 2A, June 2001 to June 2002.

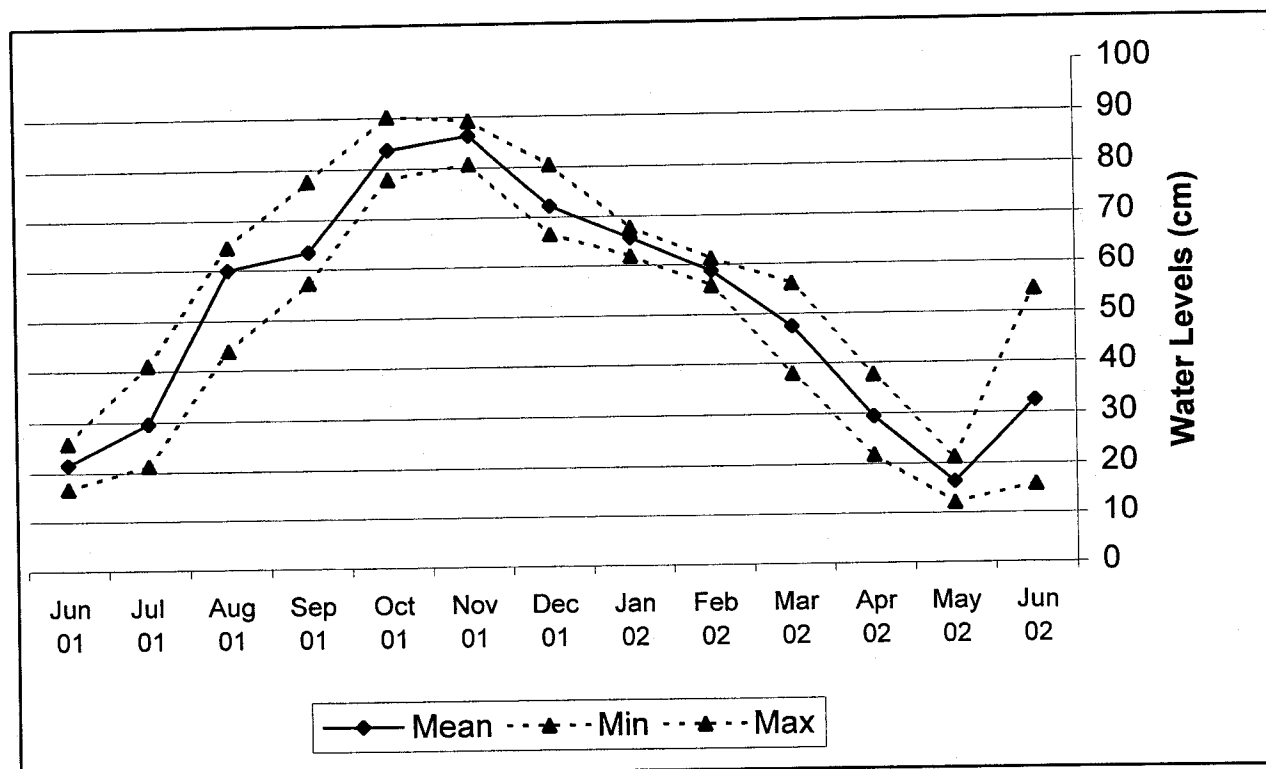


Figure G3. Mean, minimum, and maximum water levels for Guage WCA 3A-4 within the Water Conservation Area 3A, June 2001 to June 2002.

APPENDIX H: Comparison of estimated abundance of each wading bird species in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H1. Comparison of estimated abundance of Great Blue Herons in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

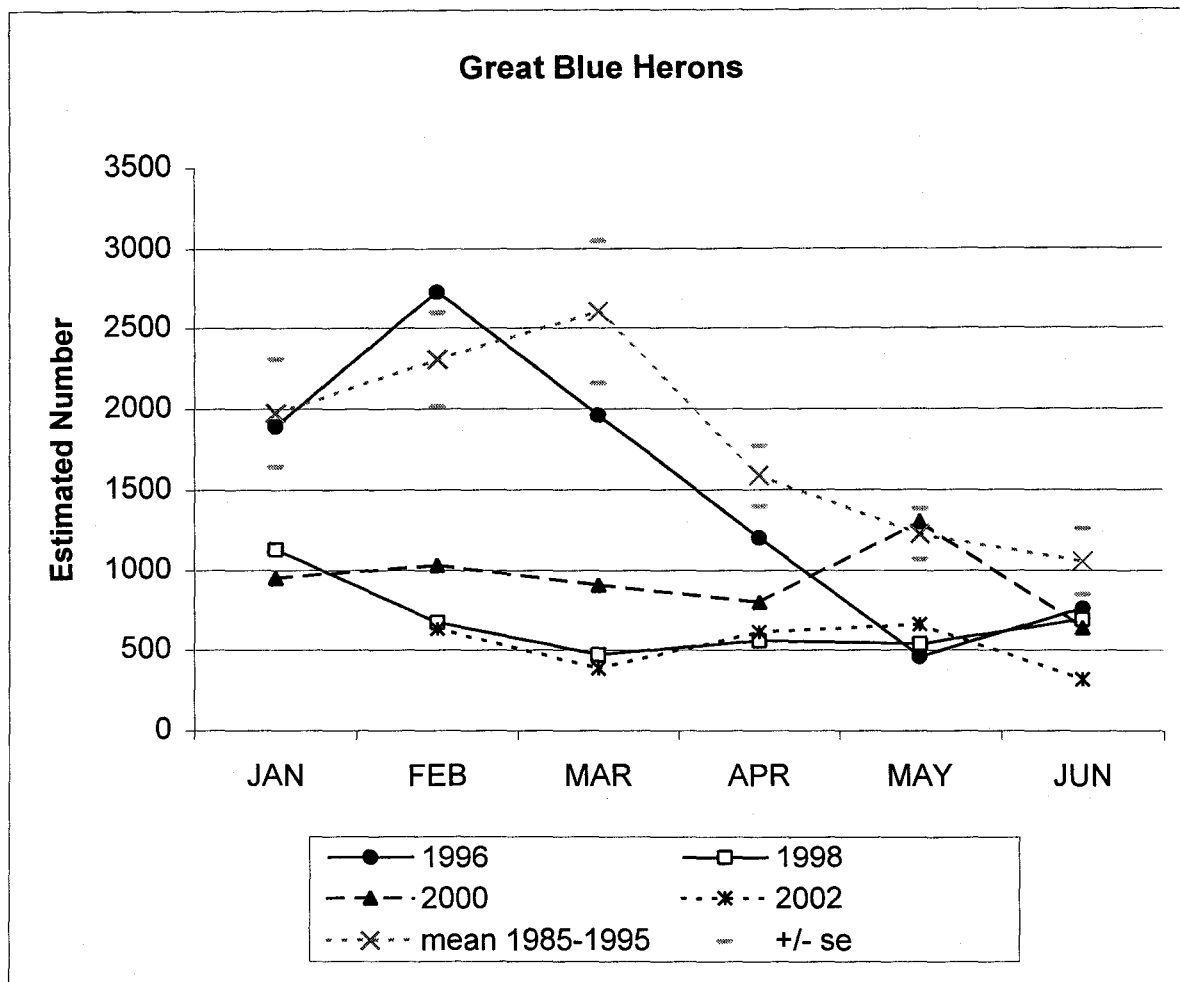
H2. Comparison of estimated abundance of Great Egrets in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H3. Comparison of estimated abundance of small herons in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H4. Comparison of estimated abundance of White Ibises in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

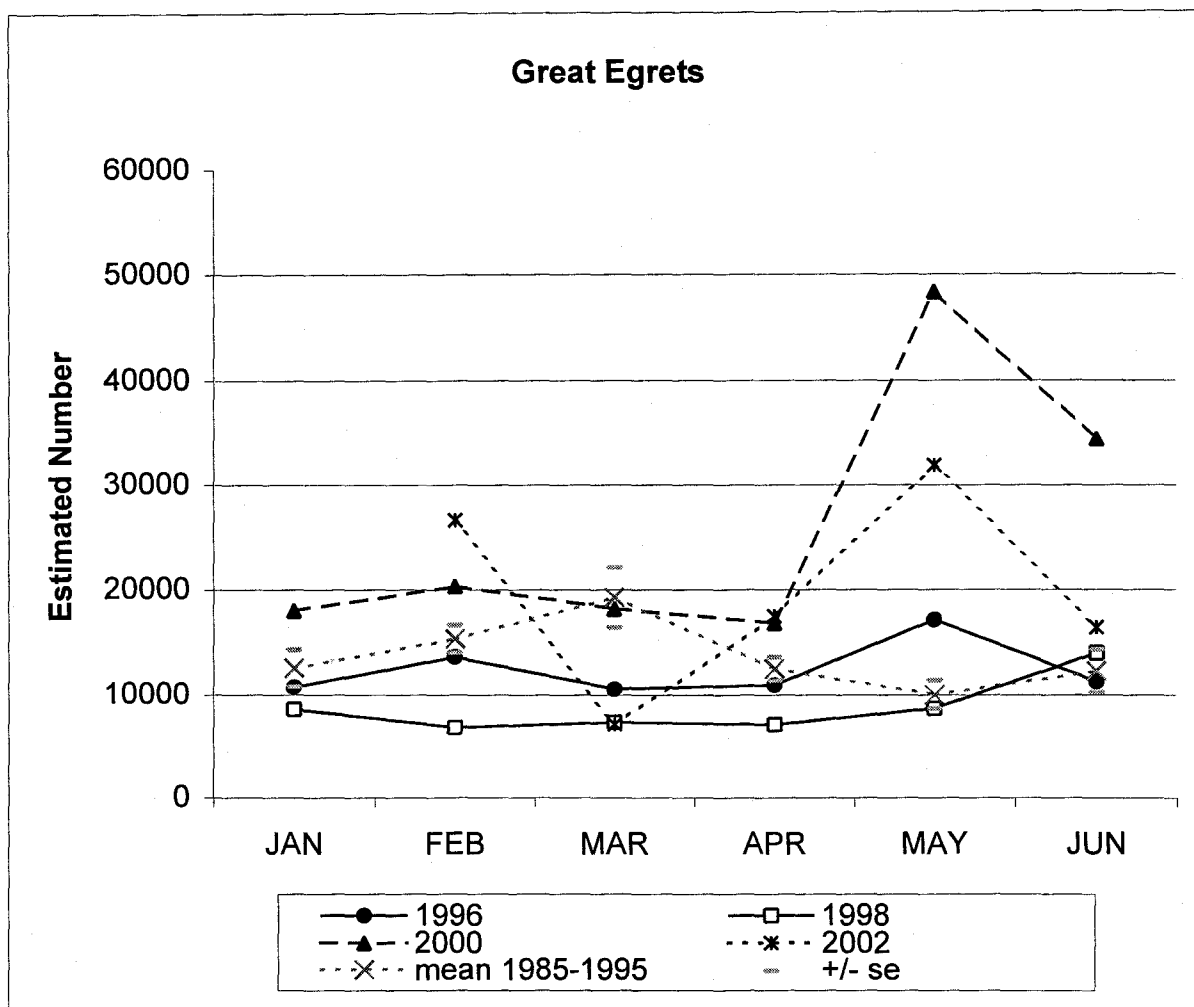
H5. Comparison of estimated abundance of Glossy Ibises in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.

H6. Comparison of estimated abundance of Wood Storks in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002 and 11 year monthly mean $\pm$ SE 1985 to 1995.



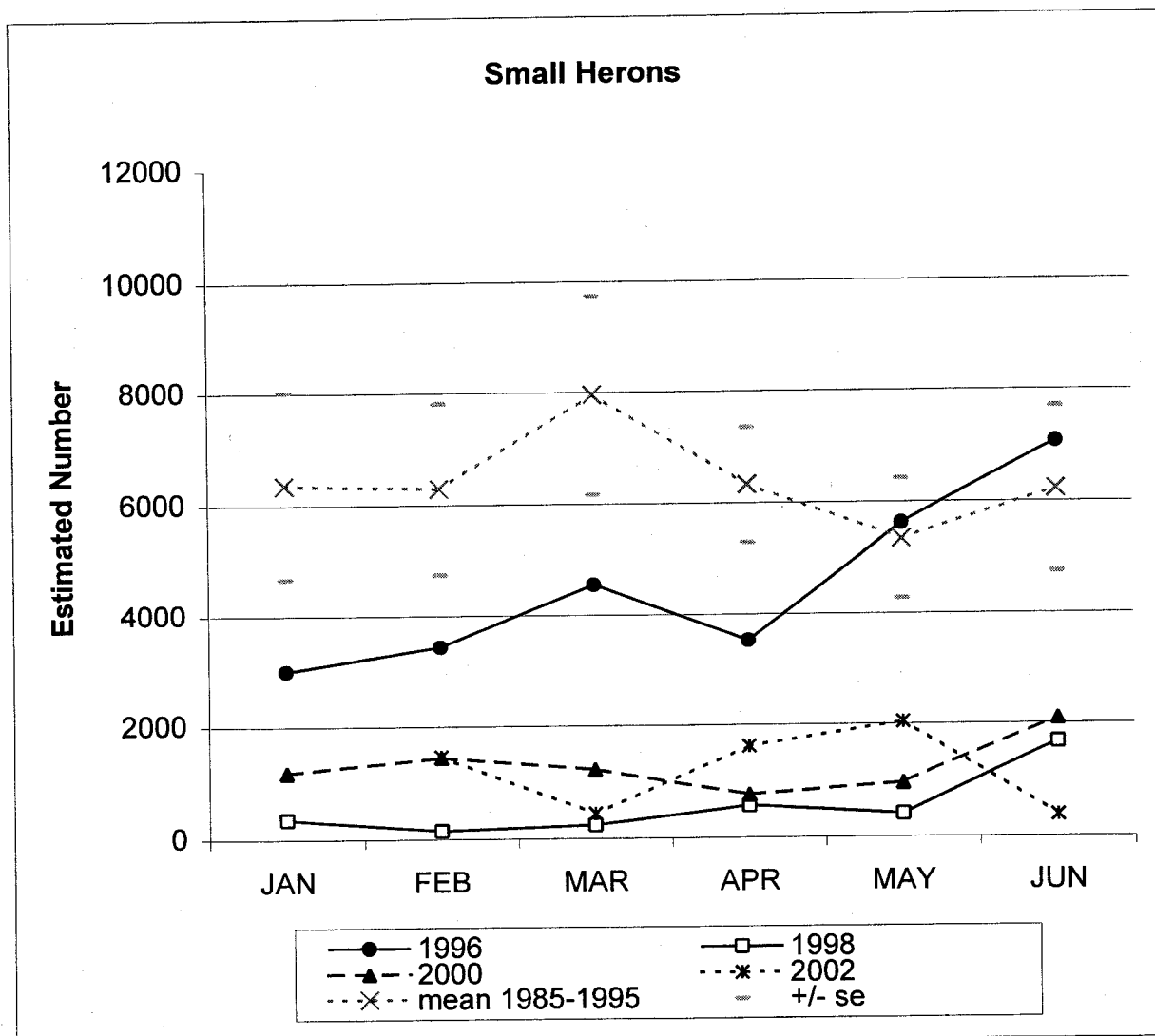
APPENDIX H1: Comparison of estimated abundance of Great Blue Herons the Water Conservation Areas, January to June 1996, 1998, 2000, 2002, and 11 year monthly mean for 1985-1995 $\pm$ se.

	1996	1998	2000	2002	Average 1985-95*	Avg + 1se	Avg -1se
JAN	1893	1133	953		1974	2307	1641
FEB	2727	673	1034	633	2306	2595	2016
MAR	1960	473	907	387	2602	3048	2157
APR	1207	560	801	613	1587	1772	1401
MAY	460	540	1307	660	1228	1385	1070
JUN	761	693	640	320	1060	1266	854
MTN AVG	1501	679	940	523	1789		
MTH SD	773	217	206	140	655		



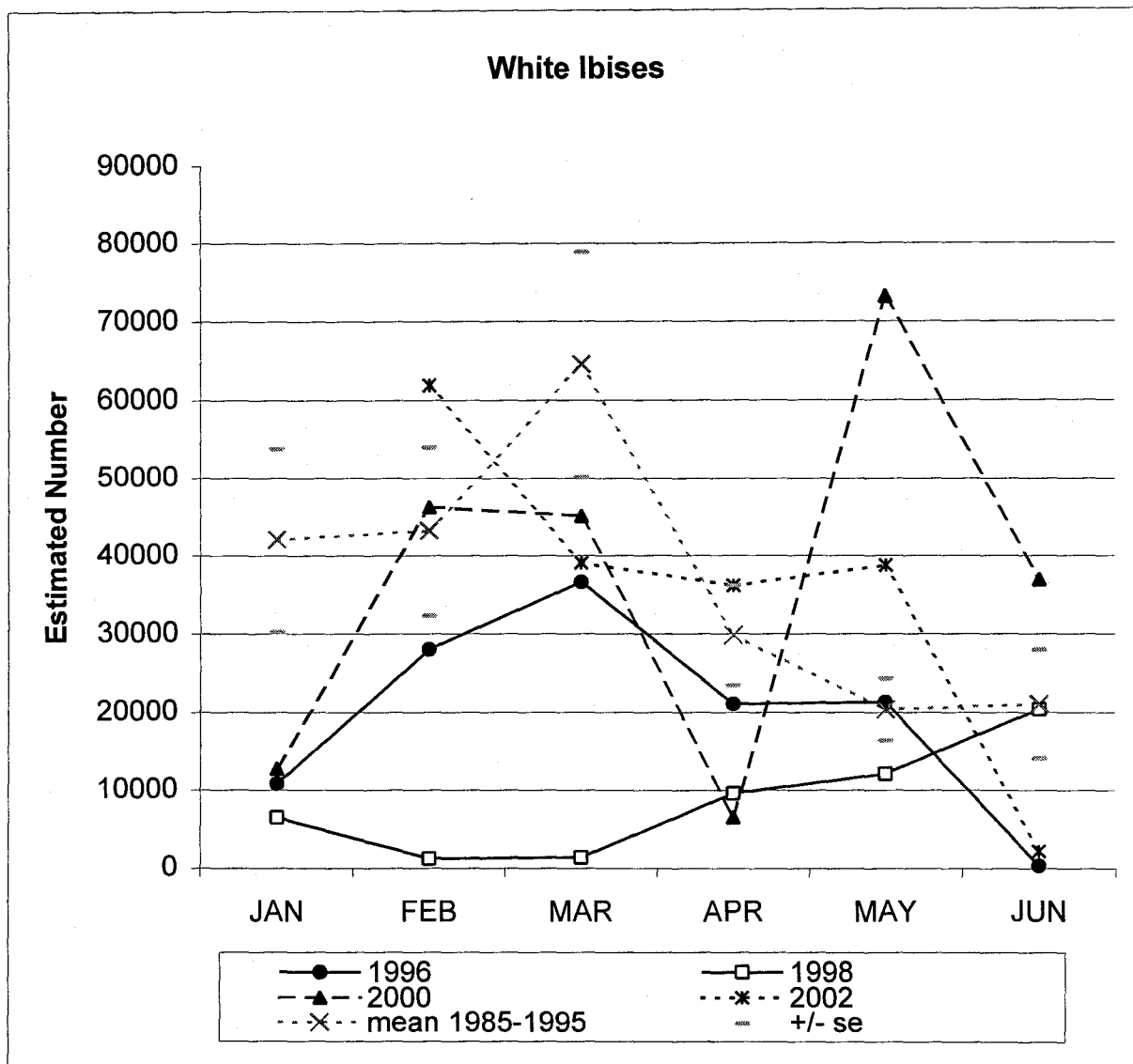
APPENDIX H2: Comparison of estimated abundance of Great Egrets the Water Conservation Areas, January to June 1996, 1998, 2000, 2002, and 11 year monthly mean for 1985-1995 $\pm$ se.

	1996	1998	2000	2002	Average 1985-95*	Avg + 1se	Avg -1se
JAN	10793	8633	18046		12618	10866	14370
FEB	13666	6833	20327	26607	15377	14070	16684
MAR	10574	7347	18188	7140	19279	16463	22095
APR	10979	7127	16853	17500	12532	11394	13671
MAY	17153	8707	48366	31900	10045	8683	11406
JUN	11307	14033	34466	16440	12327	10303	14350
MTH AVG	12412	8780	26041	19917	14082		
MTH SD	2357	2456	11634	8597	4499		



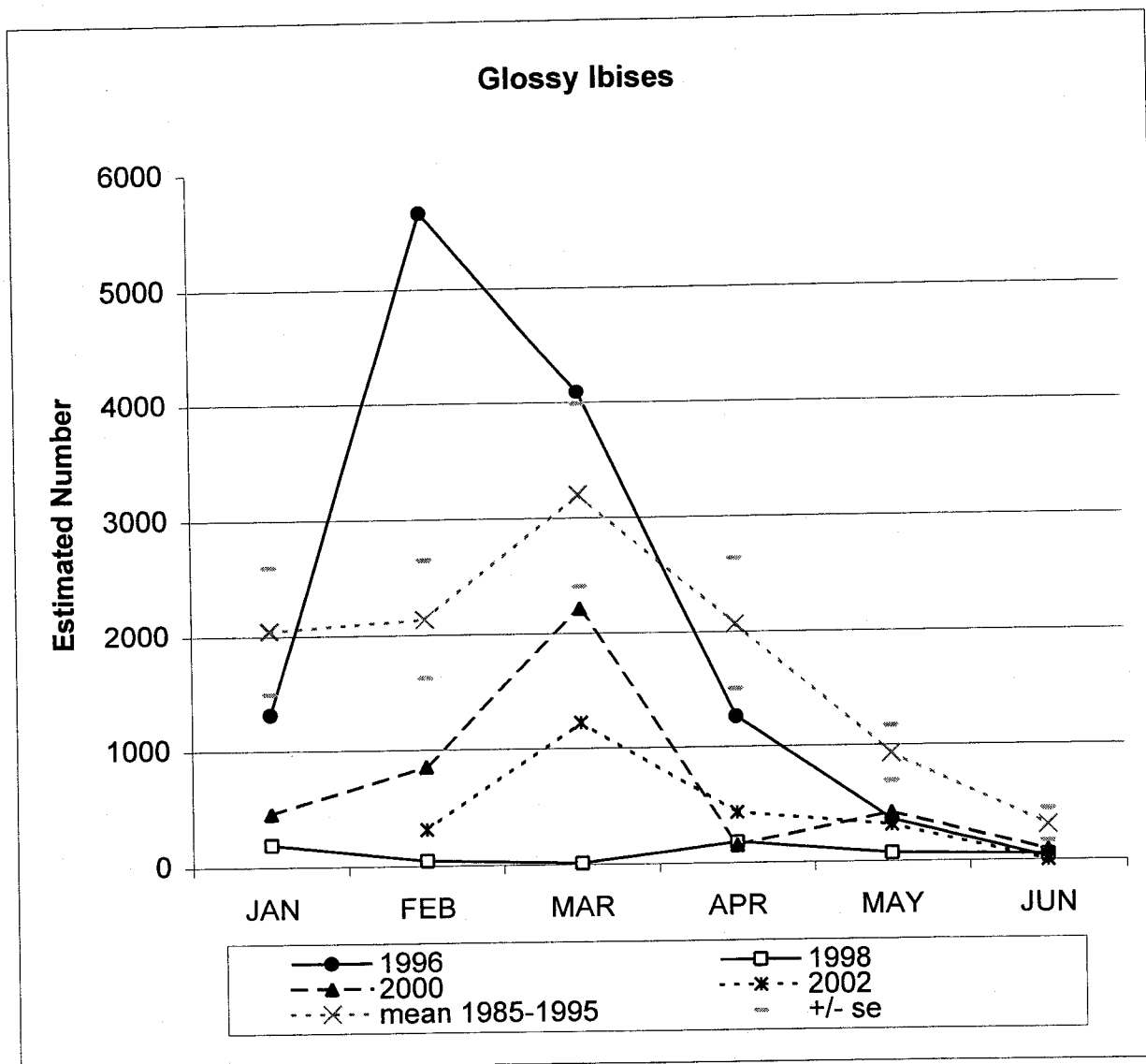
APPENDIX H3: Comparison of estimated abundance of small herons the Water Conservation Areas, January to June 1996, 1998, 2000, 2002, and 11 year monthly mean for 1985-1995 $\pm$ se.

	1996	1998	2000	2002	Average 1985-95*	Avg + 1se	Avg -1se
JAN	2993	360	1186		6353	8023	4684
FEB	3433	153	1446	1460	6290	7814	4767
MAR	4567	247	1220	446	7957	9743	6171
APR	3520	580	768	1620	6327	7355	5300
MAY	5641	420	966	2047	5356	6424	4287
JUN	7081	1680	2101	387	6231	7709	4754
MTH AVG	4539	573	1281	1192	6701		
MTH SD	1433	513	423	662	3246		



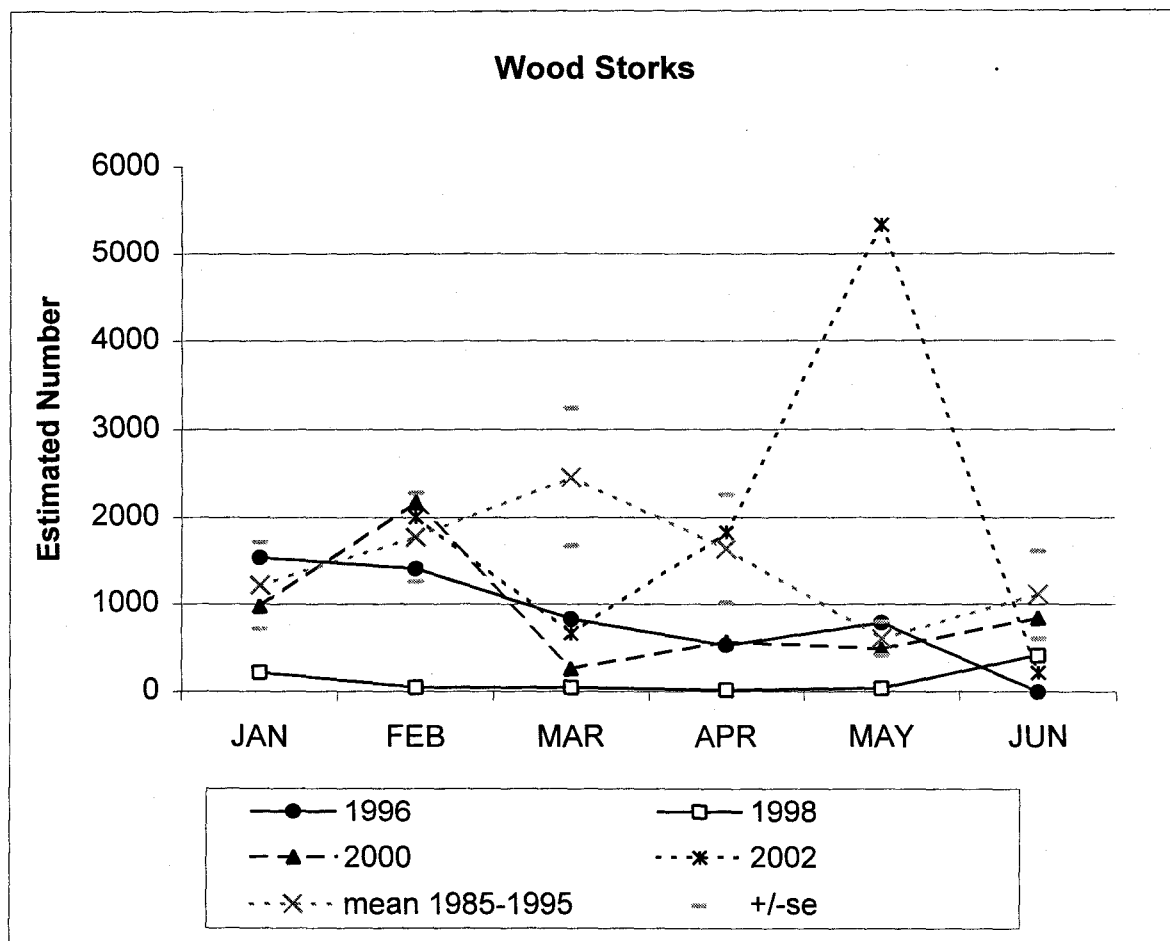
APPENDIX H4: Comparison of estimated abundance of White Ibises the Water Conservation Areas, January to June 1996, 1998, 2000, 2002, and 11 year monthly mean for 1985-1995 $\pm$ se.

	1996	1998	2000	2002	Average 1985-95*	Avg + 1se	Avg -1se
JAN	10840	6540	12800		42041	53815	30267
FEB	28053	1253	46260	61900	43200	54029	32370
MAR	36627	1413	45107	39047	64555	78882	50228
APR	21094	9620	6580	36194	29848	36201	23495
MAY	21340	12140	73214	38747	20361	24310	16412
JUN	387	20453	36985	2233	21103	28060	14147
MTH AVG	19724	8570	36824	35624	38087		
MTH SD	11636	6632	22263	19116	20347		



APPENDIX H5: Comparison of estimated abundance of Glossy Ibises the Water Conservation Areas, January to June 1996, 1998, 2000, 2002, and 11 year monthly mean for 1985-1995 $\pm$ se.

	1996	1998	2000	2002	Average 1985-95*	Avg + 1se	Avg -1se
JAN	1314	193	460		2047	2602	1492
FEB	5660	47	853	313	2139	2653	1625
MAR	4094	13	2220	1220	3200	3989	2412
APR	1260	180	153	433	2070	2639	1501
MAY	360	73	420	313	929	1169	690
JUN	27	53	87	0	304	441	167
MTH AVG	2119	93	699	456	1839		
MTH SD	2053	68	724	408	1248		



APPENDIX H6: Comparison of estimated abundance of Wood Storks in the Water Conservation Areas, January to June 1996, 1998, 2000, 2002, and 11 year monthly mean for 1985-1995 $\pm$ se.

	1996	1998	2000	2002	Average 1985-95*	Avg + 1se	Avg -1se
JAN	1533	221	980		1216	1712	721
FEB	1407	47	2173	2007	1773	2284	1262
MAR	833	47	267	667	2459	3239	1678
APR	533	20	574	1827	1639	2257	1020
MAY	793	40	493	5333	609	802	416
JUN	0	420	847	220	1115	1616	615
MTH AVG	850	133	889	2011	1564		
MTH SD	517	145	619	1794	1207		

APPENDIX I: Comparison of estimated abundance of each wading bird species in the Water Conservation Areas, 1985 to 2002.

- I1. Mean estimated abundance January to June of Great Blue Herons in the Water Conservation Areas, 1985 to 2002.
- I2. Mean estimated abundance January to June of Great Egrets in the Water Conservation Areas, 1985 to 2002.
- I3. Mean estimated abundance January to June of small herons in the Water Conservation Areas, 1985 to 2002.
- I4. Mean estimated abundance January to June of White Ibises in the Water Conservation Areas, 1985 to 2002.
- I5. Mean estimated abundance January to June of Glossy Ibises in the Water Conservation Areas, 1985 to 2002.
- I6. Mean estimated abundance January to June of Wood Storks in the Water Conservation Areas, 1985 to 2002.

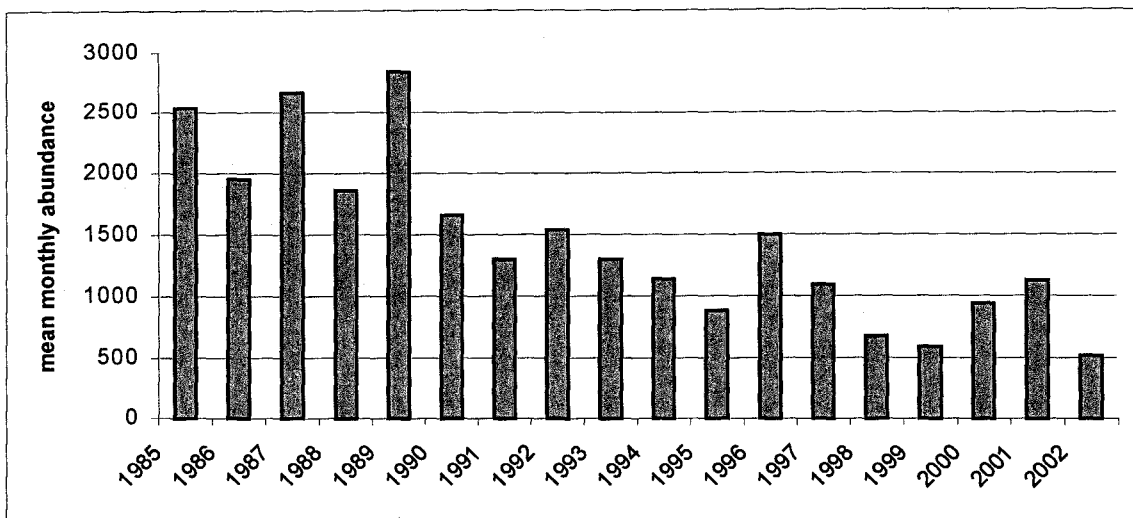


Figure I1. Mean estimated abundance January to June of Great Blue Herons in the Water Conservation Areas, 1985 to 2002 (1985 to 1994 adapted from Bancroft and Sawicki, 1995; 1995 adapted from Sawicki et al., 1995).

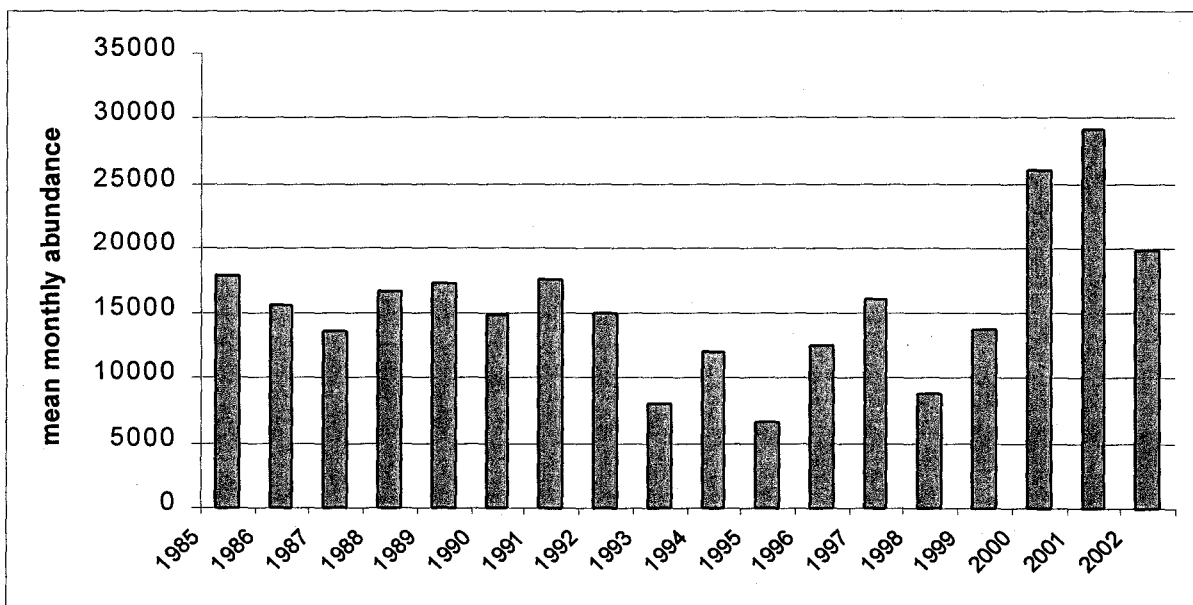


Figure I2. Mean estimated abundance January to June of Great Egrets in the Water Conservation Areas, 1985 to 2002 (1985 to 1994 adapted from Bancroft and Sawicki, 1995; 1995 adapted from Sawicki et al., 1995).

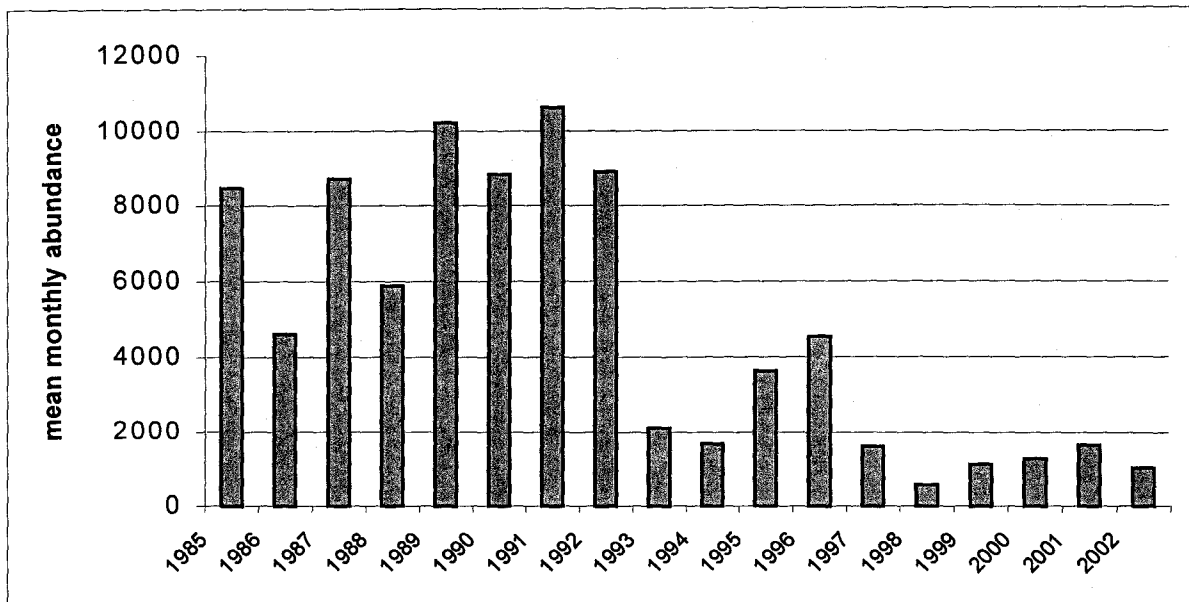


Figure I3. Mean estimated abundance January to June of small herons in the Water Conservation Areas, 1985 to 2002 (1985 to 1994 adapted from Bancroft and Sawicki, 1995; 1995 adapted from Sawicki et al., 1995).

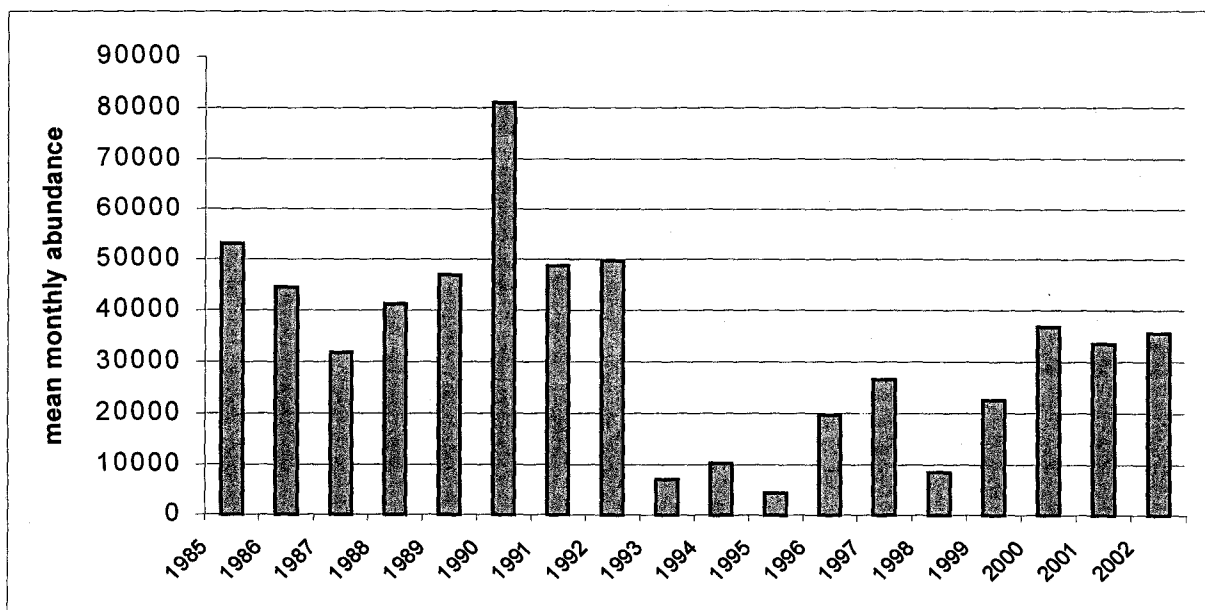


Figure I4. Mean estimated abundance January to June of White Ibises in the Water Conservation Areas, 1985 to 2002 (1985 to 1994 adapted from Bancroft and Sawicki, 1995; 1995 adapted from Sawicki et al., 1995).

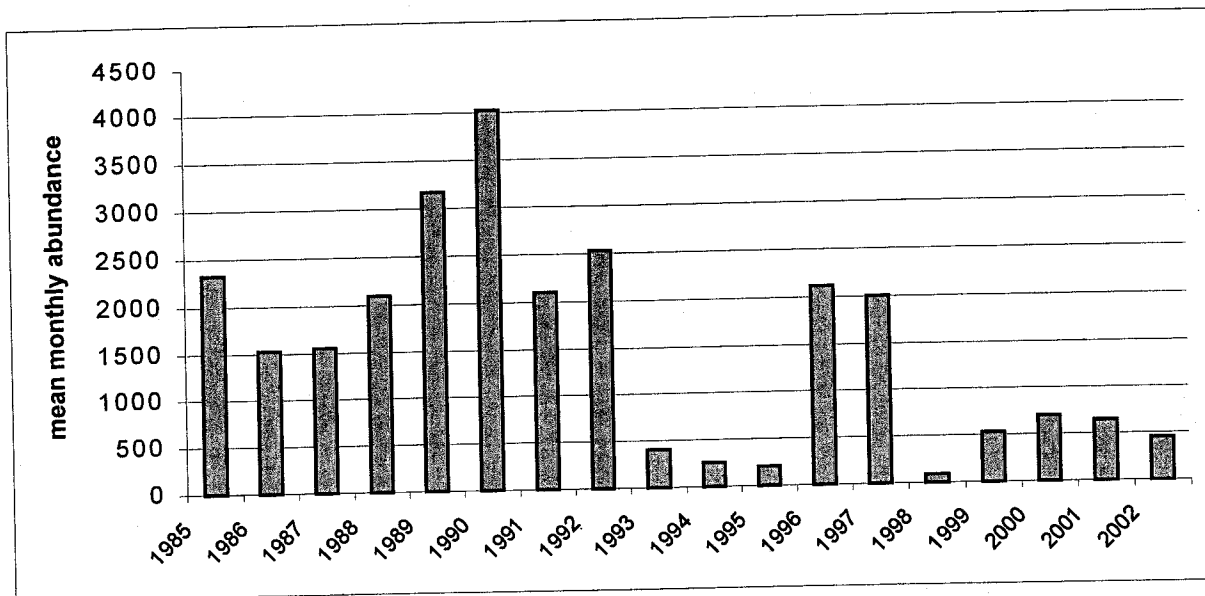


Figure I5. Mean estimated abundance January to June of Glossy Ibises in the Water Conservation Areas, 1985 to 2002 (1985 to 1994 adapted from Bancroft and Sawicki, 1995; 1995 adapted from Sawicki et al., 1995).

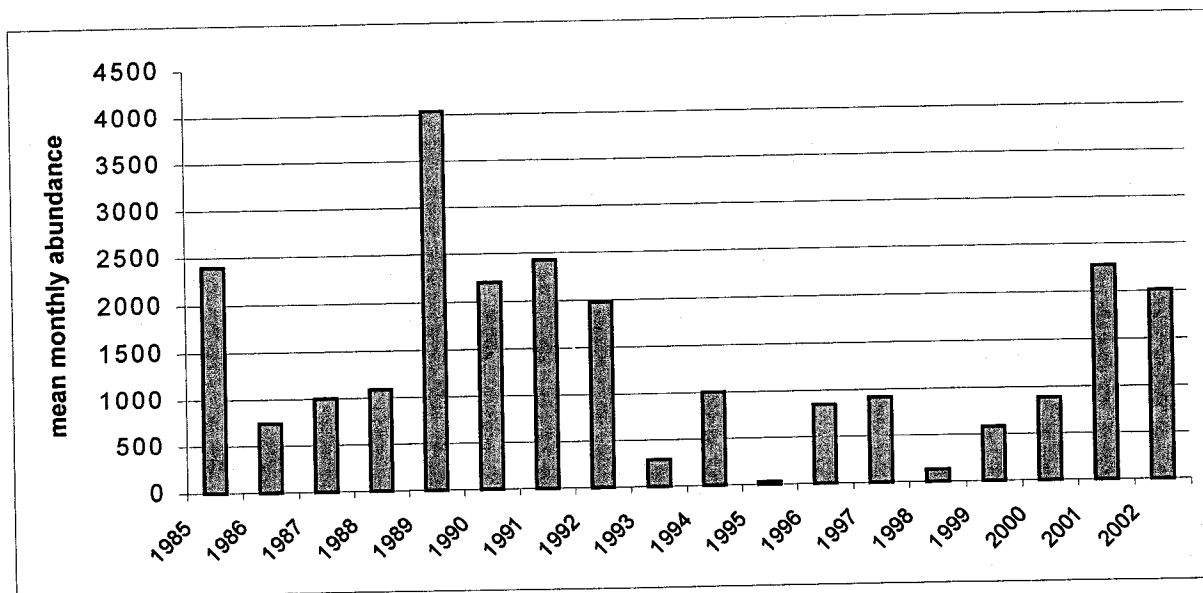


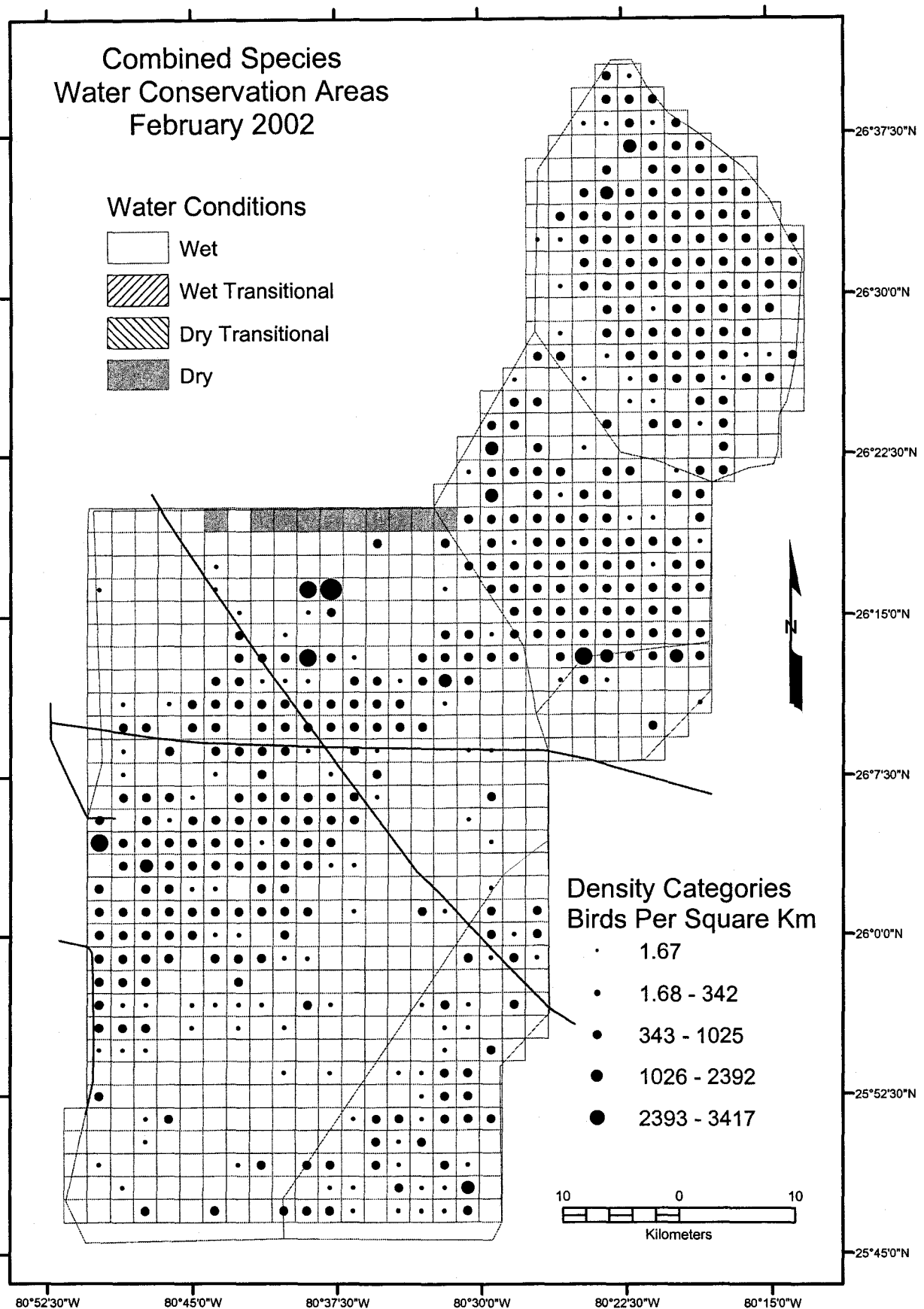
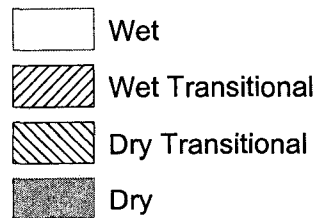
Figure I6. Mean estimated abundance January to June of Wood Storks in the Water Conservation Areas, 1985 to 2002 (1985 to 1994 adapted from Bancroft and Sawicki, 1995; 1995 adapted from Sawicki et al., 1995).

APPENDIX J: Monthly density maps of wading birds (species combined) in the Water Conservation Areas, February to June 2002.

- J1. Density maps of wading birds (species combined) in the Water Conservation Areas, February 2002.
- J2. Density maps of wading birds (species combined) in the Water Conservation Areas, March 2002.
- J3. Density maps of wading birds (species combined) in the Water Conservation Areas, April 2002.
- J4. Density maps of wading birds (species combined) in the Water Conservation Areas, May 2002.
- J5. Density maps of wading birds (species combined) in the Water Conservation Areas, June 2002.

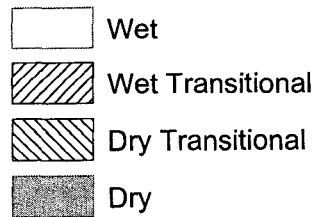
Combined Species Water Conservation Areas February 2002

Water Conditions

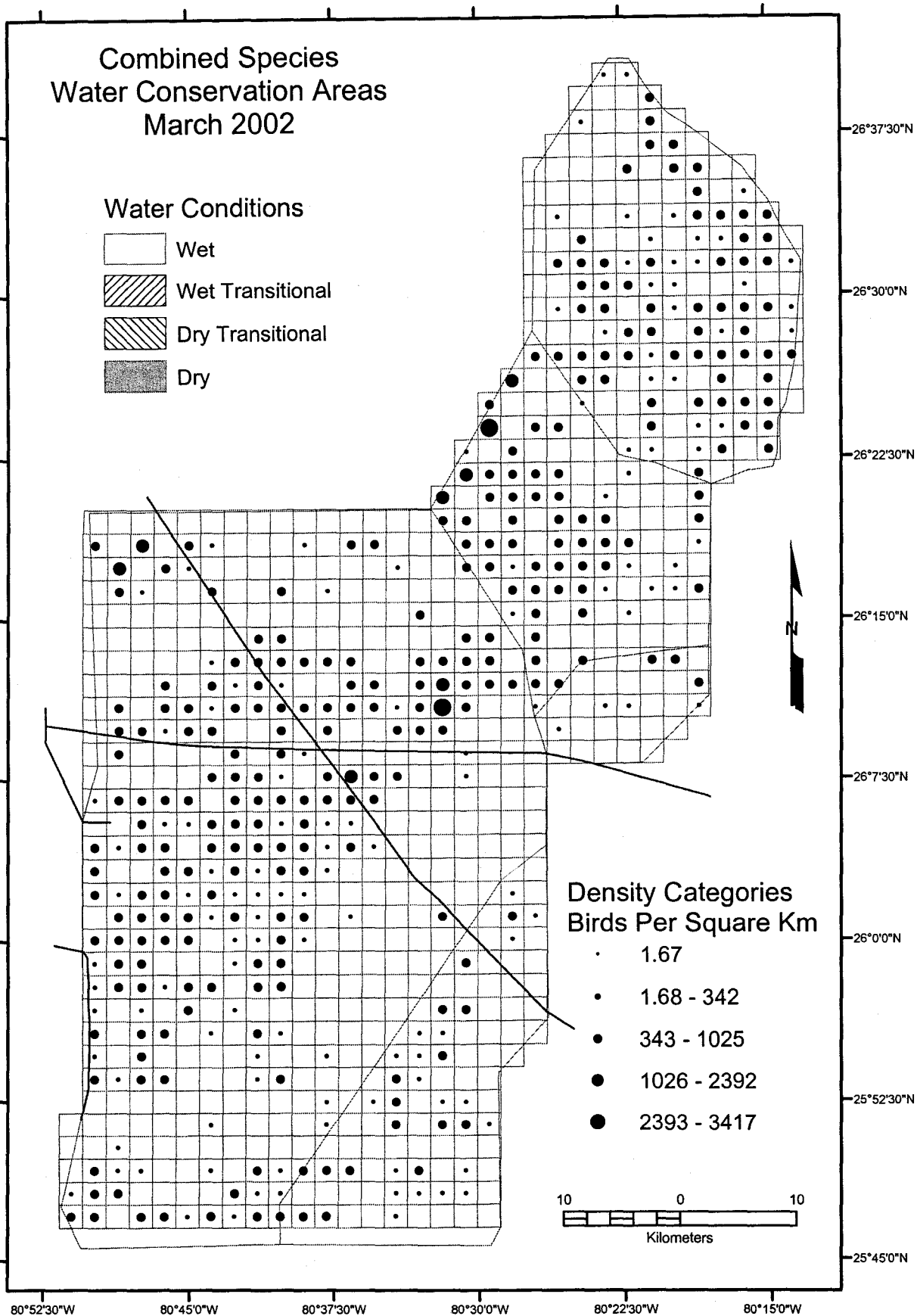
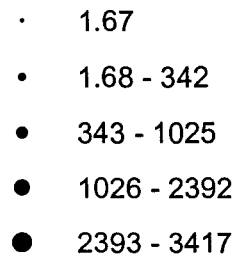


Combined Species Water Conservation Areas March 2002

Water Conditions

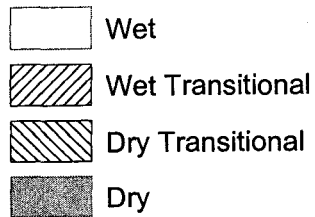


Density Categories Birds Per Square Km

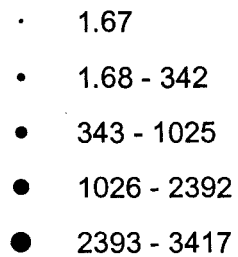


Combined Species Water Conservation Areas April 2002

Water Conditions

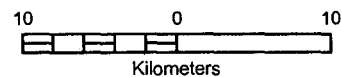


Density Categories Birds Per Square Km



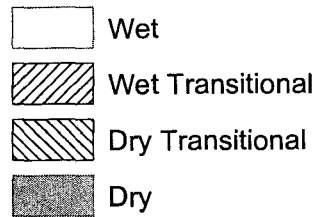
80°52'30"W 80°45'0"W 80°37'30"W 80°30'0"W 80°22'30"W 80°15'0"W

26°37'30"N
26°30'0"N
26°22'30"N
26°15'0"N
26°7'30"N
26°0'0"N
25°52'30"N
25°45'0"N

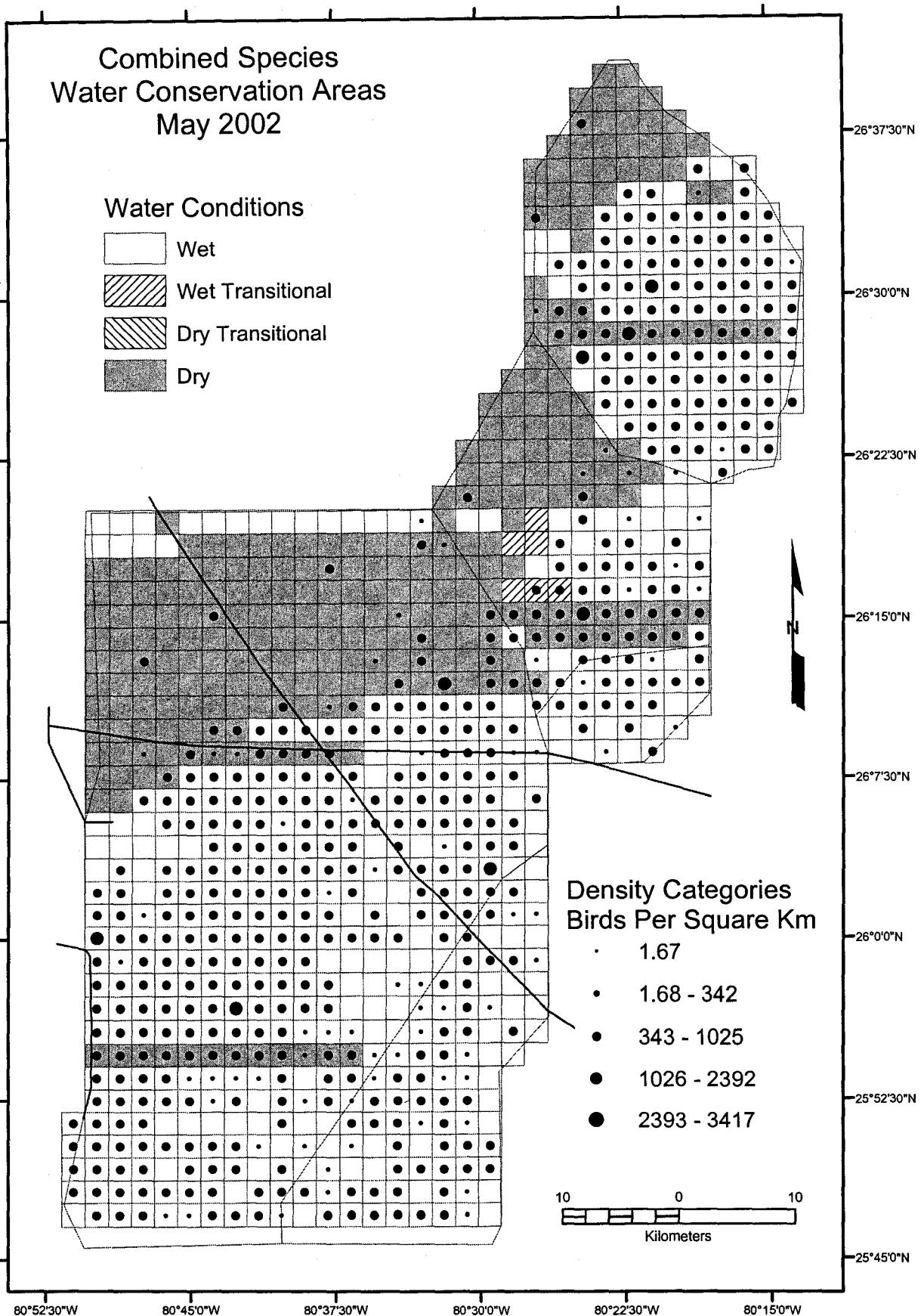
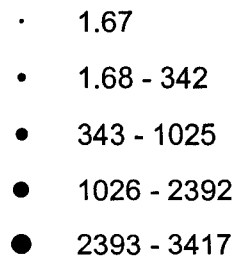


Combined Species Water Conservation Areas May 2002

Water Conditions

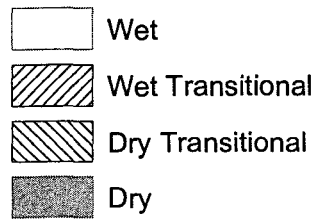


Density Categories Birds Per Square Km

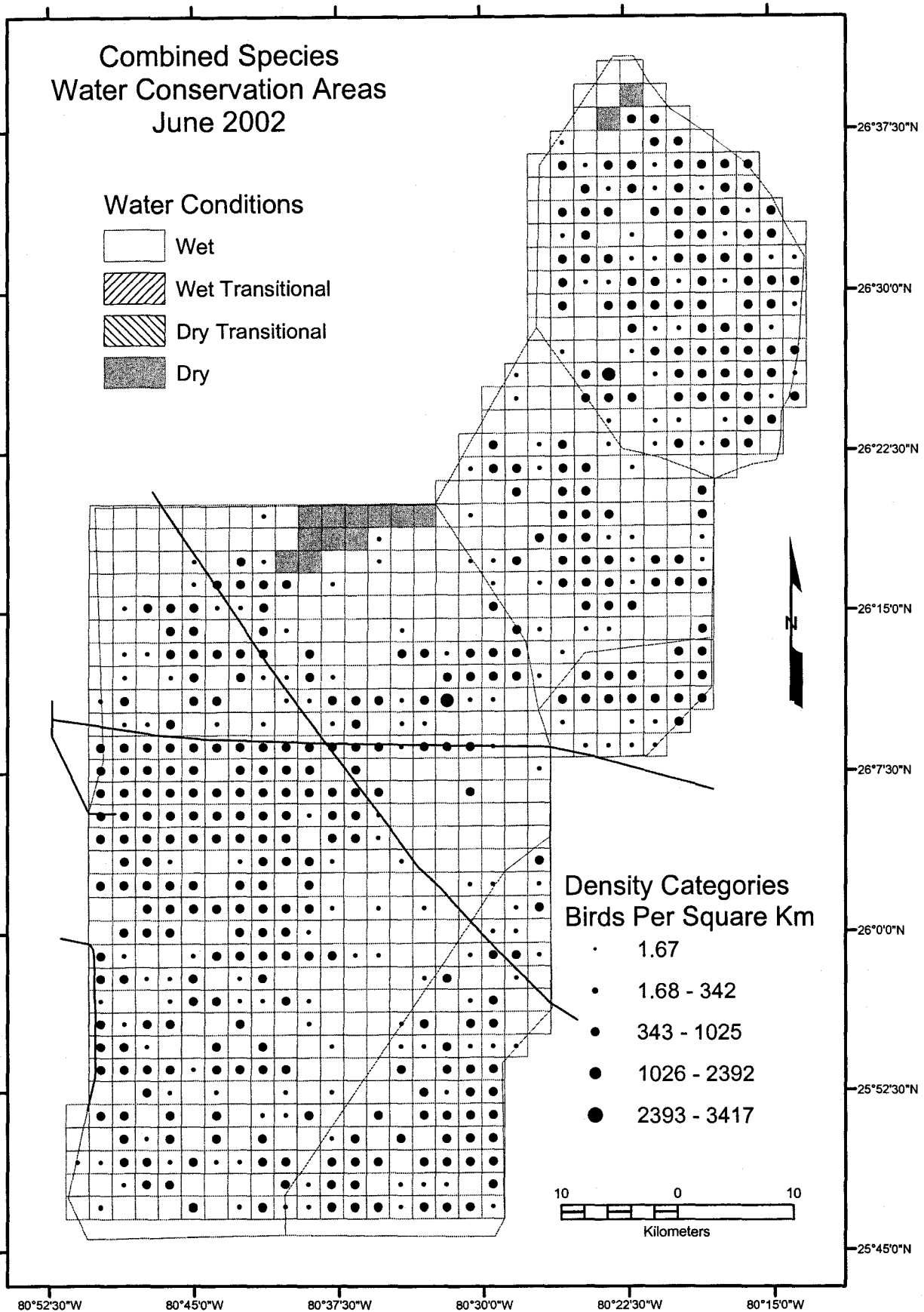
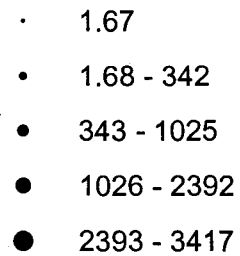


Combined Species Water Conservation Areas June 2002

Water Conditions



Density Categories Birds Per Square Km



APPENDIX K: Monthly density maps of Great Blue Herons in the Water Conservation Areas, February to June 2002.

K1. Density maps of Great Blue Herons in the Water Conservation Areas, February 2002.

K2. Density maps of Great Blue Herons in the Water Conservation Areas, March 2002.

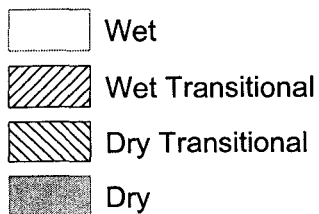
K3. Density maps of Great Blue Herons in the Water Conservation Areas, April 2002.

K4. Density maps of Great Blue Herons in the Water Conservation Areas, May 2002.

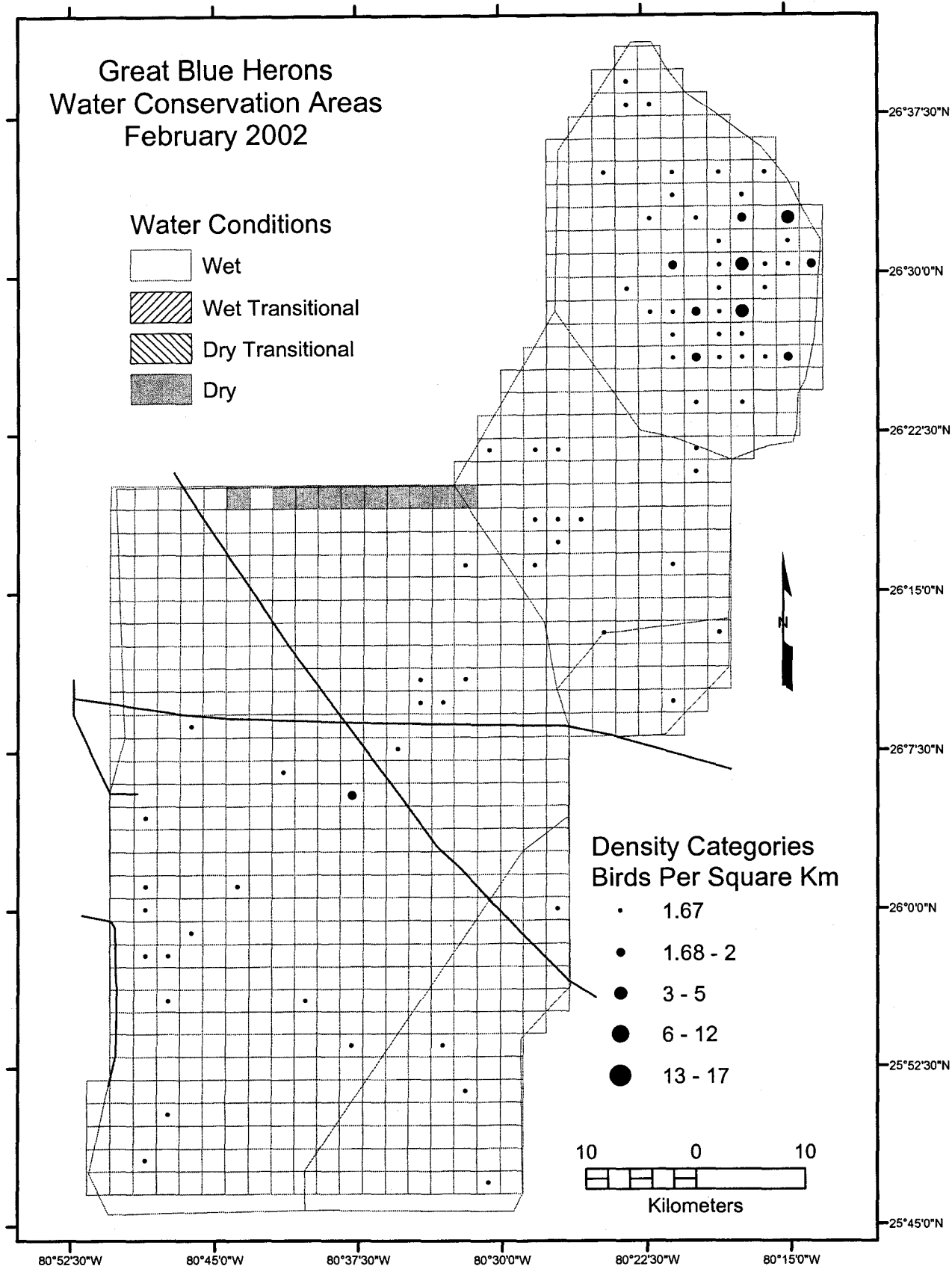
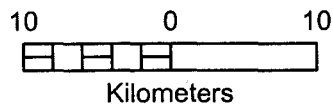
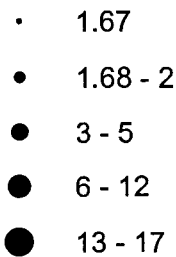
K5. Density maps of Great Blue Herons in the Water Conservation Areas, June 2002.

Great Blue Herons Water Conservation Areas February 2002

Water Conditions

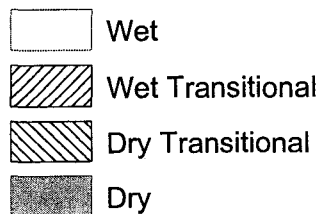


Density Categories Birds Per Square Km

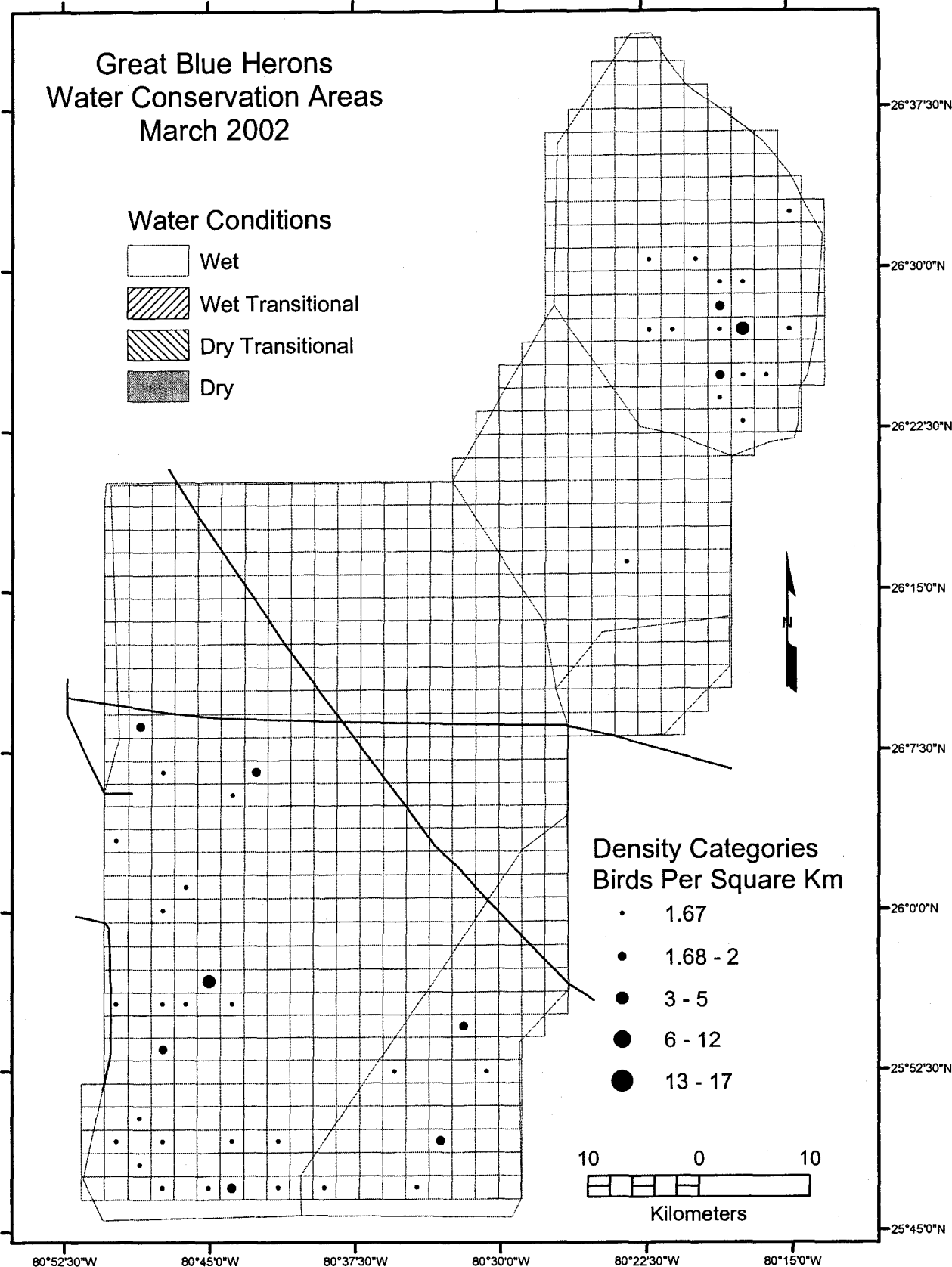
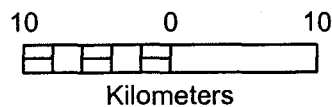
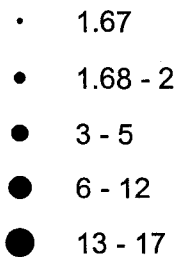


Great Blue Herons Water Conservation Areas March 2002

Water Conditions

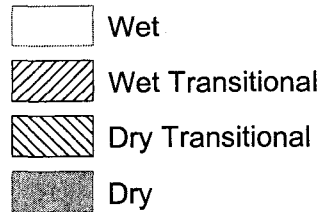


Density Categories Birds Per Square Km

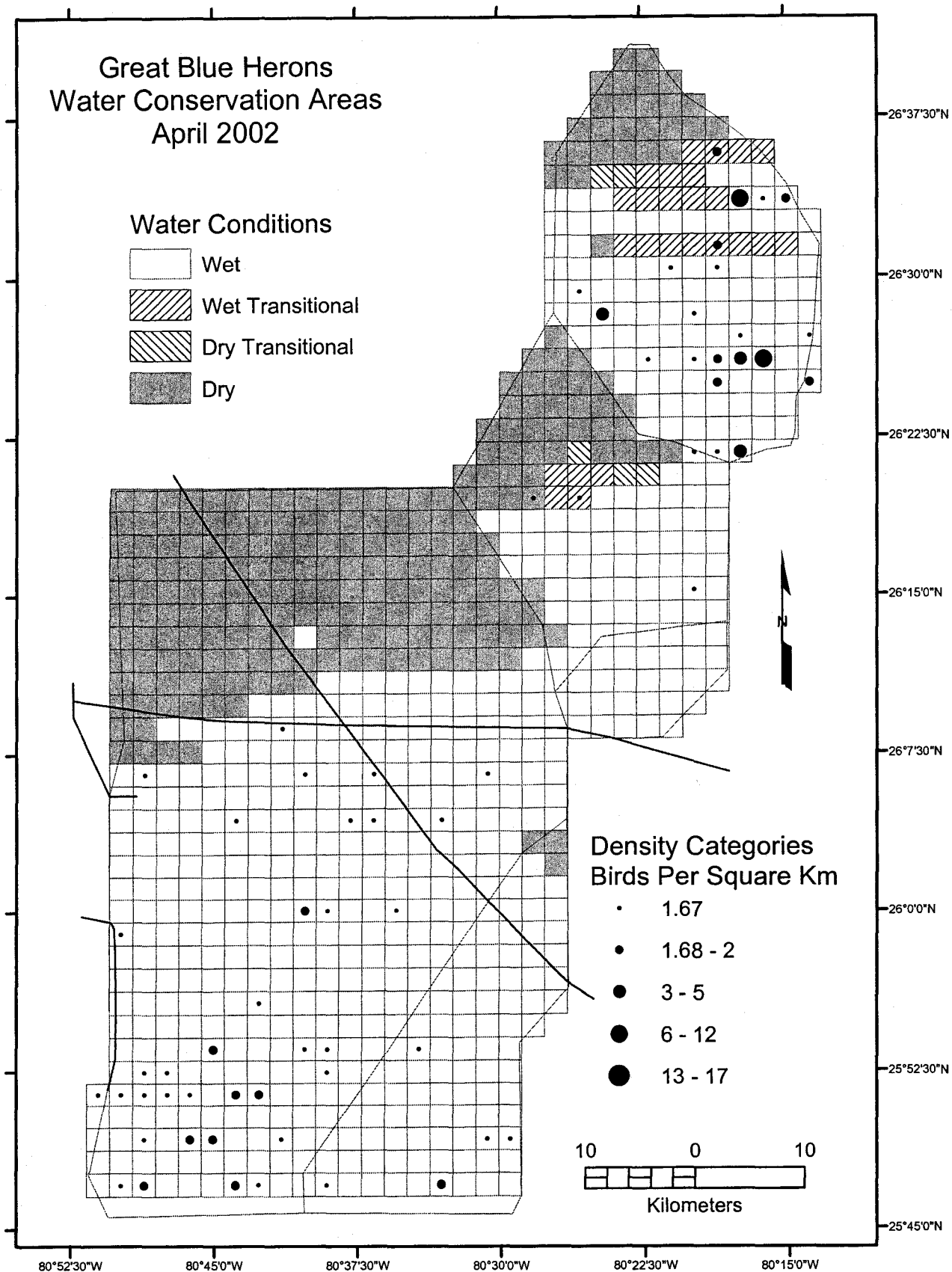
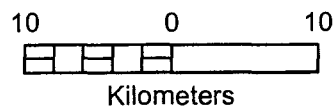
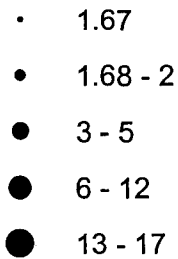


Great Blue Herons Water Conservation Areas April 2002

Water Conditions

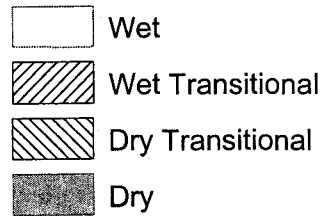


Density Categories Birds Per Square Km

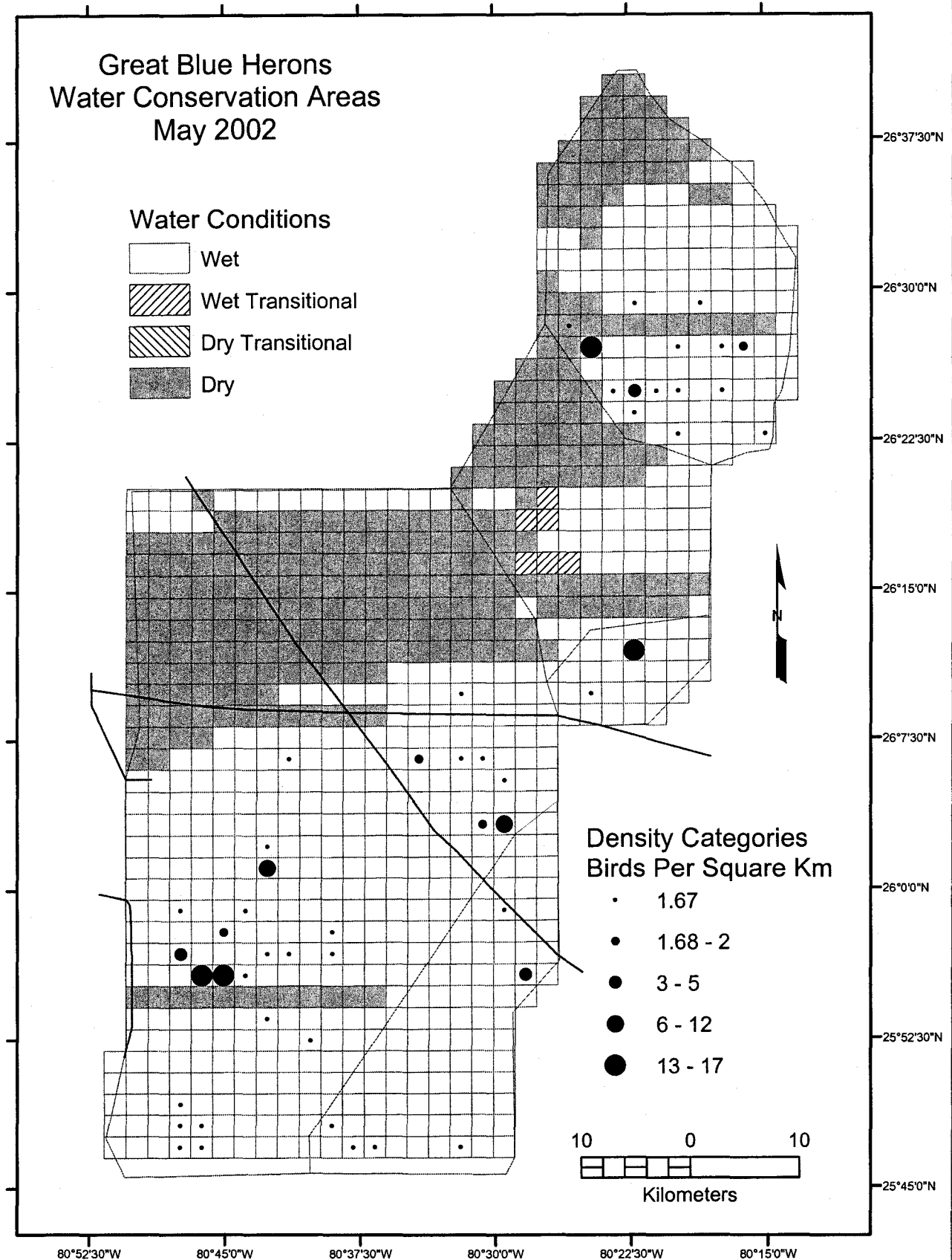
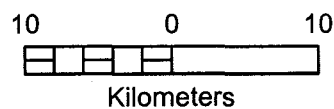
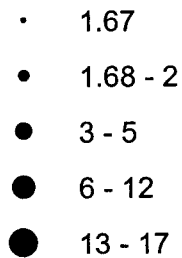


Great Blue Herons Water Conservation Areas May 2002

Water Conditions

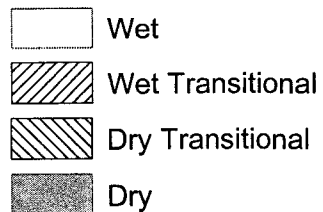


Density Categories Birds Per Square Km

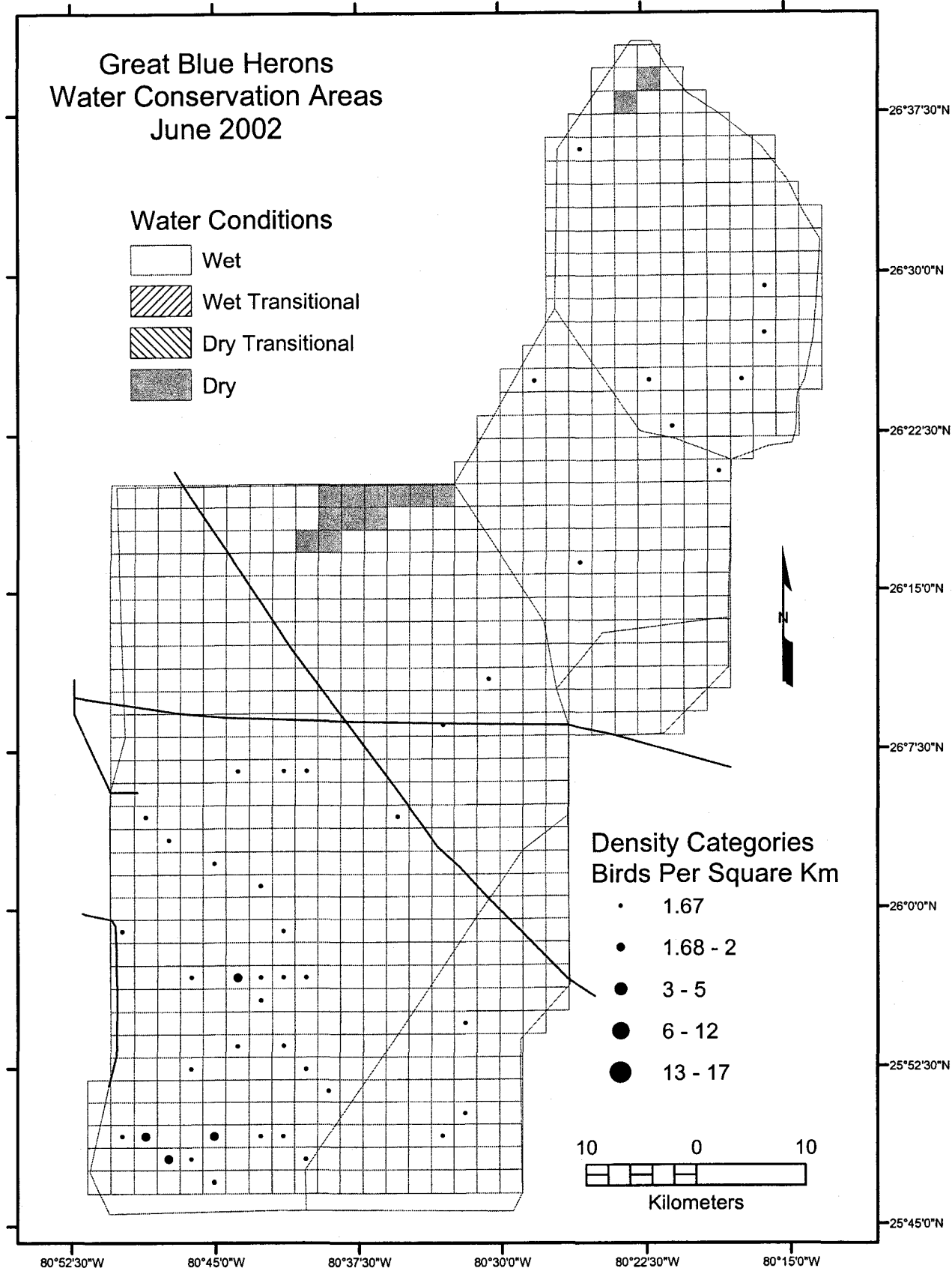
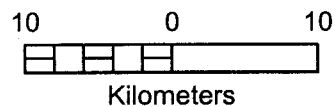
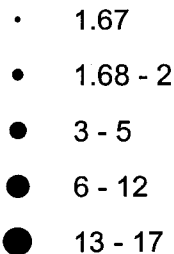


Great Blue Herons Water Conservation Areas June 2002

Water Conditions



Density Categories Birds Per Square Km

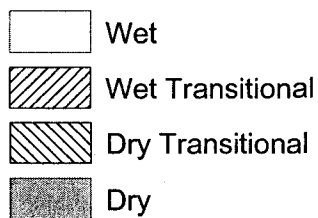


APPENDIX L: Monthly density maps of Great Egrets in the Water Conservation Areas, February to June 2002.

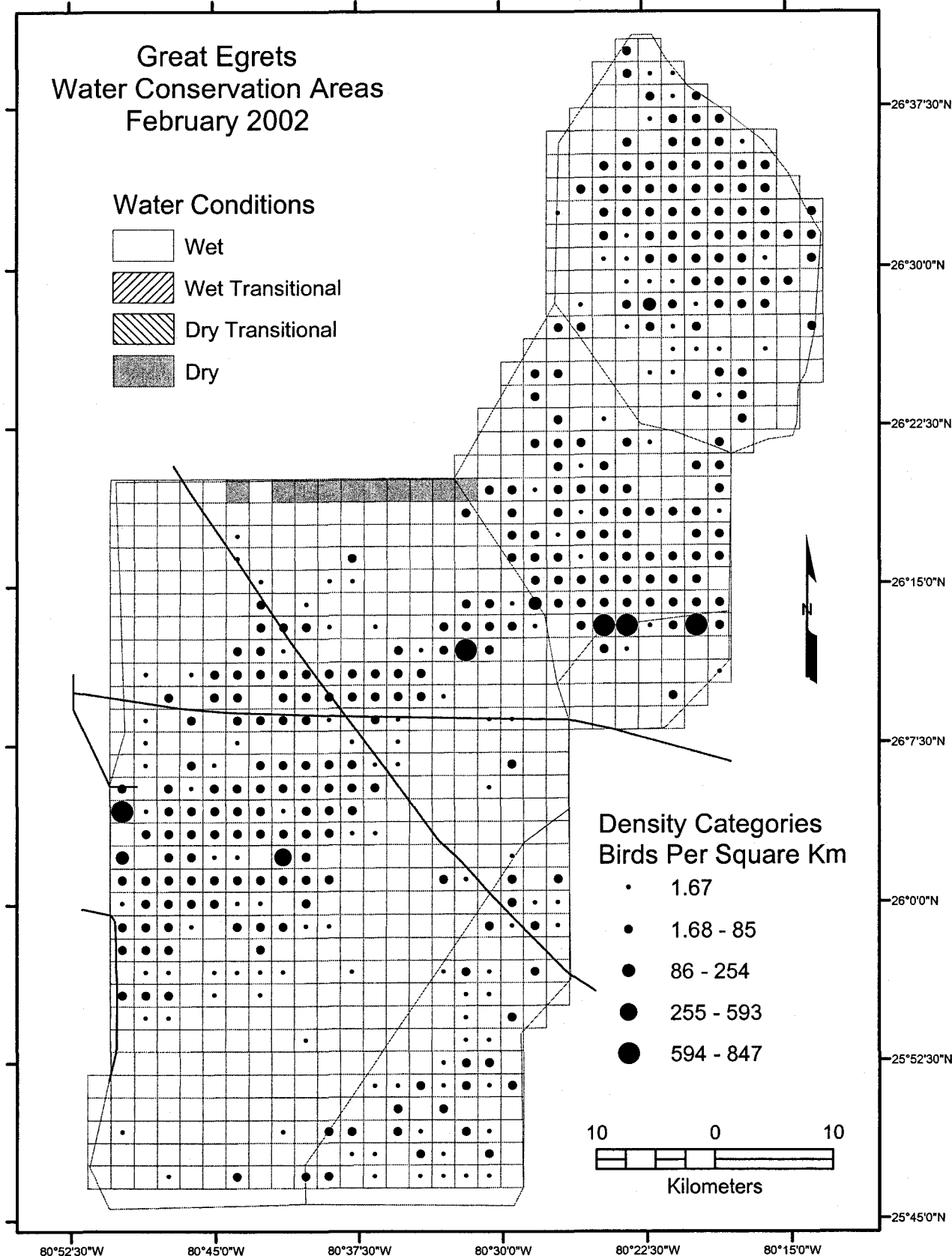
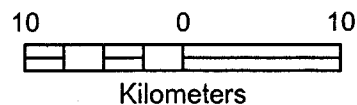
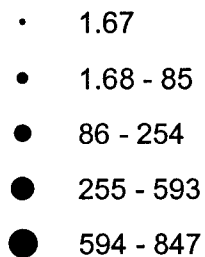
- L1. Density maps of Great Egrets in the Water Conservation Areas, February 2002.
- L2. Density maps of Great Egrets in the Water Conservation Areas, March 2002.
- L3. Density maps of Great Egrets in the Water Conservation Areas, April 2002.
- L4. Density maps of Great Egrets in the Water Conservation Areas, May 2002.
- L5. Density maps of Great Egrets in the Water Conservation Areas, June 2002.

Great Egrets Water Conservation Areas February 2002

Water Conditions



Density Categories Birds Per Square Km

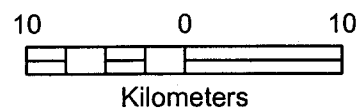
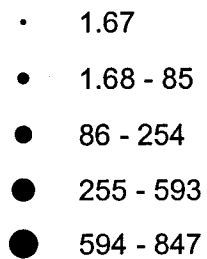


Great Egrets Water Conservation Areas March 2002

Water Conditions



Density Categories Birds Per Square Km



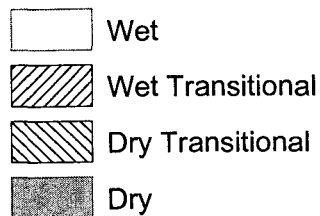
80°52'30"W 80°45'0"W 80°37'30"W 80°30'0"W 80°22'30"W 80°15'0"W

26°37'30"N
26°30'0"N
26°22'30"N
26°15'0"N
26°7'30"N
26°0'0"N
25°52'30"N
25°45'0"N

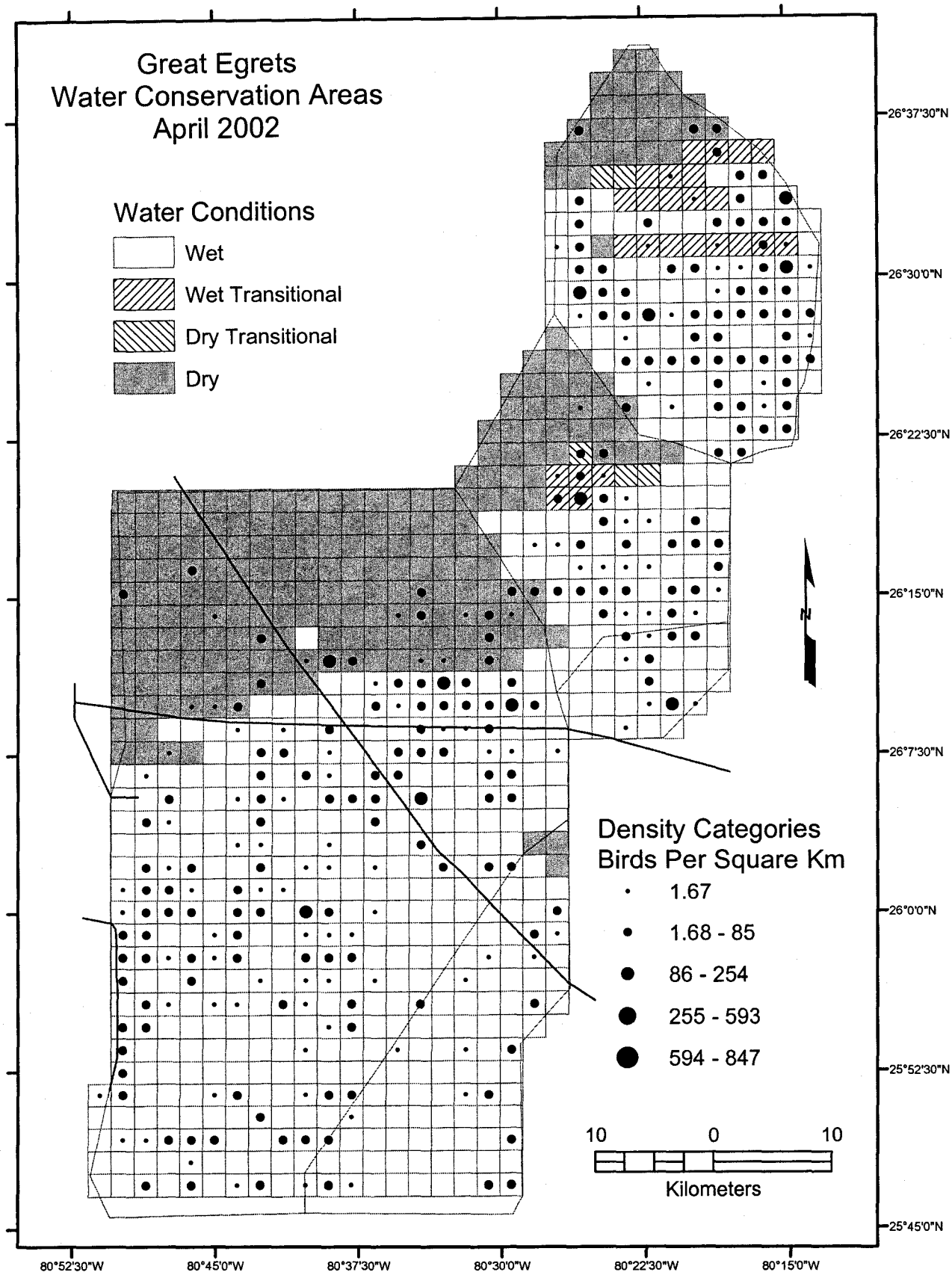
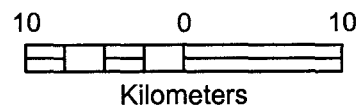
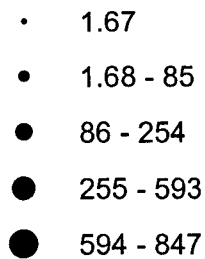


Great Egrets Water Conservation Areas April 2002

Water Conditions

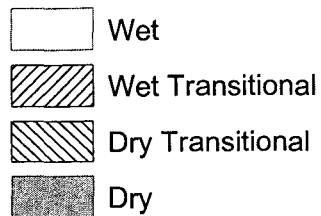


Density Categories Birds Per Square Km

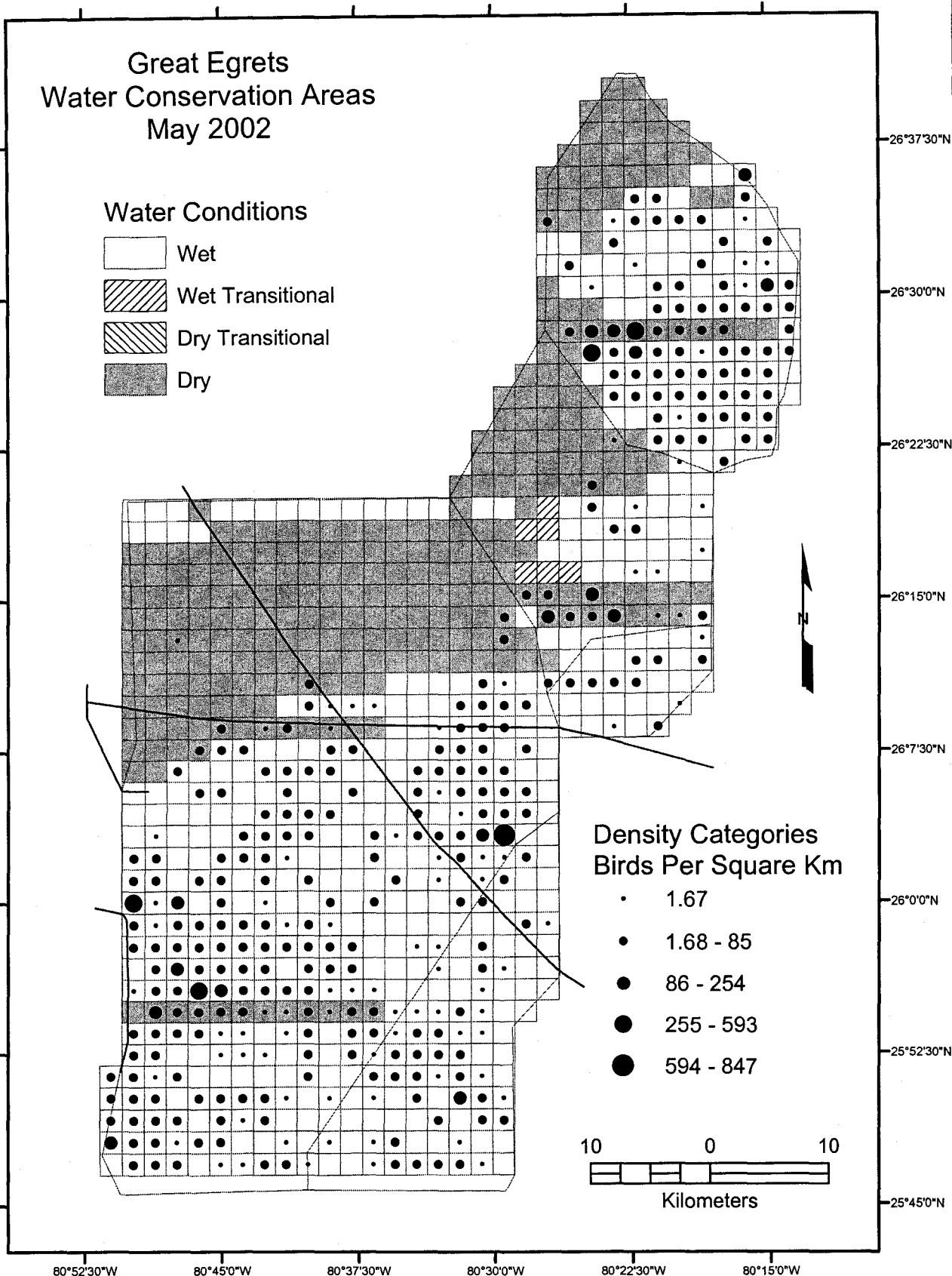
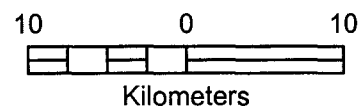
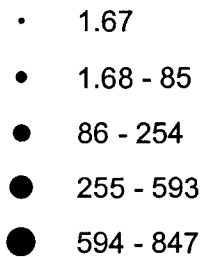


Great Egrets Water Conservation Areas May 2002

Water Conditions

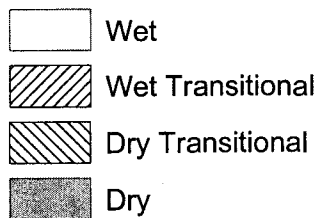


Density Categories Birds Per Square Km

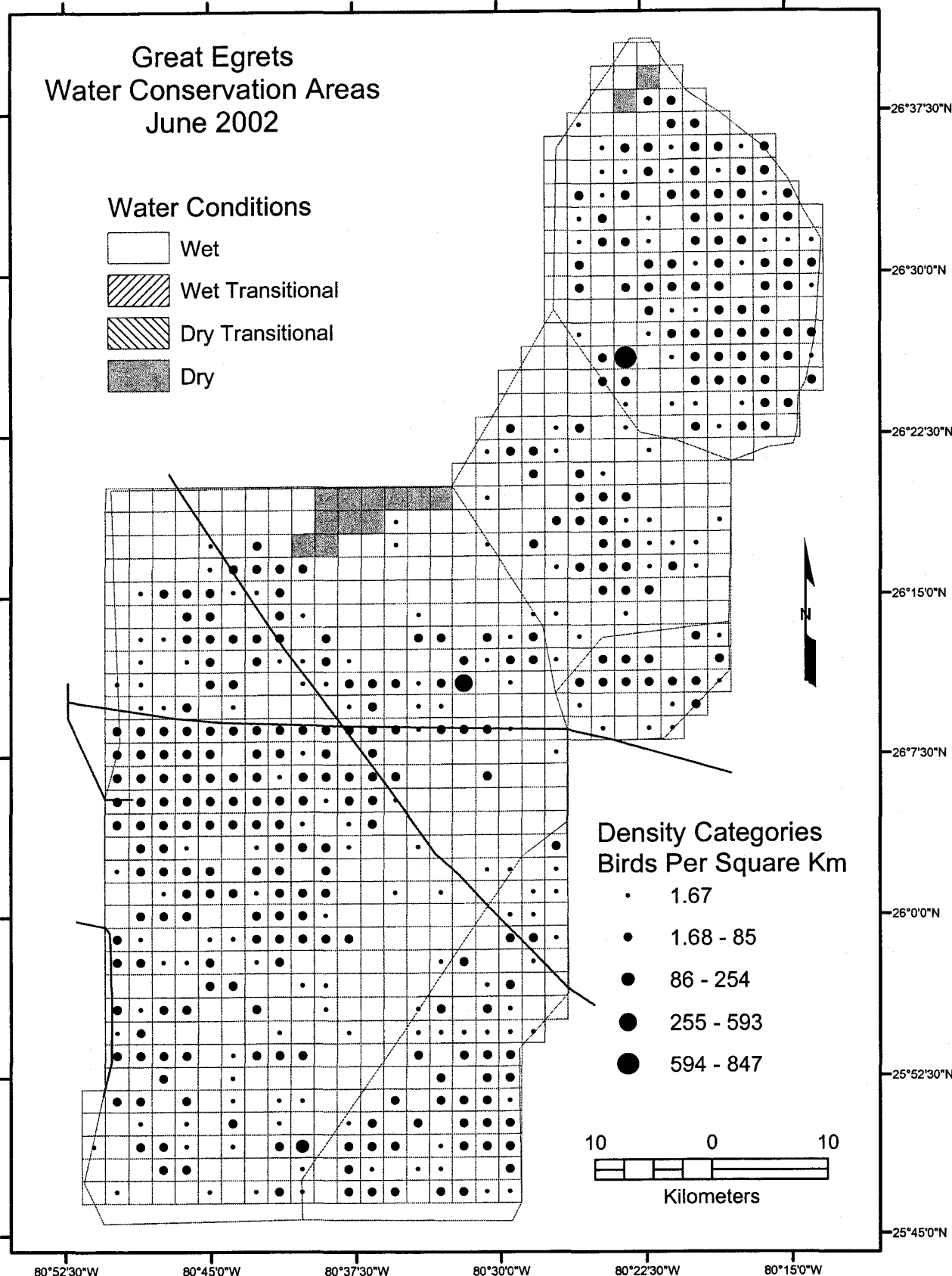
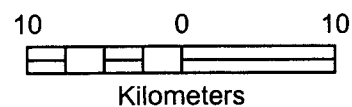
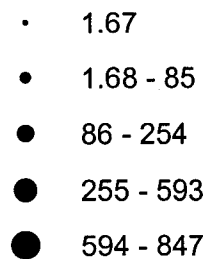


Great Egrets Water Conservation Areas June 2002

Water Conditions



Density Categories Birds Per Square Km



APPENDIX M: Monthly density maps of small dark herons in the Water Conservation Areas, February to June 2002.

M1. Density maps of small dark herons in the Water Conservation Areas, February 2002.

M2. Density maps of small dark herons in the Water Conservation Areas, March 2002.

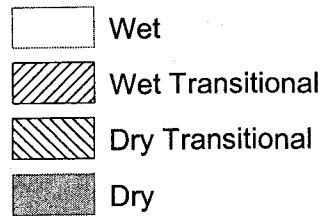
M3. Density maps of small dark herons in the Water Conservation Areas, April 2002.

M4. Density maps of small dark herons in the Water Conservation Areas, May 2002.

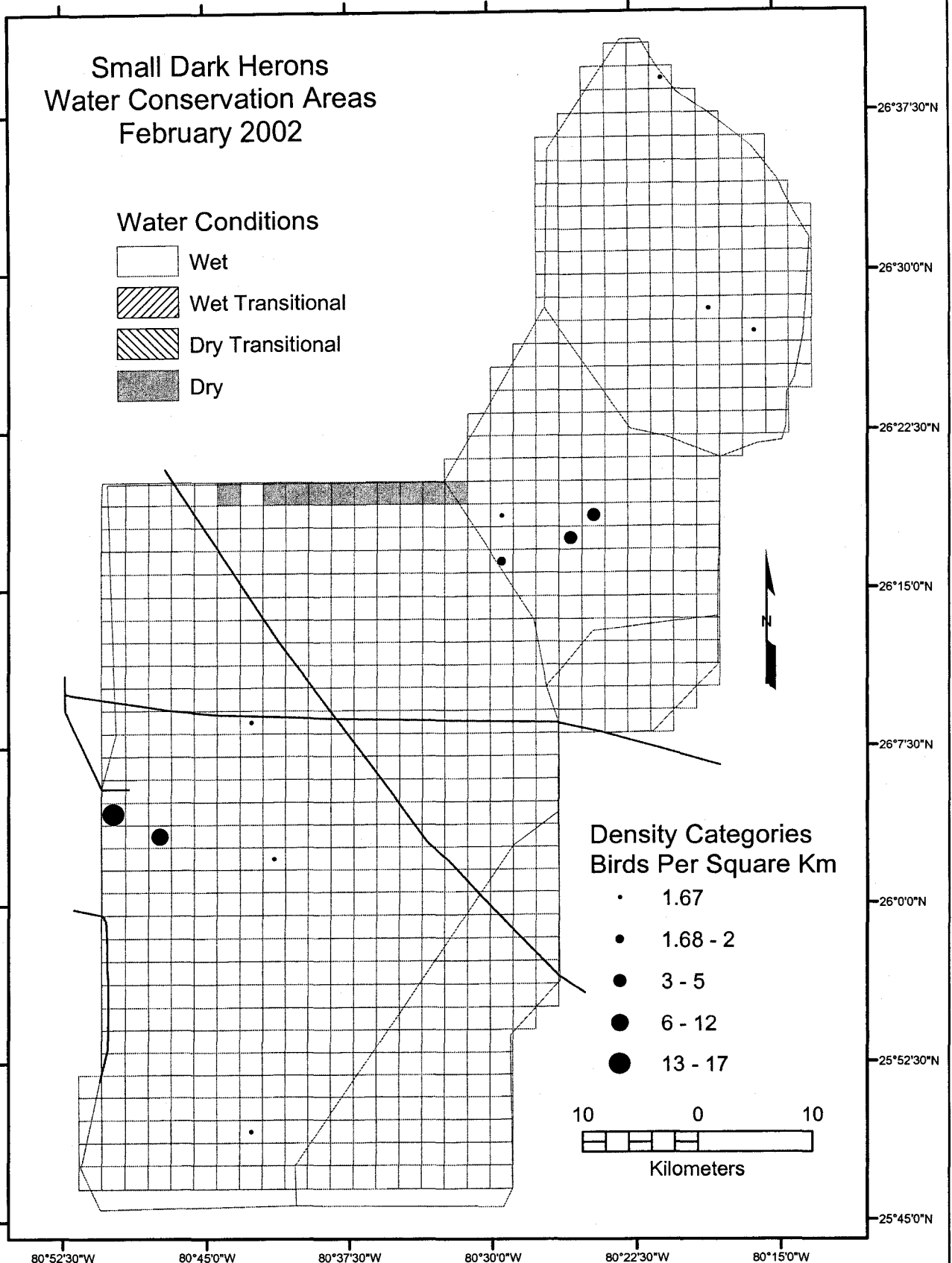
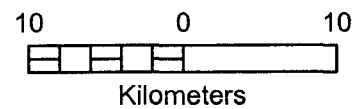
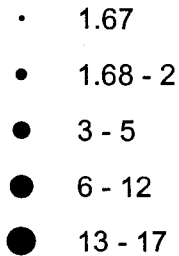
M5. Density maps of small dark herons in the Water Conservation Areas, June 2002.

Small Dark Herons Water Conservation Areas February 2002

Water Conditions



Density Categories Birds Per Square Km

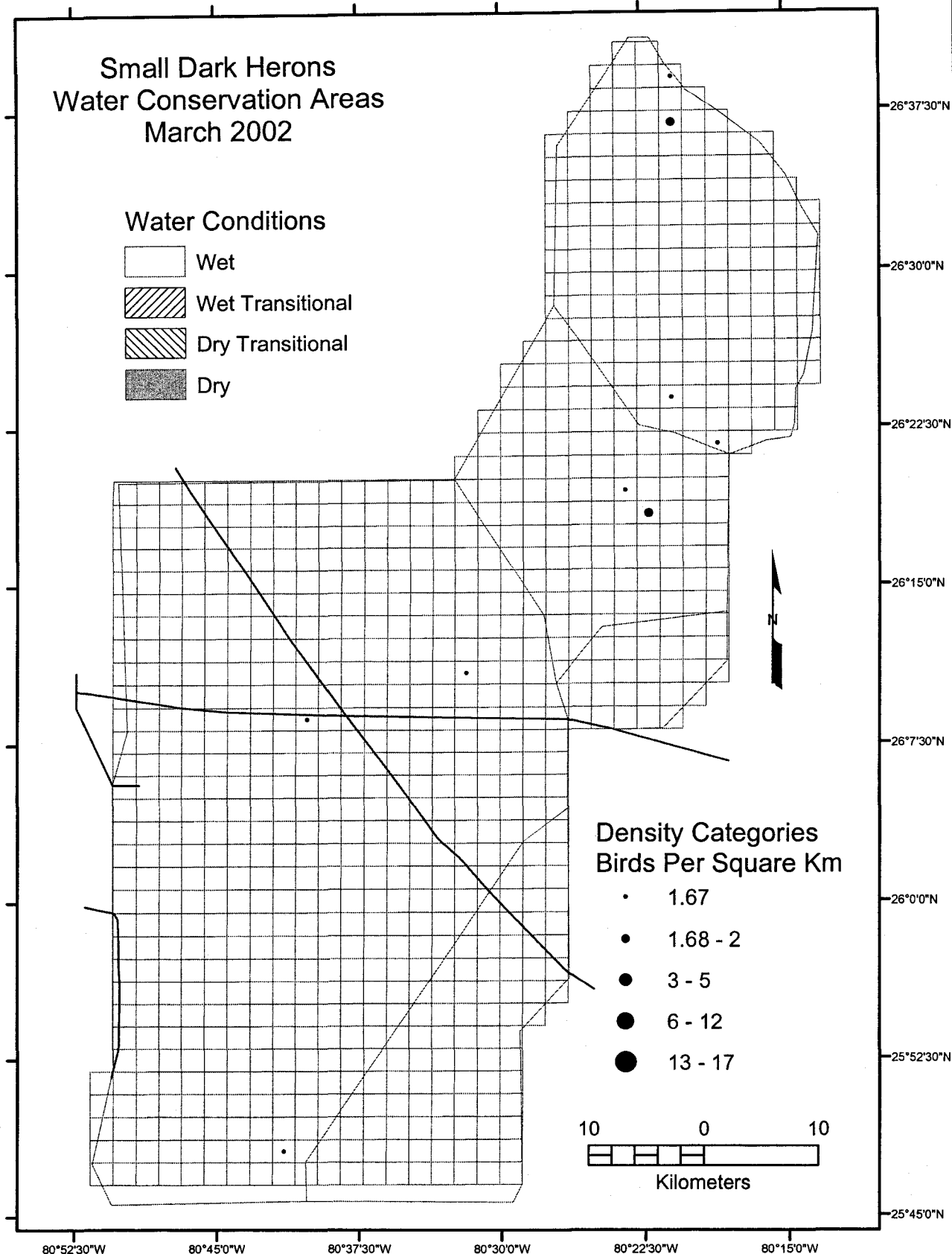
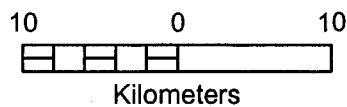
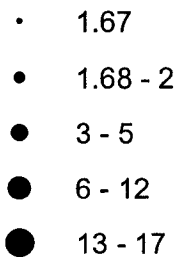


Small Dark Herons Water Conservation Areas March 2002

Water Conditions

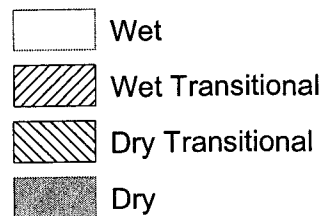


Density Categories Birds Per Square Km

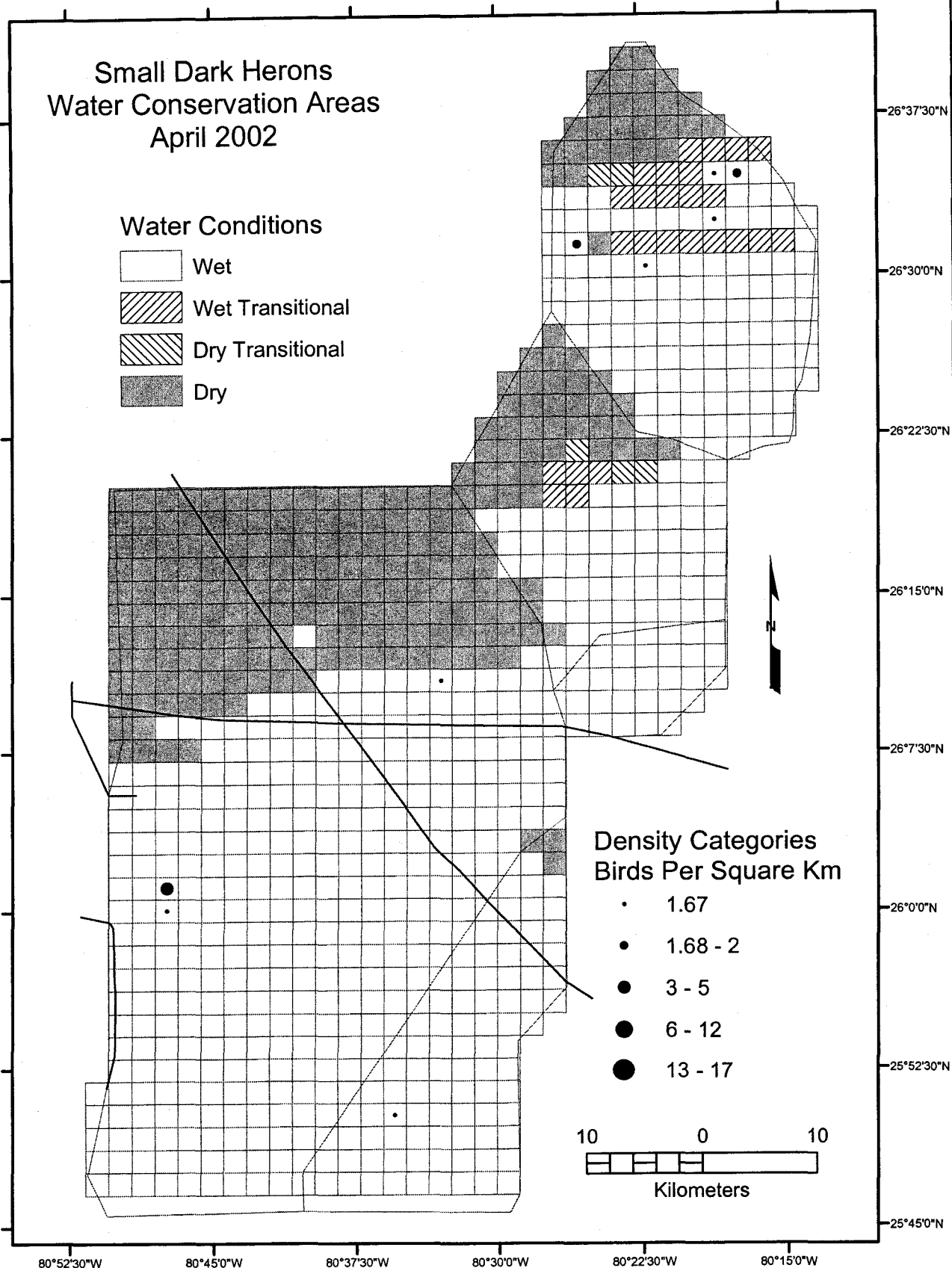
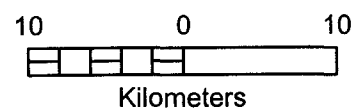
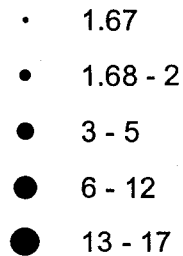


Small Dark Herons Water Conservation Areas April 2002

Water Conditions

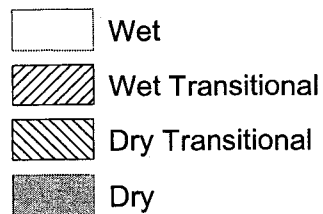


Density Categories Birds Per Square Km

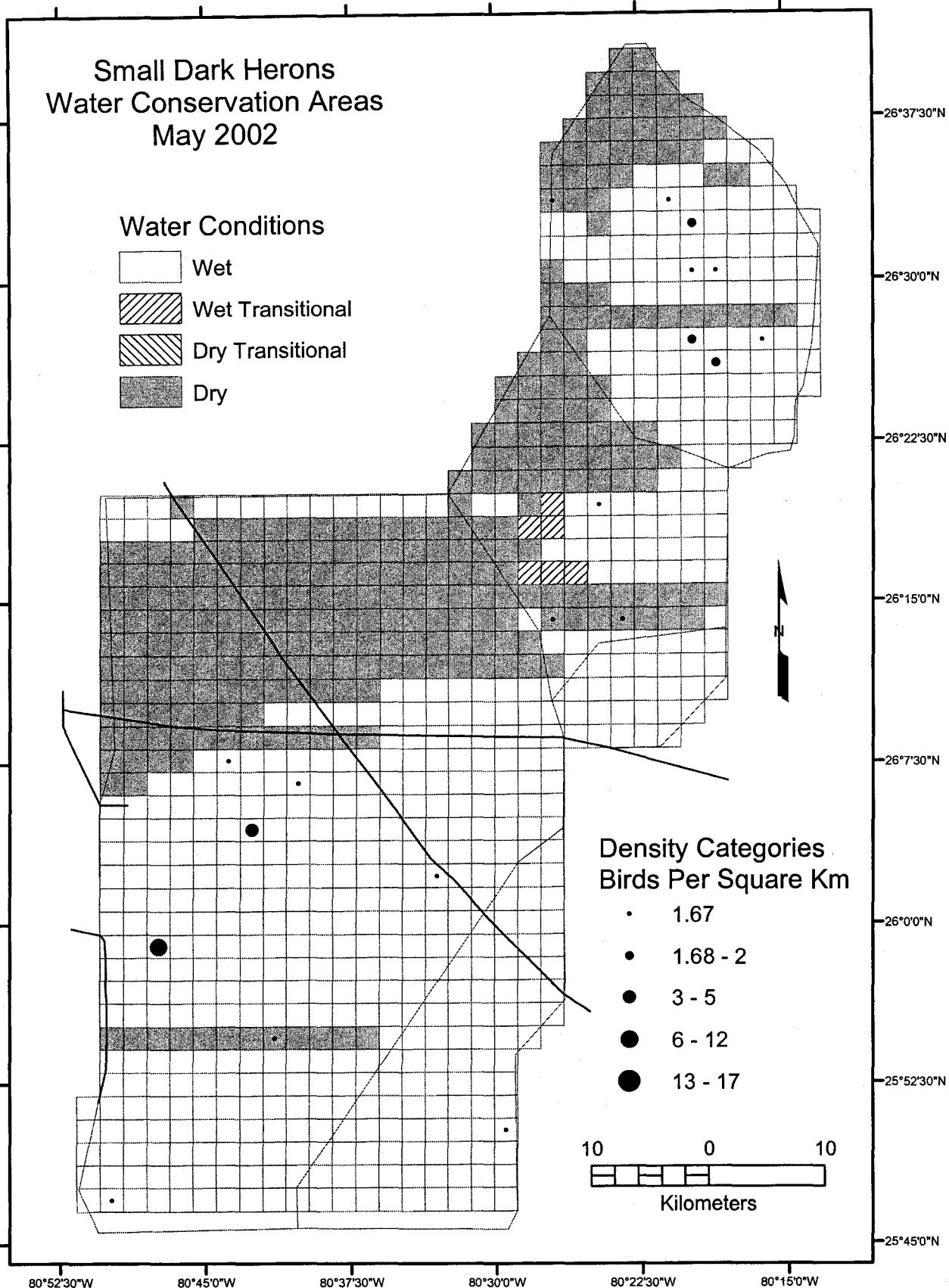
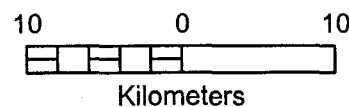
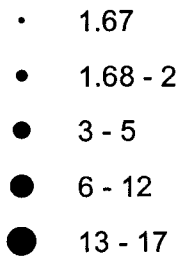


Small Dark Herons Water Conservation Areas May 2002

Water Conditions

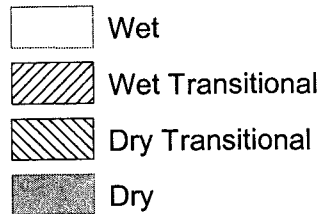


Density Categories Birds Per Square Km

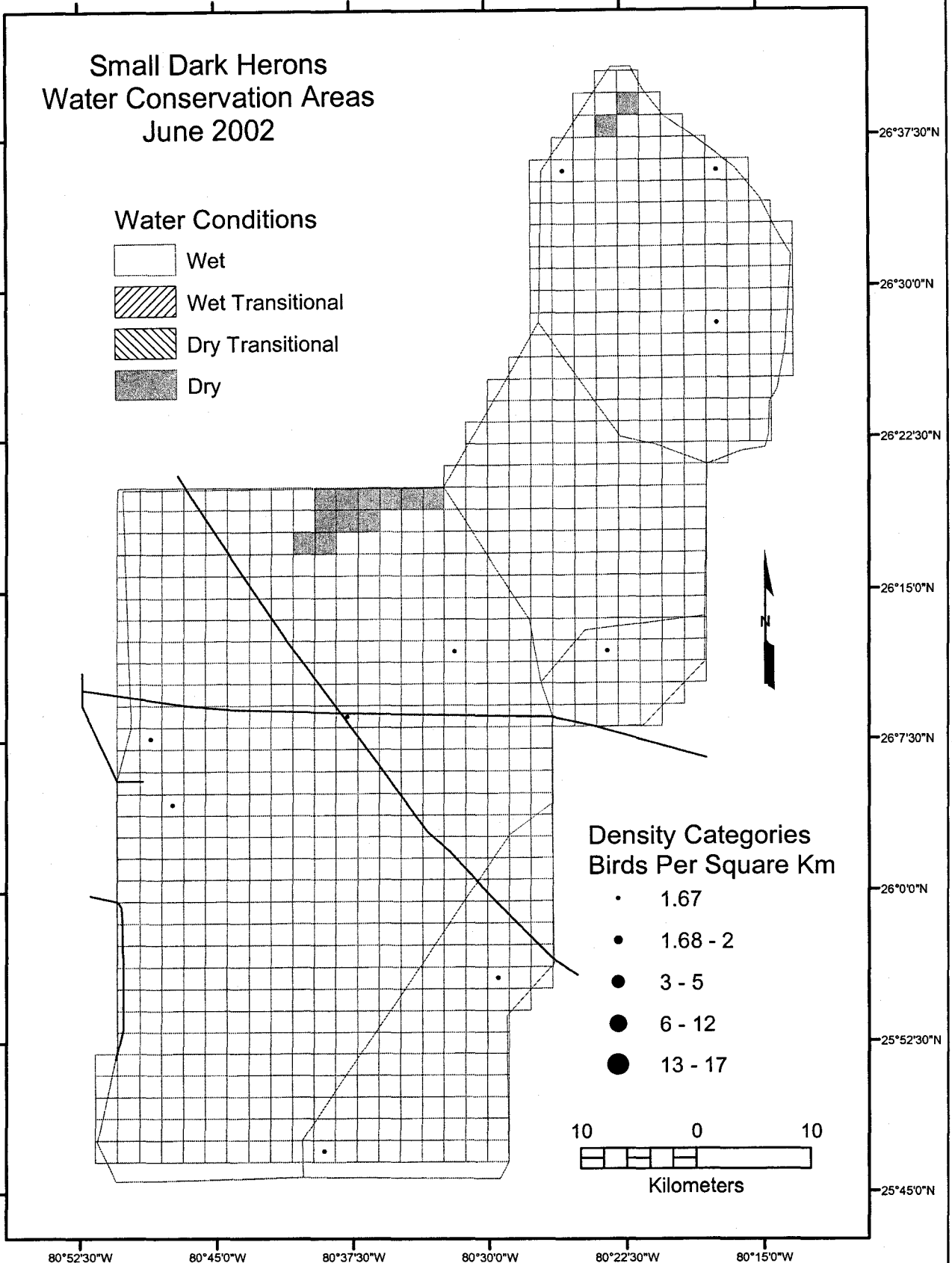
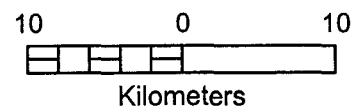
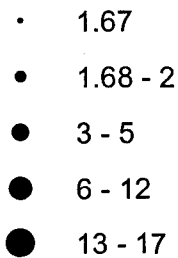


Small Dark Herons Water Conservation Areas June 2002

Water Conditions



Density Categories Birds Per Square Km



APPENDIX N: Monthly density maps of small white herons in the Water Conservation Areas, February to June 2000.

N1. Density maps of small white herons in the Water Conservation Areas, February 2002.

N2. Density maps of small white herons in the Water Conservation Areas, March 2002.

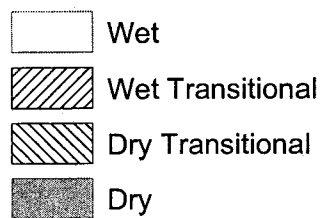
N3. Density maps of small white herons in the Water Conservation Areas, April 2002.

N4. Density maps of small white herons in the Water Conservation Areas, May 2002.

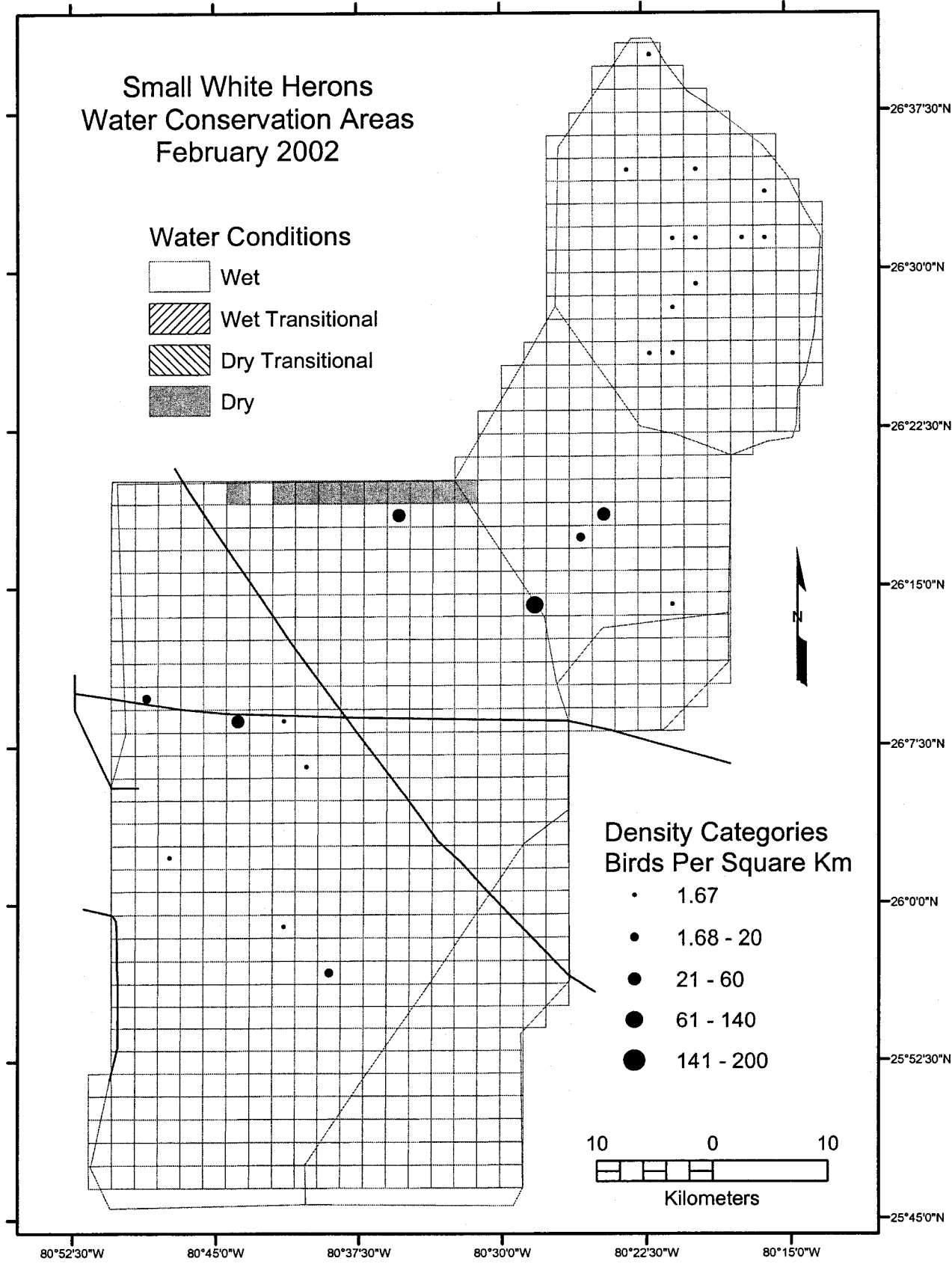
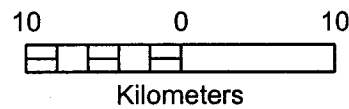
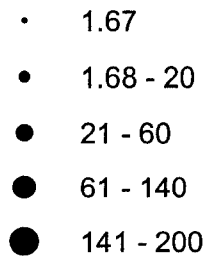
N5. Density maps of small white herons in the Water Conservation Areas, June 2002.

Small White Herons Water Conservation Areas February 2002

Water Conditions

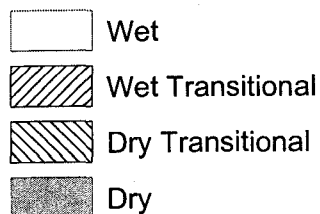


Density Categories Birds Per Square Km

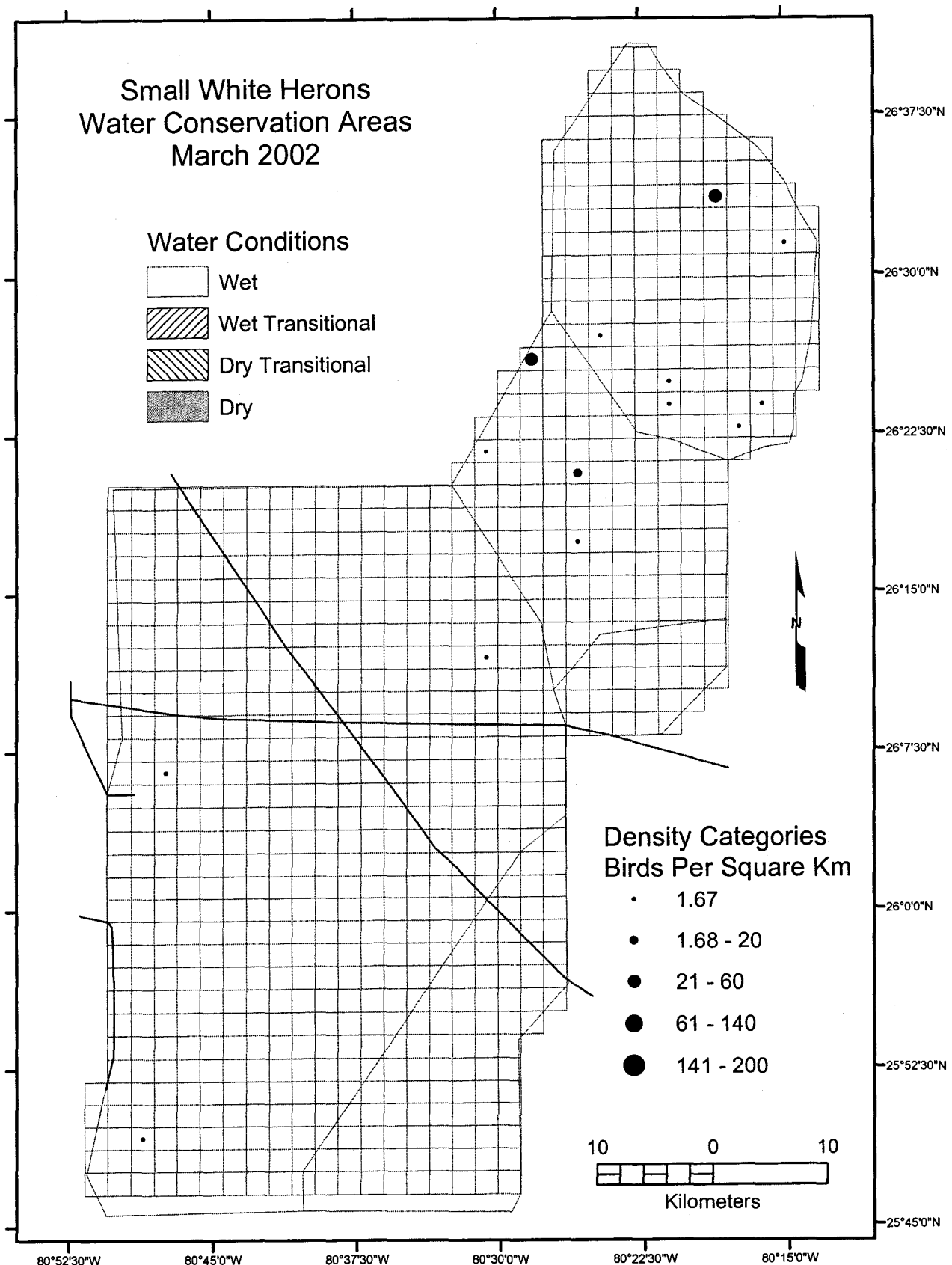
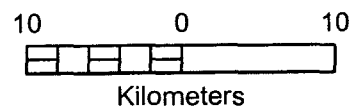
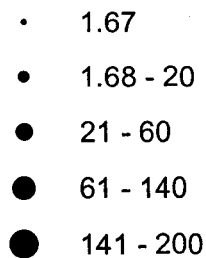


Small White Herons Water Conservation Areas March 2002

Water Conditions

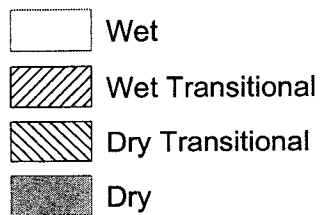


Density Categories Birds Per Square Km

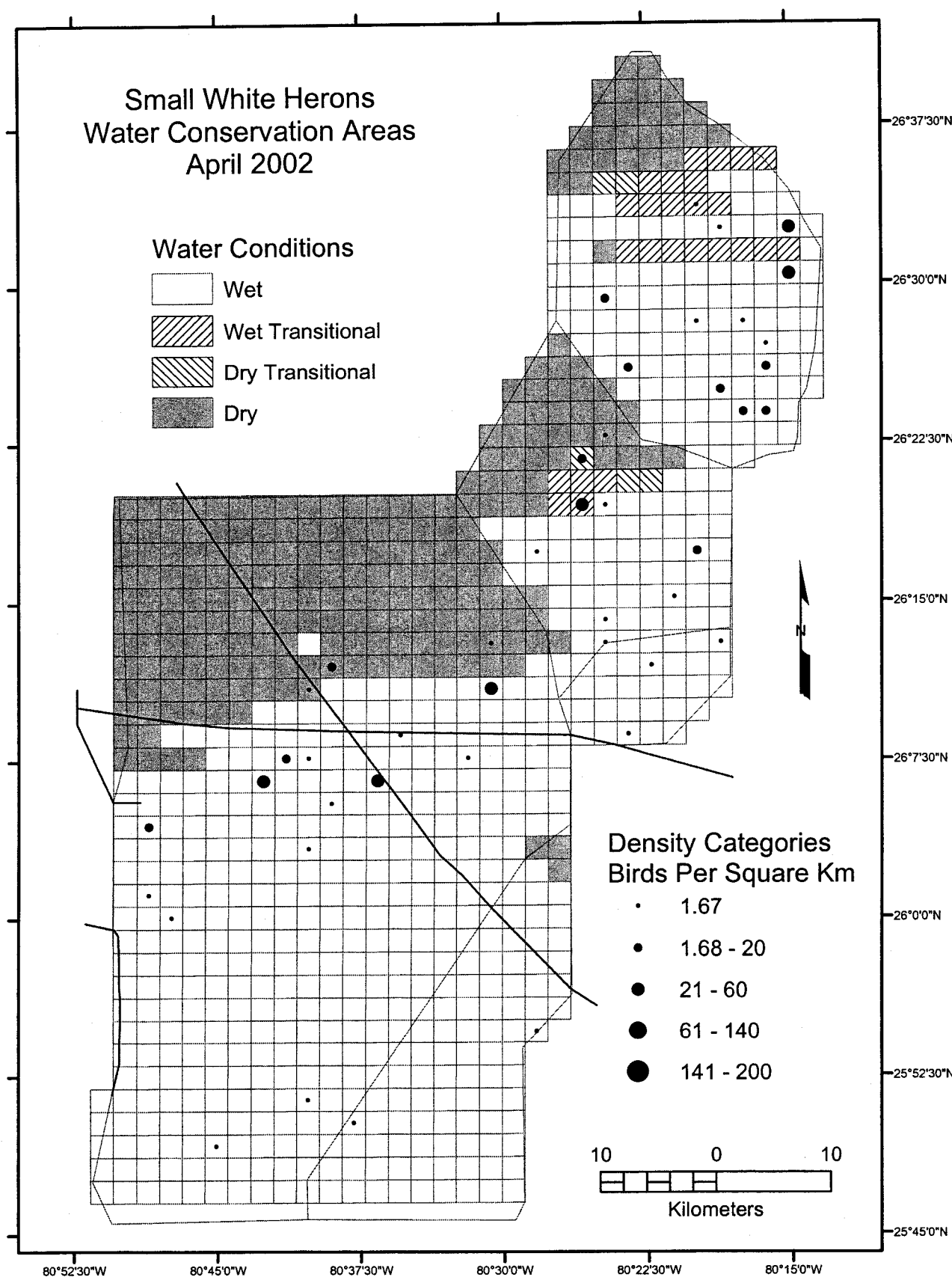
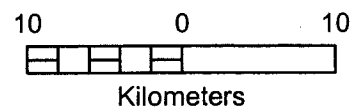
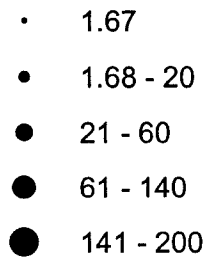


Small White Herons Water Conservation Areas April 2002

Water Conditions

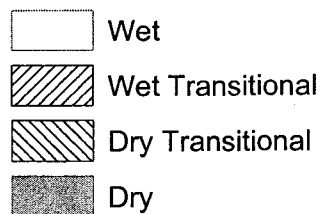


Density Categories Birds Per Square Km

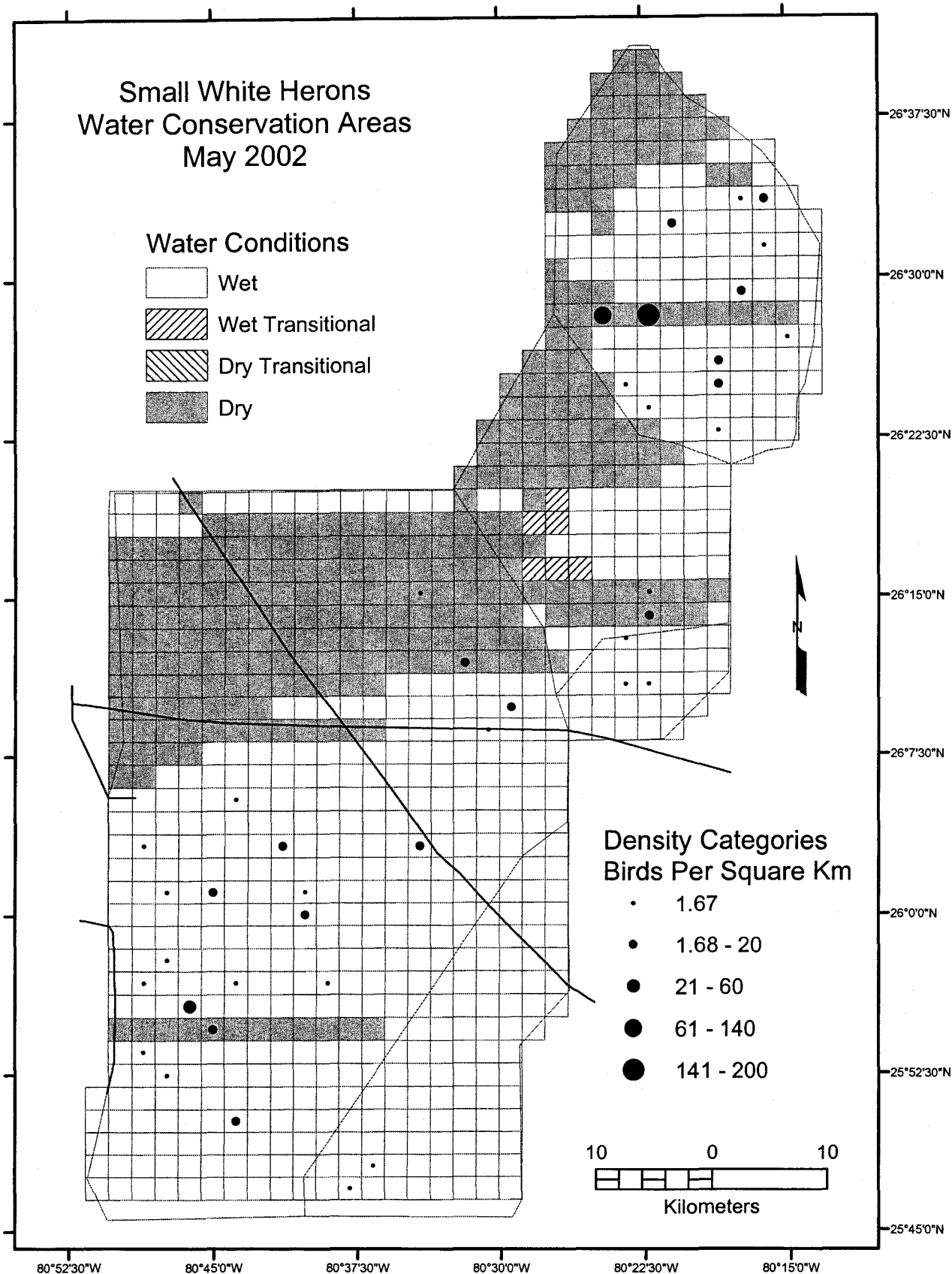
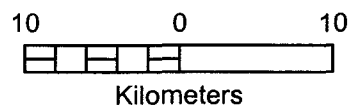
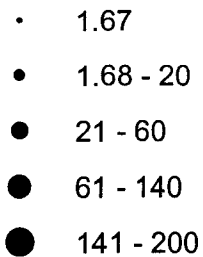


Small White Herons Water Conservation Areas May 2002

Water Conditions

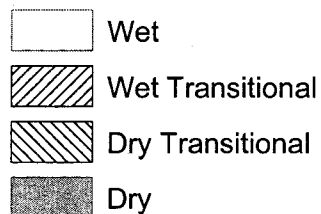


Density Categories Birds Per Square Km

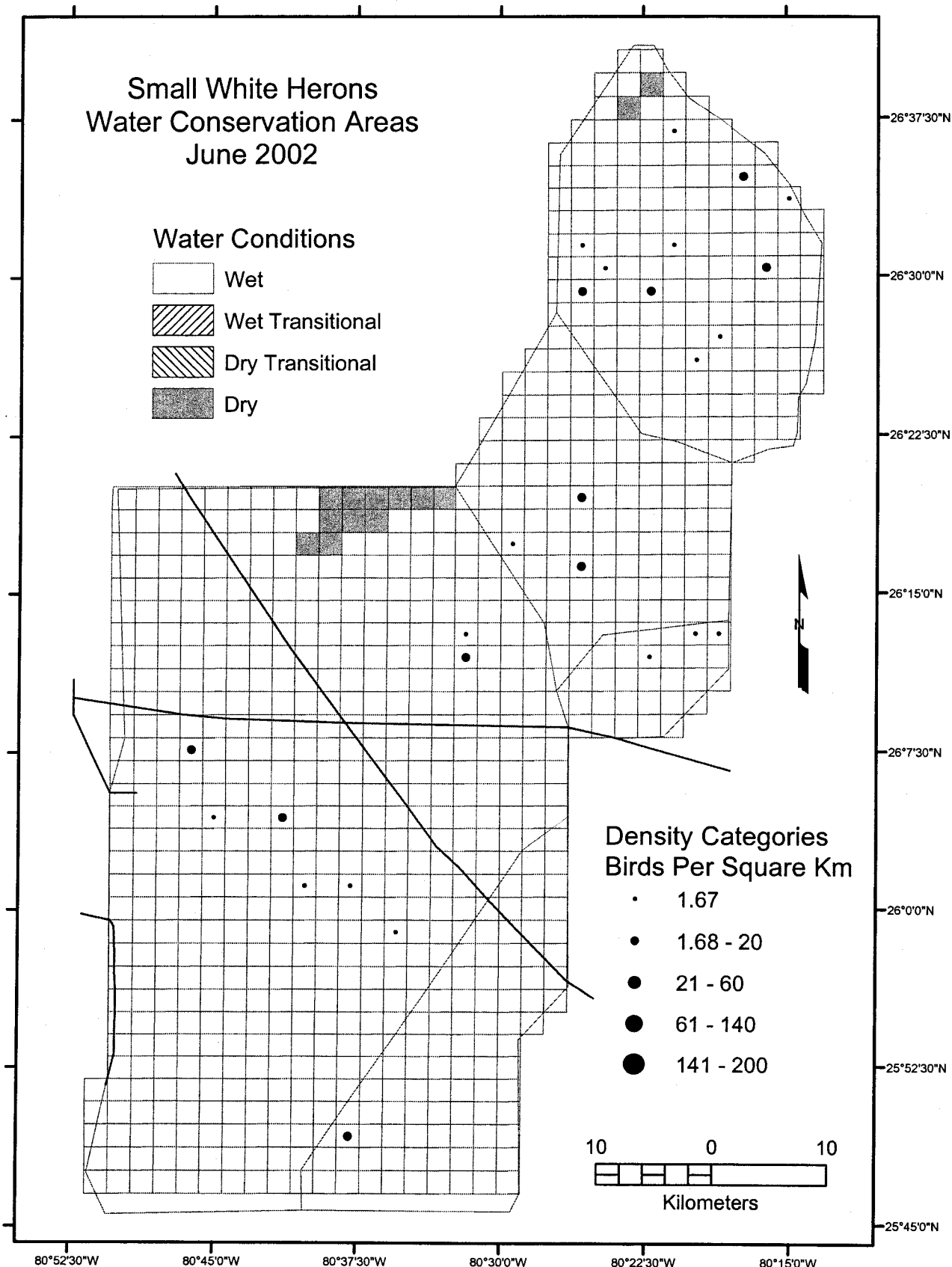
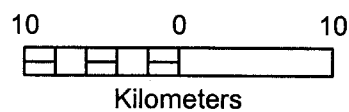
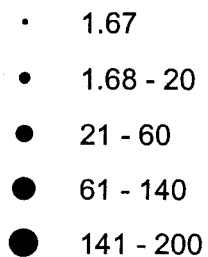


Small White Herons Water Conservation Areas June 2002

Water Conditions



Density Categories Birds Per Square Km

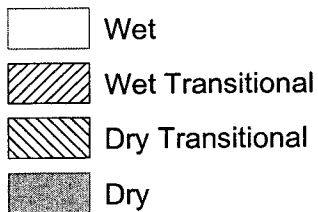


APPENDIX O: Monthly density maps of White Ibises in the Water Conservation Areas, February to June 2002.

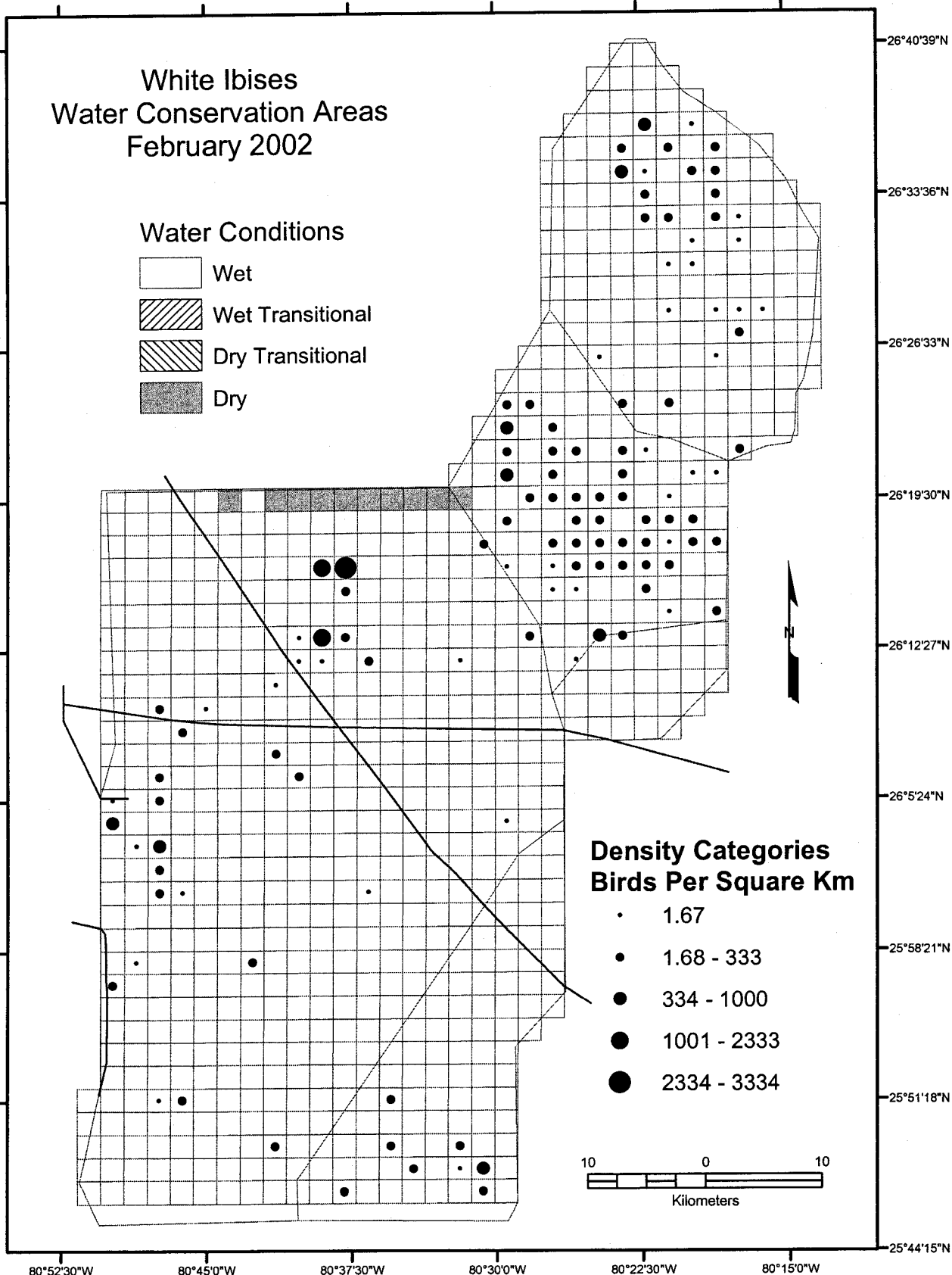
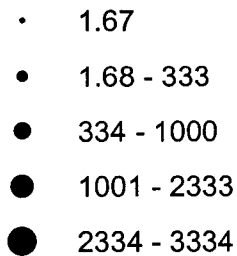
- O2. Density maps of White Ibises in the Water Conservation Areas, February 2002.
- O3. Density maps of White Ibises in the Water Conservation Areas, March 2002.
- O4. Density maps of White Ibises in the Water Conservation Areas, April 2002.
- O5. Density maps of White Ibises in the Water Conservation Areas, May 2002.
- O6. Density maps of White Ibises in the Water Conservation Areas, June 2002.

White Ibises Water Conservation Areas February 2002

Water Conditions

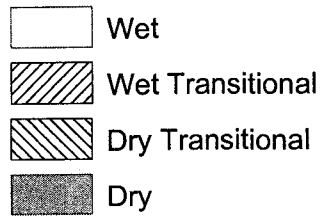


Density Categories Birds Per Square Km

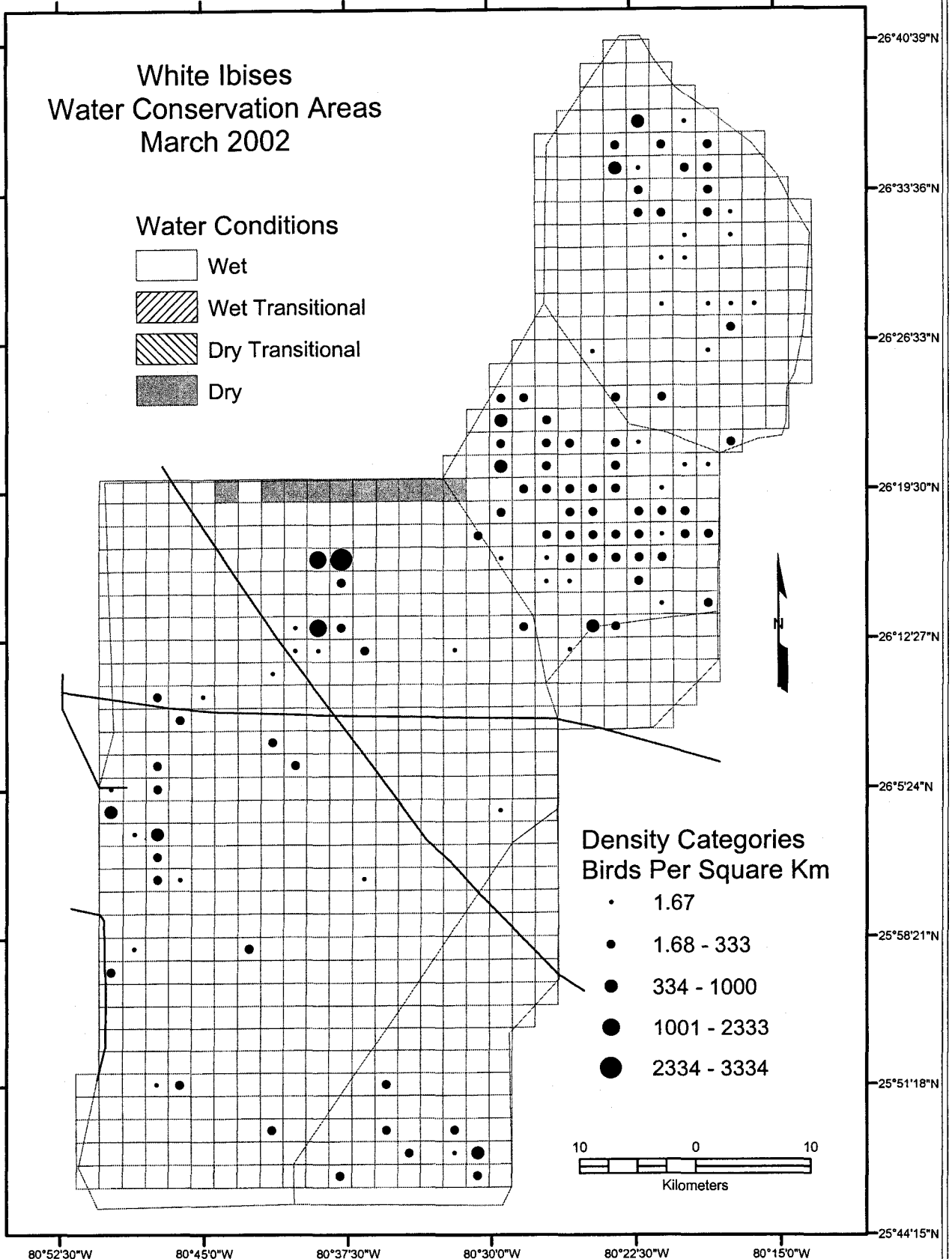
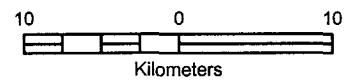
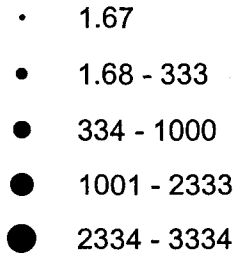


White Ibises Water Conservation Areas March 2002

Water Conditions

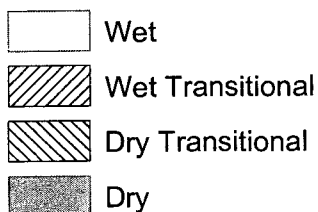


Density Categories Birds Per Square Km

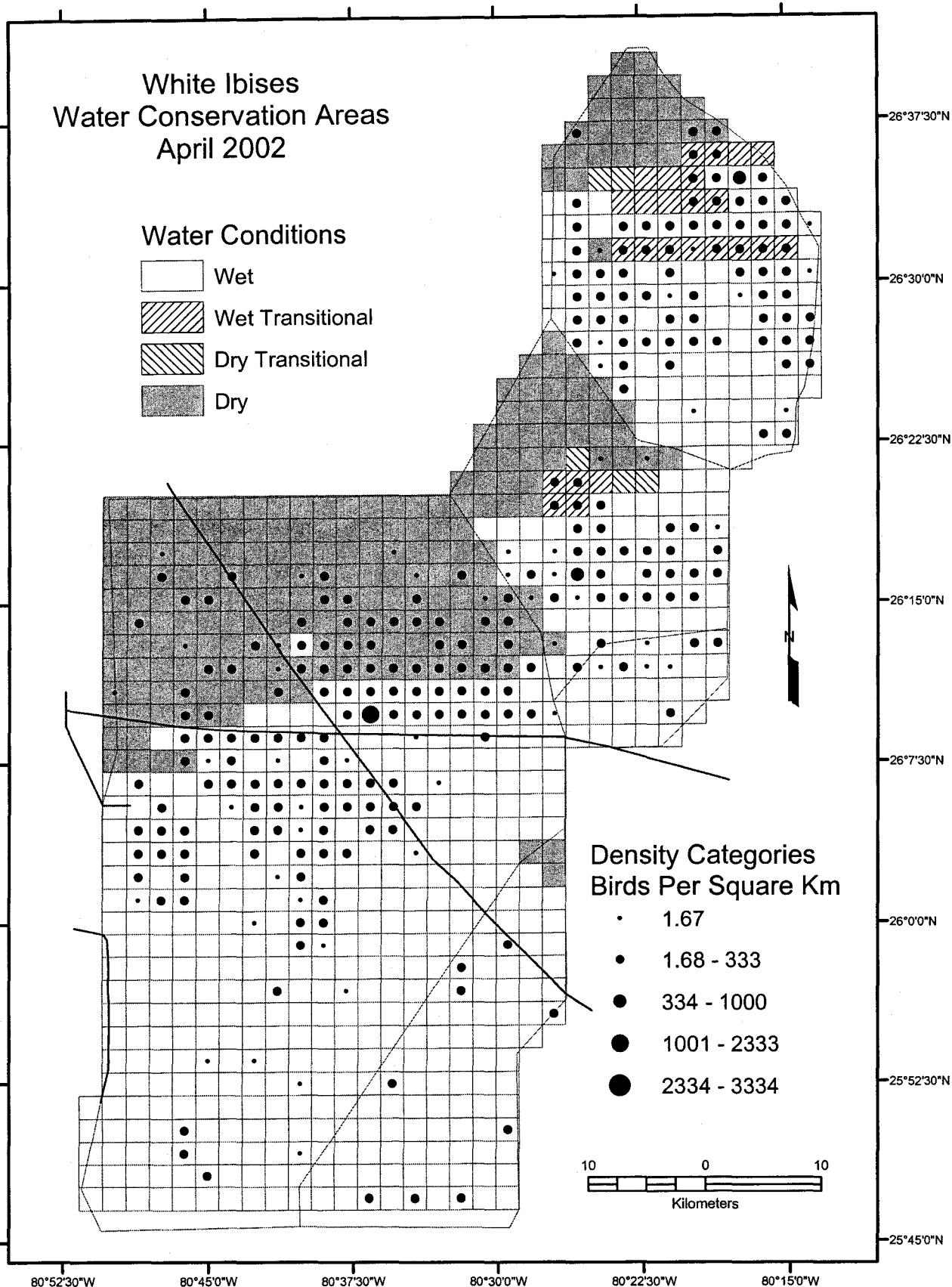
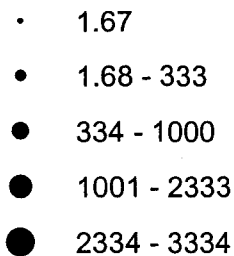


White Ibises Water Conservation Areas April 2002

Water Conditions

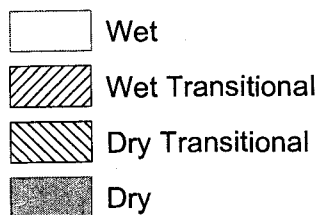


Density Categories Birds Per Square Km

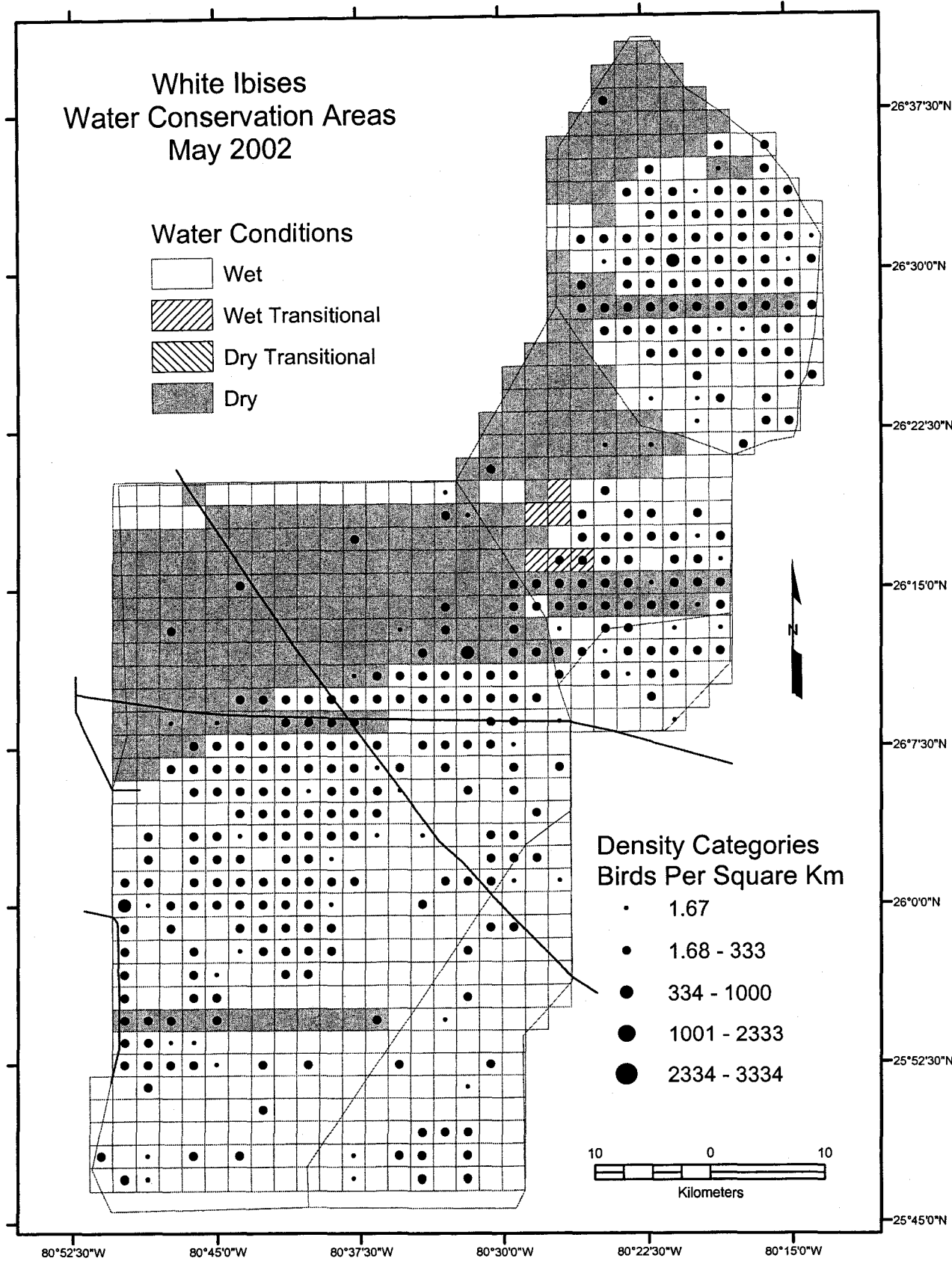
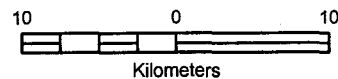
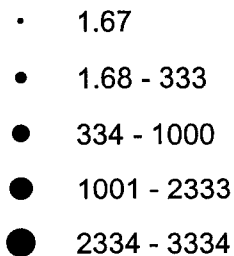


White Ibises Water Conservation Areas May 2002

Water Conditions

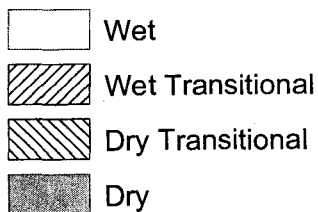


Density Categories Birds Per Square Km

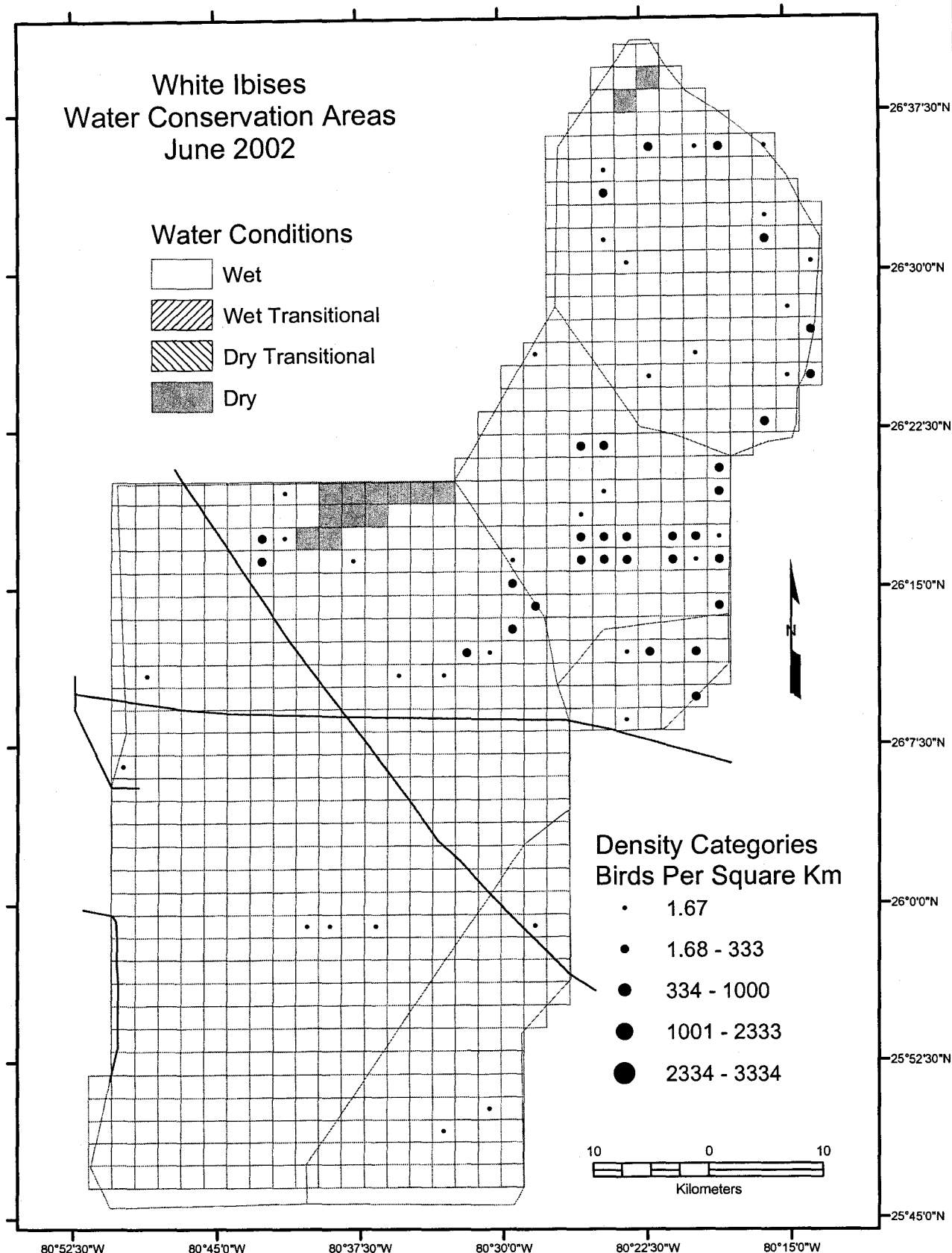
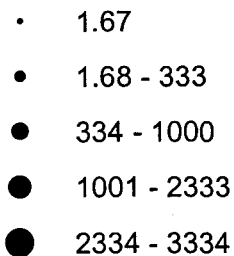


White Ibises Water Conservation Areas June 2002

Water Conditions



Density Categories Birds Per Square Km

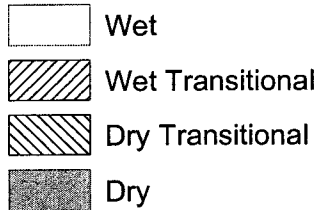


APPENDIX P: Monthly density maps of Glossy Ibises in the Water Conservation Areas, February to June 2002.

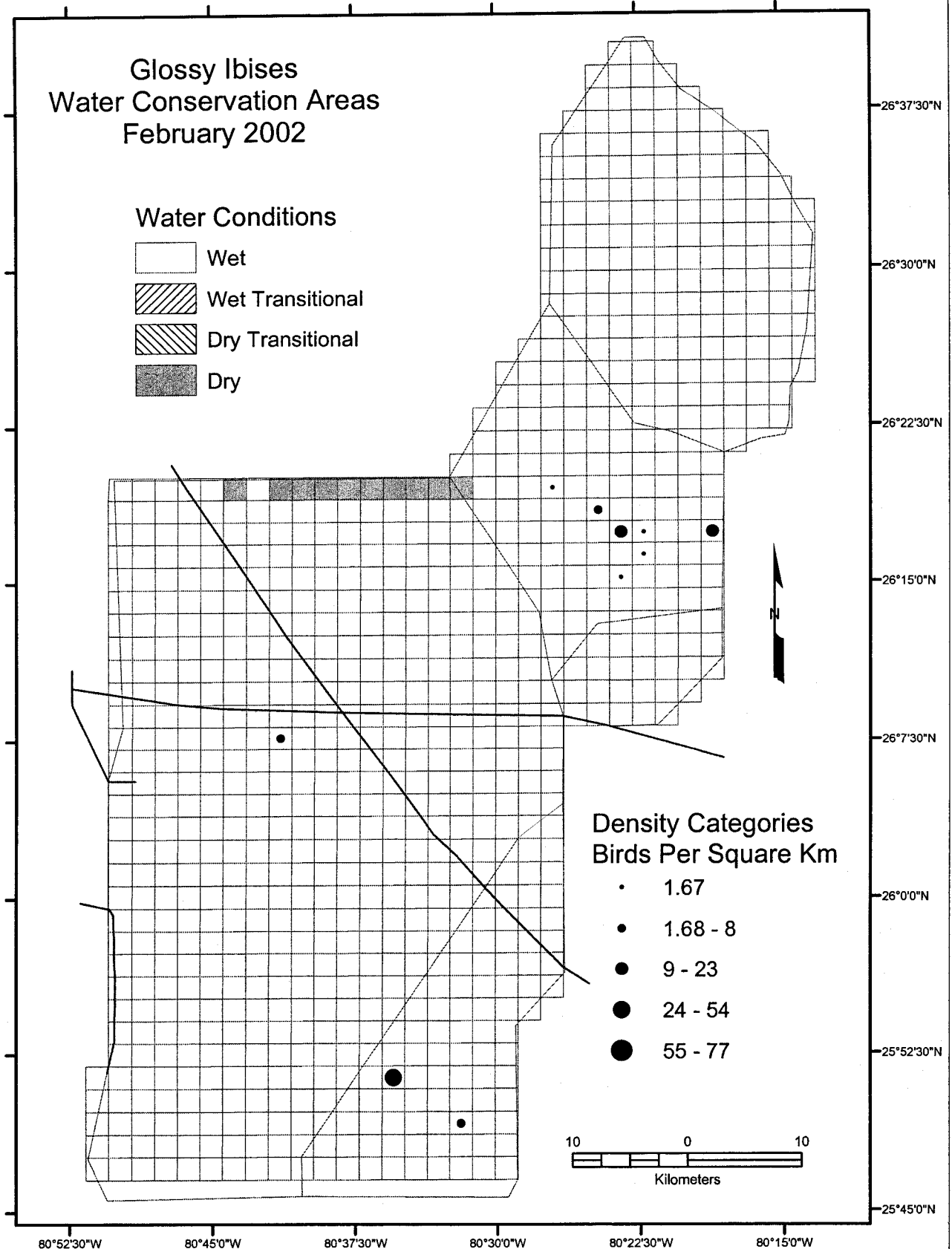
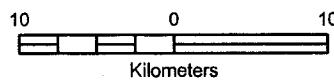
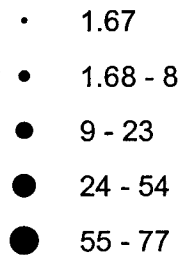
- P1. Density maps of Glossy Ibises in the Water Conservation Areas, February 2002.
- P2. Density maps of Glossy Ibises in the Water Conservation Areas, March 2002.
- P3. Density maps of Glossy Ibises in the Water Conservation Areas, April 2002.
- P4. Density maps of Glossy Ibises in the Water Conservation Areas, May 2002.
- P5. Density maps of Glossy Ibises in the Water Conservation Areas, June 2002.

Glossy Ibises Water Conservation Areas February 2002

Water Conditions

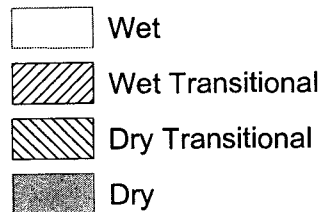


Density Categories Birds Per Square Km

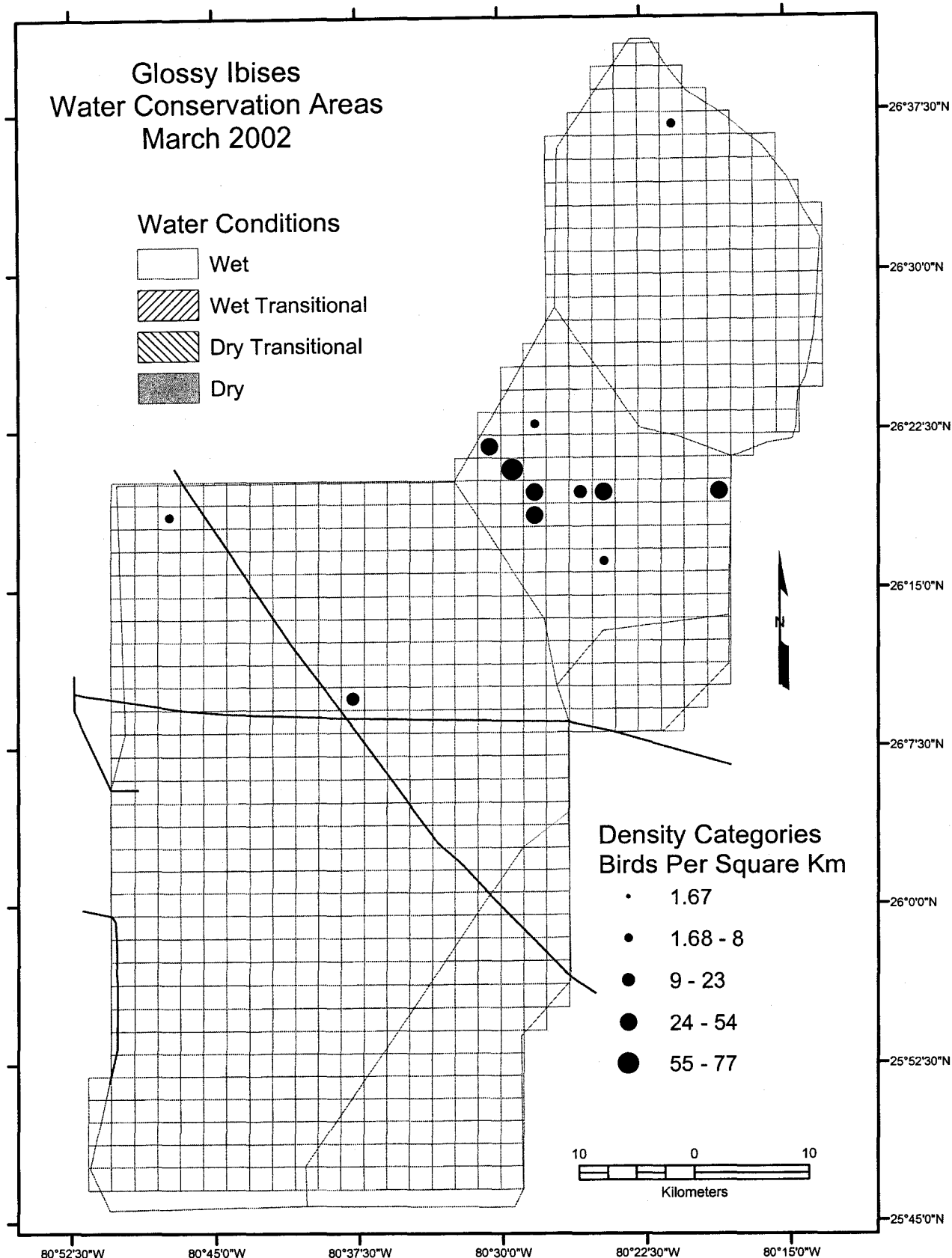
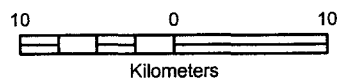
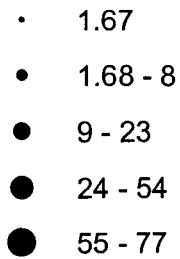


Glossy Ibises Water Conservation Areas March 2002

Water Conditions

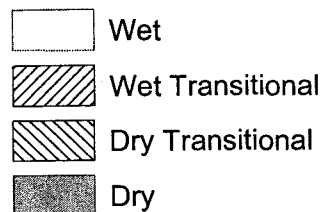


Density Categories Birds Per Square Km

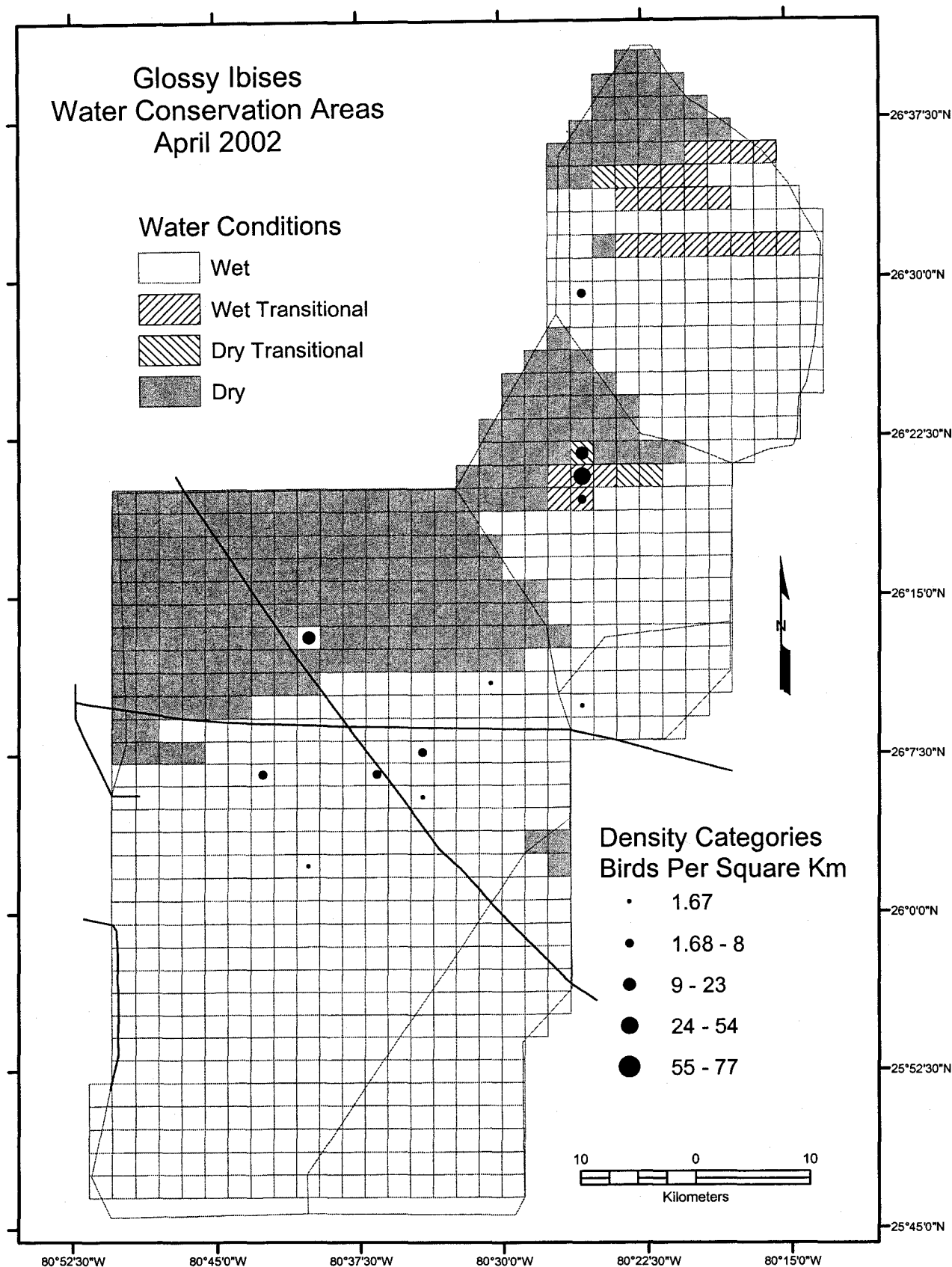
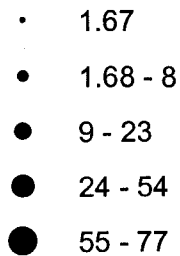


Glossy Ibises Water Conservation Areas April 2002

Water Conditions

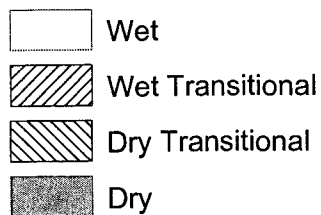


Density Categories Birds Per Square Km

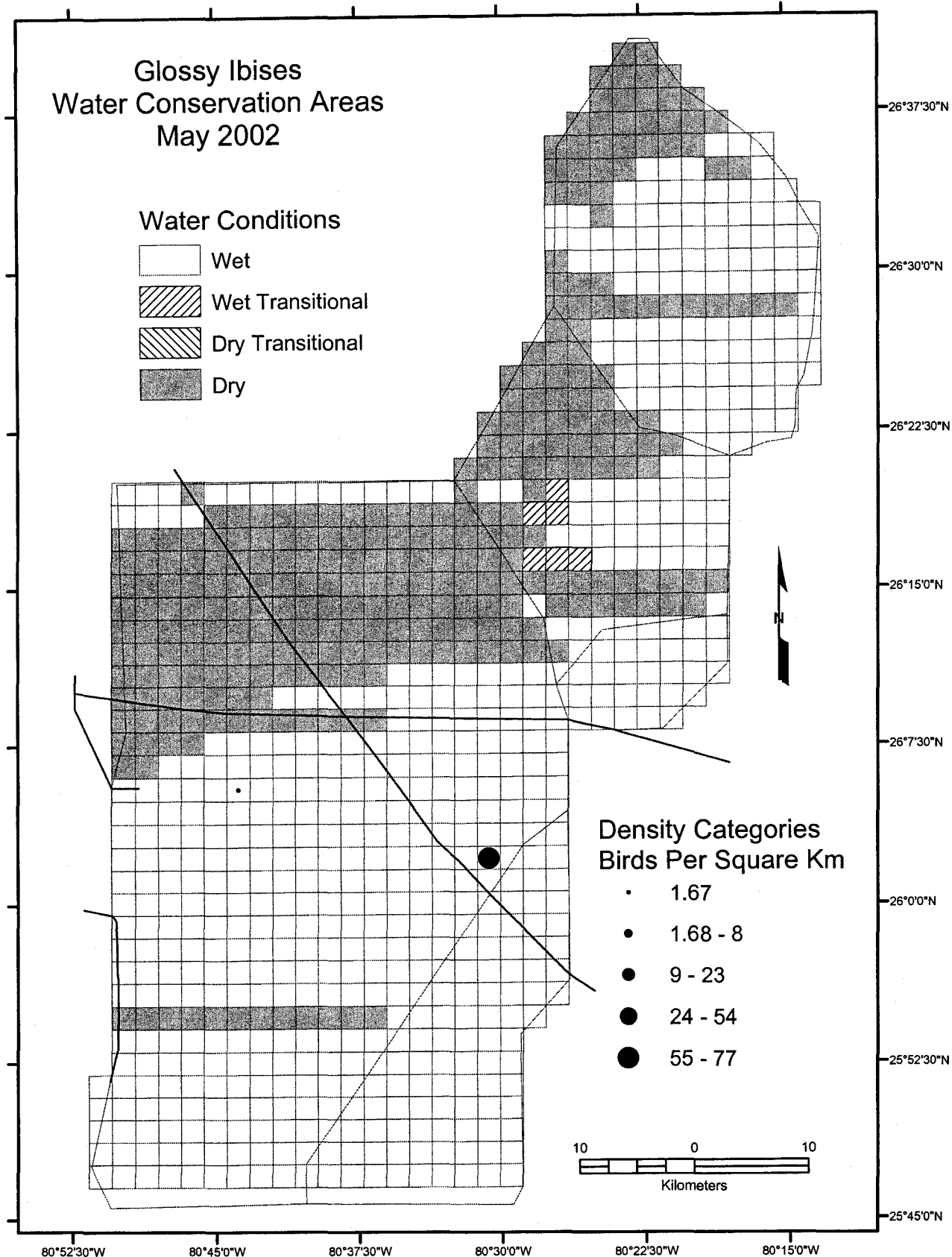
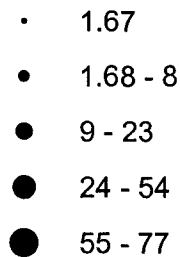


Glossy Ibises Water Conservation Areas May 2002

Water Conditions

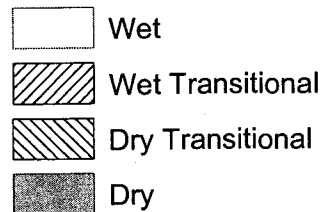


Density Categories Birds Per Square Km

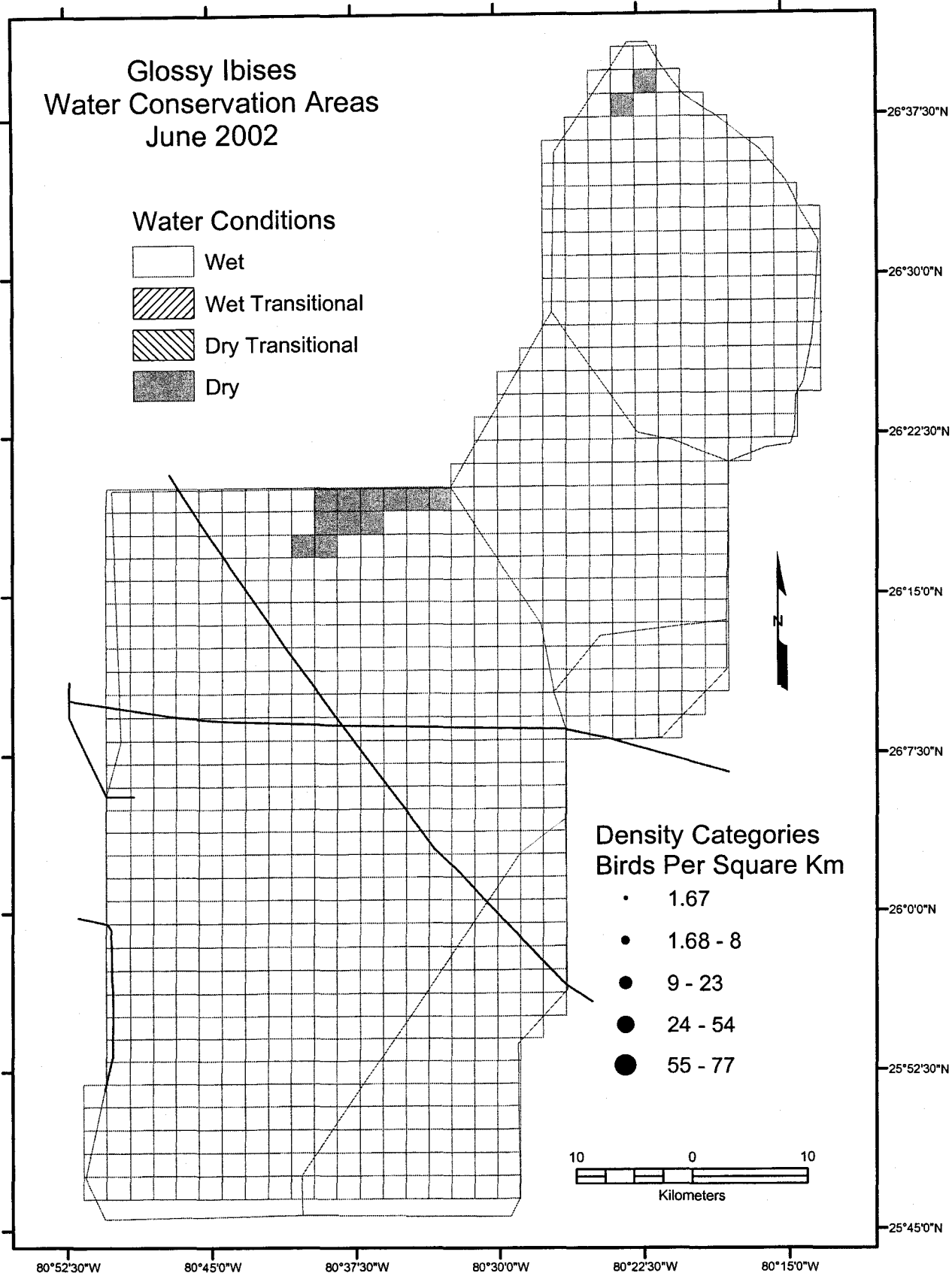
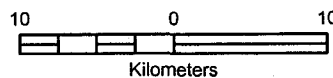
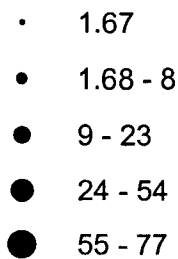


Glossy Ibises Water Conservation Areas June 2002

Water Conditions



Density Categories Birds Per Square Km

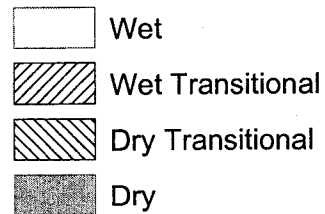


APPENDIX Q: Monthly density maps of Wood Storks in the Water Conservation Areas, February to June 2002.

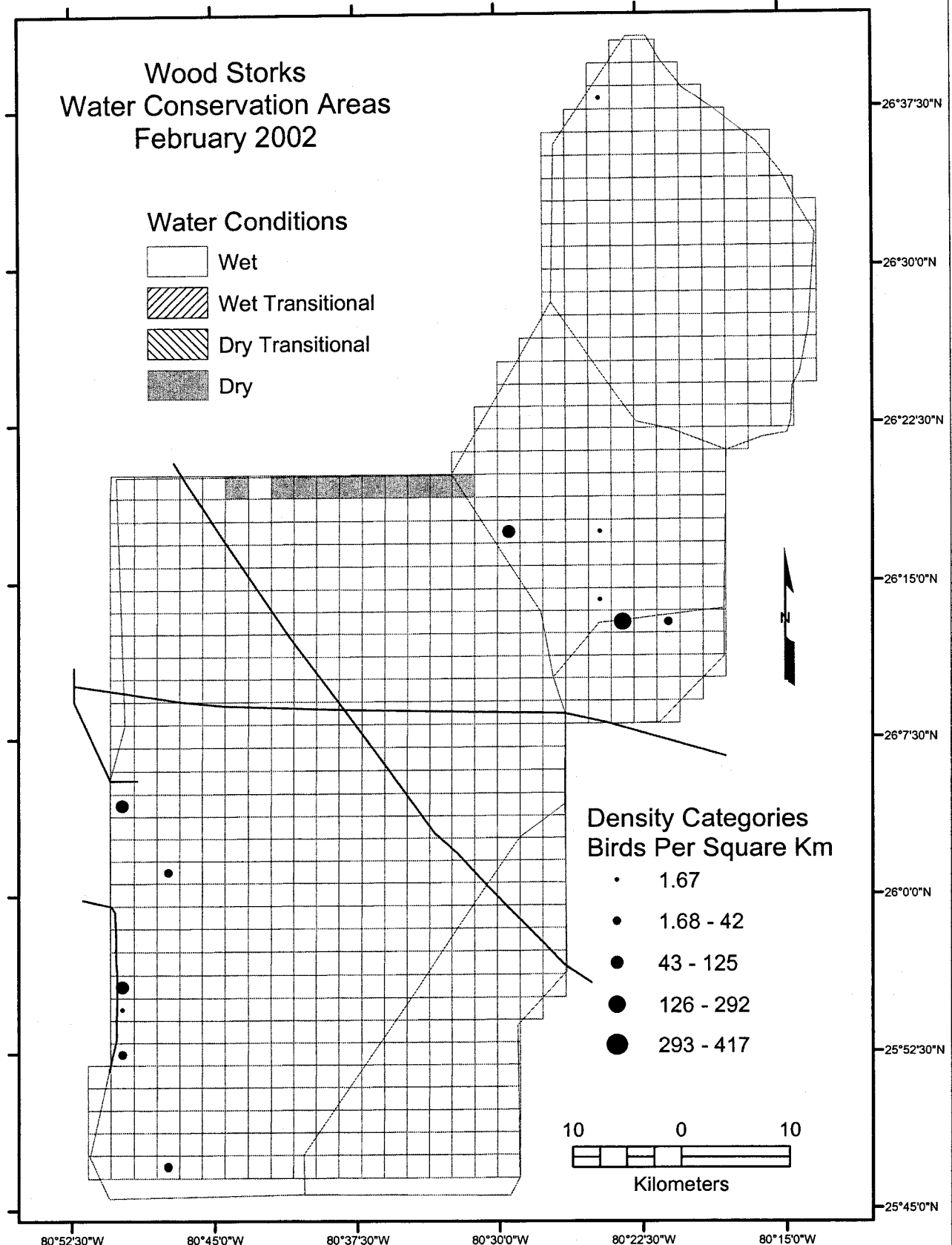
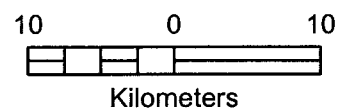
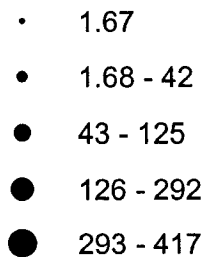
- Q1. Density maps of Wood Storks in the Water Conservation Areas, February 2002.
- Q2. Density maps of Wood Storks in the Water Conservation Areas, March 2002.
- Q3. Density maps of Wood Storks in the Water Conservation Areas, April 2002.
- Q4. Density maps of Wood Storks in the Water Conservation Areas, May 2002.
- Q5. Density maps of Wood Storks in the Water Conservation Areas, June 2002.

Wood Storks Water Conservation Areas February 2002

Water Conditions

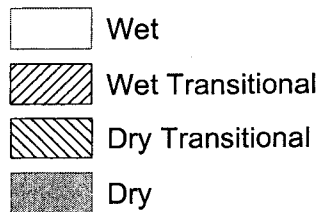


Density Categories Birds Per Square Km

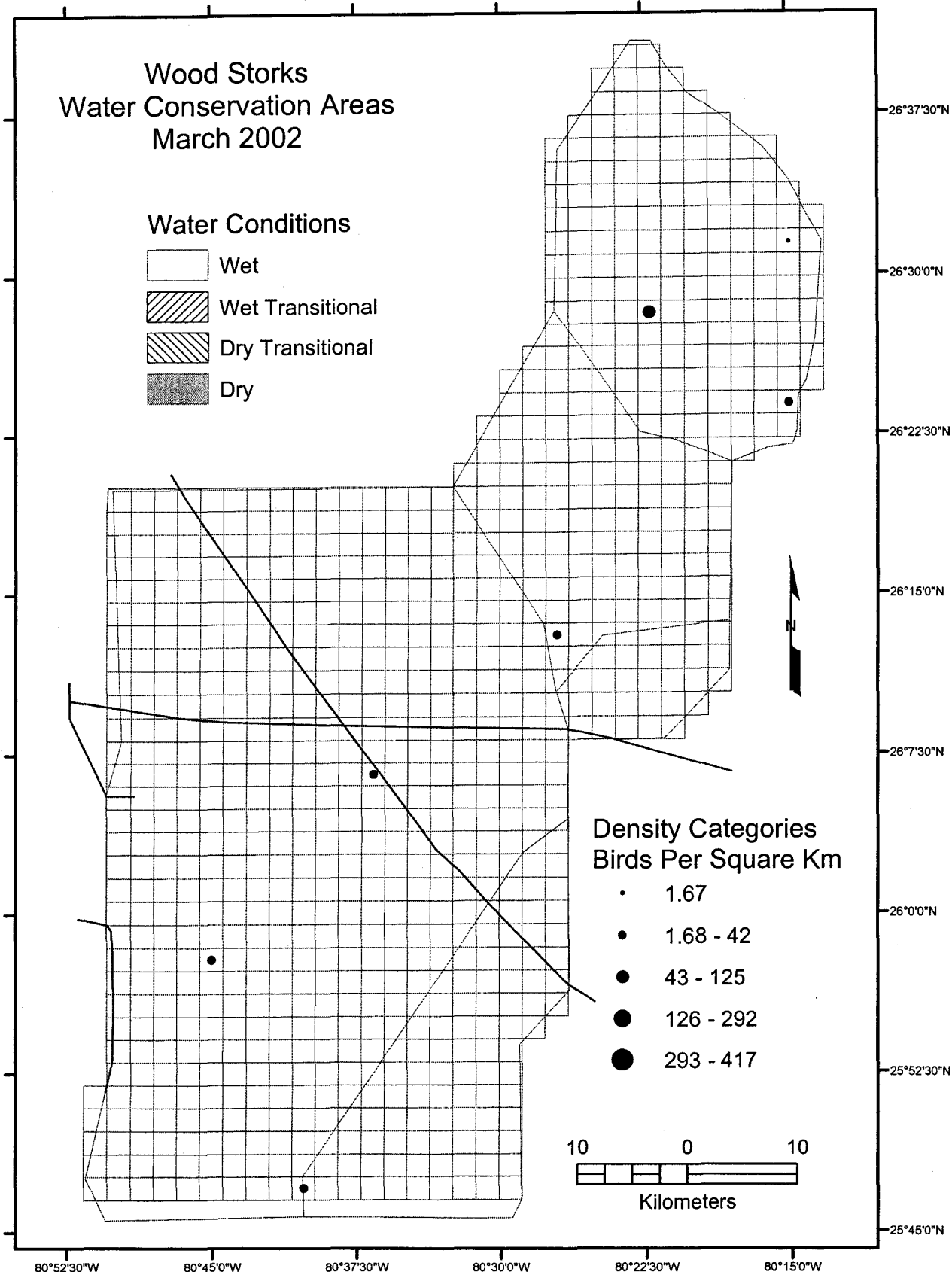
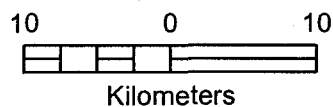
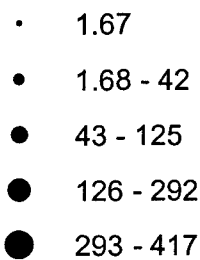


Wood Storks Water Conservation Areas March 2002

Water Conditions

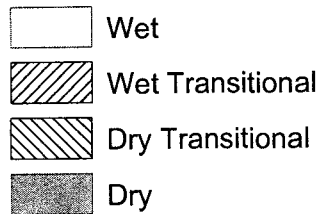


Density Categories Birds Per Square Km

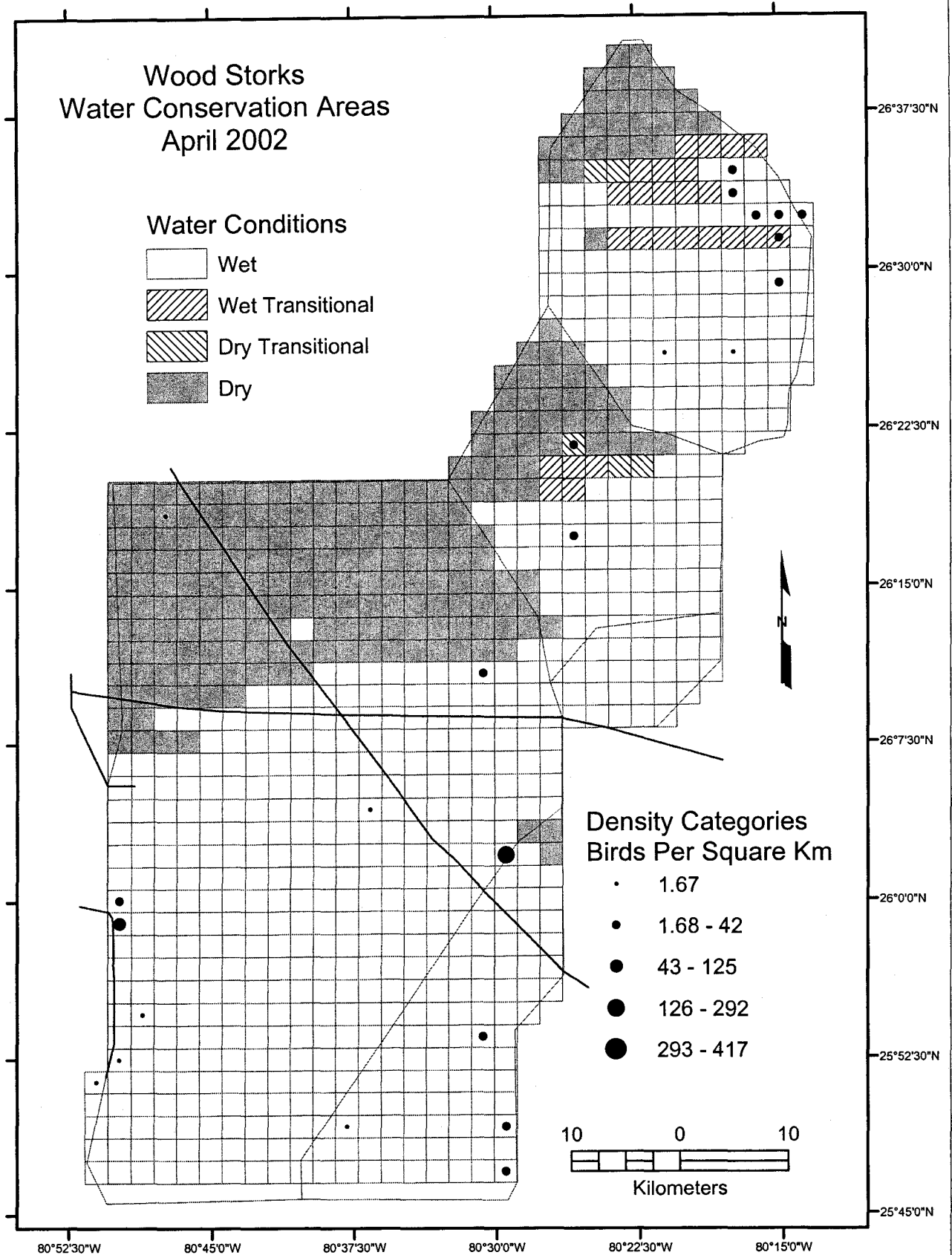
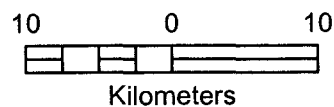
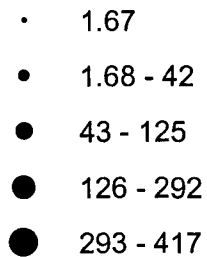


Wood Storks Water Conservation Areas April 2002

Water Conditions

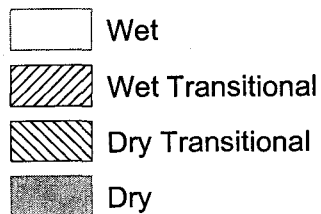


Density Categories Birds Per Square Km

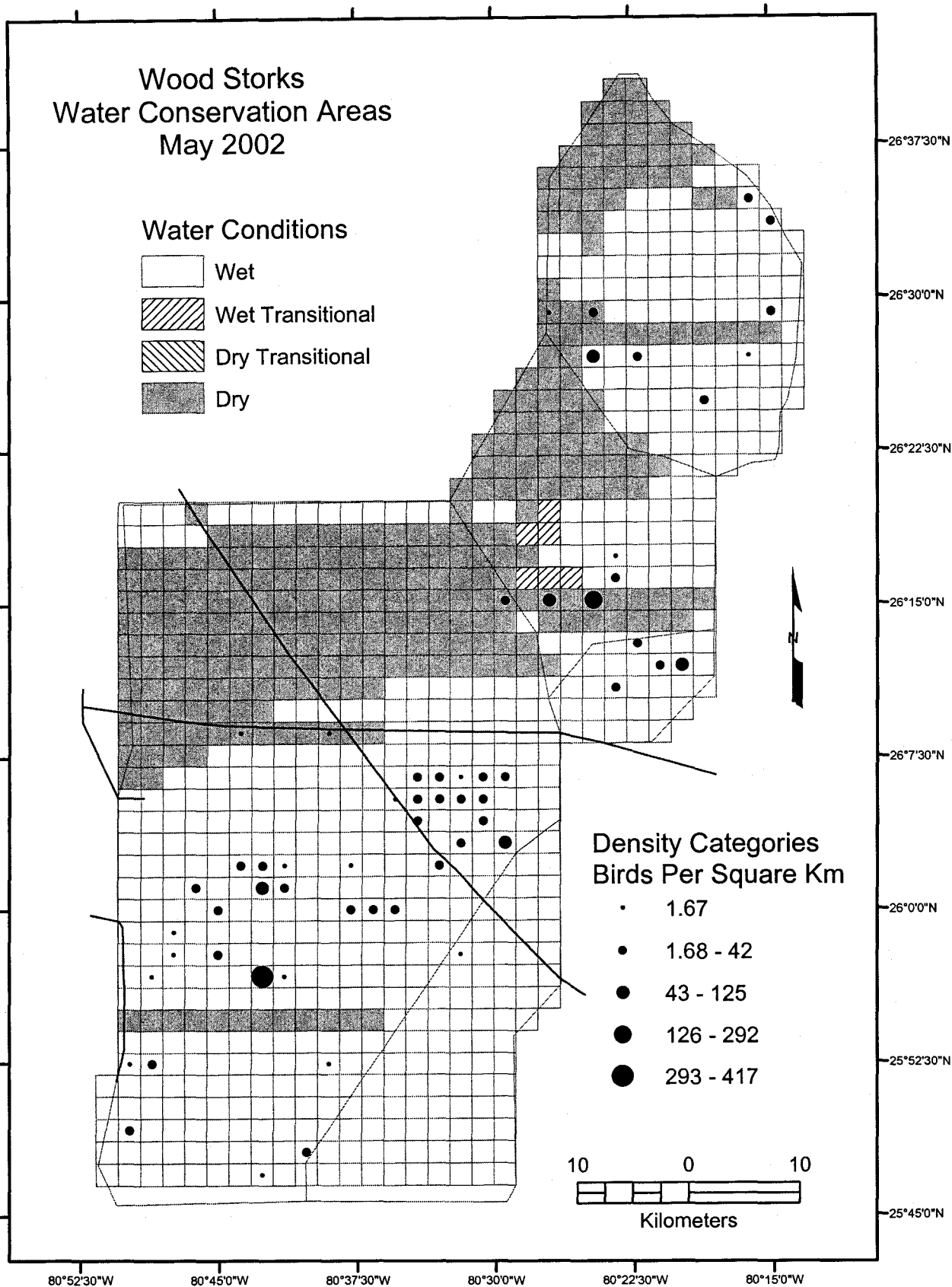
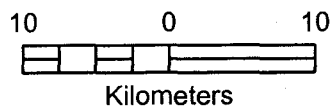
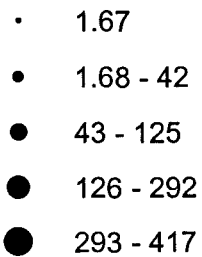


Wood Storks Water Conservation Areas May 2002

Water Conditions

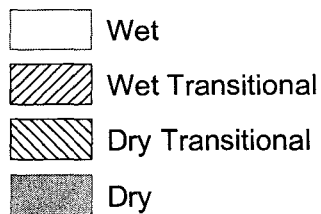


Density Categories Birds Per Square Km

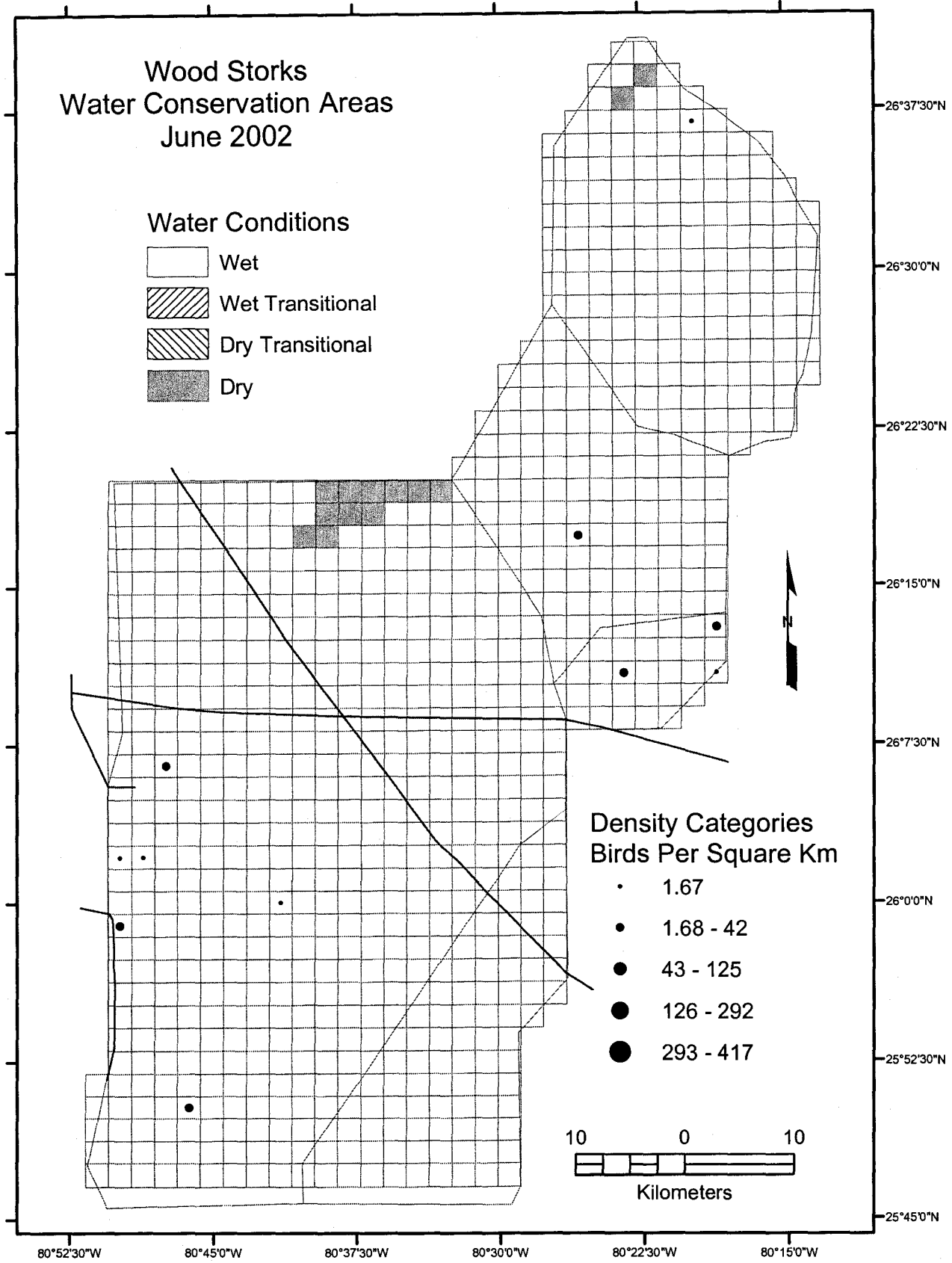
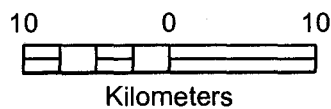
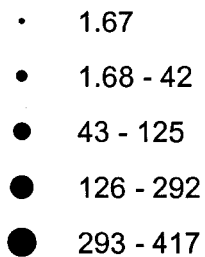


Wood Storks Water Conservation Areas June 2002

Water Conditions



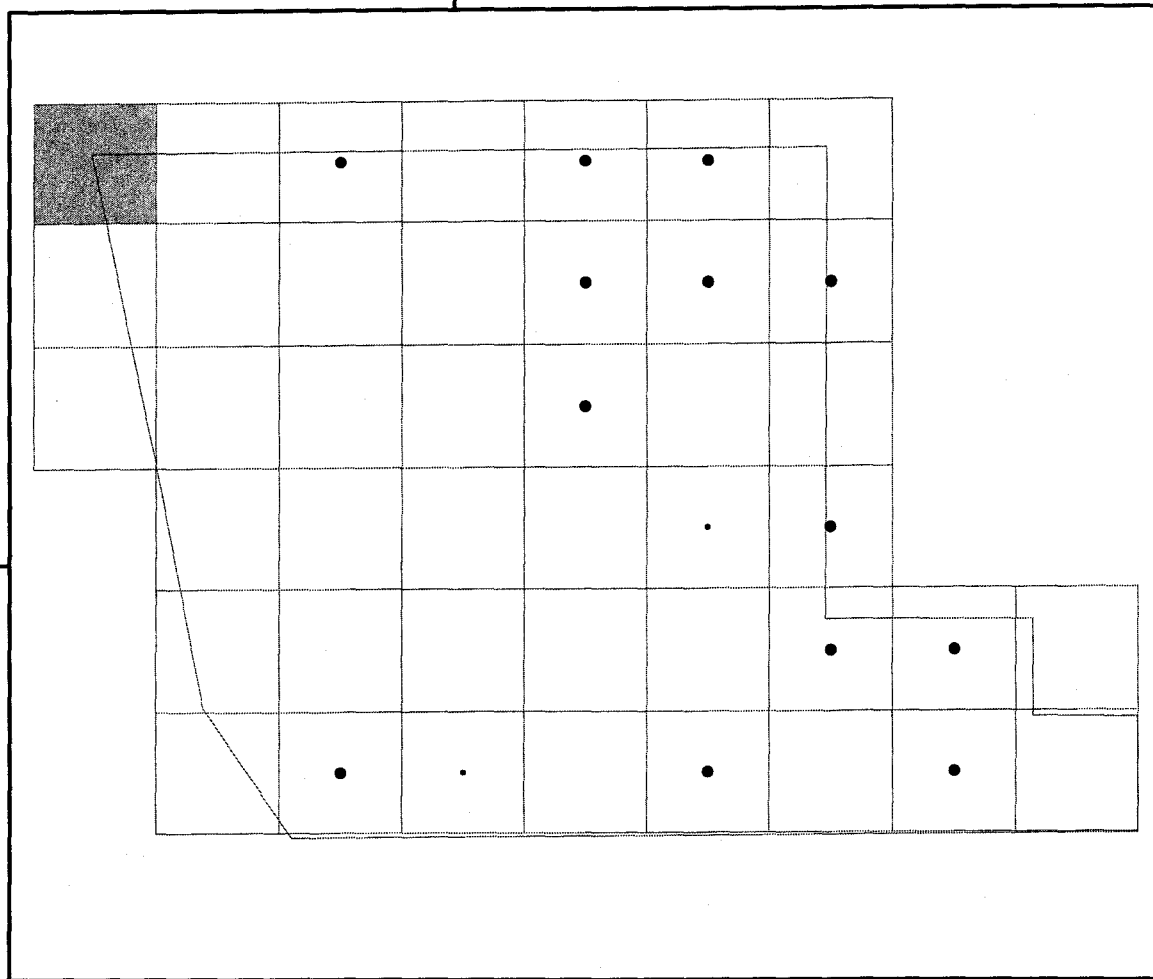
Density Categories Birds Per Square Km



APPENDIX R: Monthly density maps of wading birds in the Holey Land, February to June 2002.

- R1. Density maps of wading birds (combined species) in the Holey Land, February to June 2002.
- R2. Density maps of Great Blue Heron in the Holey Land, February to June 2002.
- R3. Density maps of Great Egret in the Holey Land, February to June 2002.
- R4. Density maps of small dark herons in the Holey Land, February to June 2002.
- R5. Density maps of small white herons in the Holey Land, February to June 2002.
- R6. Density maps of White Ibises in the Holey Land, February to June 2002.
- R7. Density maps of Glossy Ibises in the Holey Land, February to June 2002.
- R8. Density maps of Wood Storks in the Holey Land, February to June 2002.

Combined Species Holey Land February 2002



26°22'30"N

80°45'0"W

Water Conditions

-  Wet
-  Wet Transitional
-  Dry Transitional
-  Dry

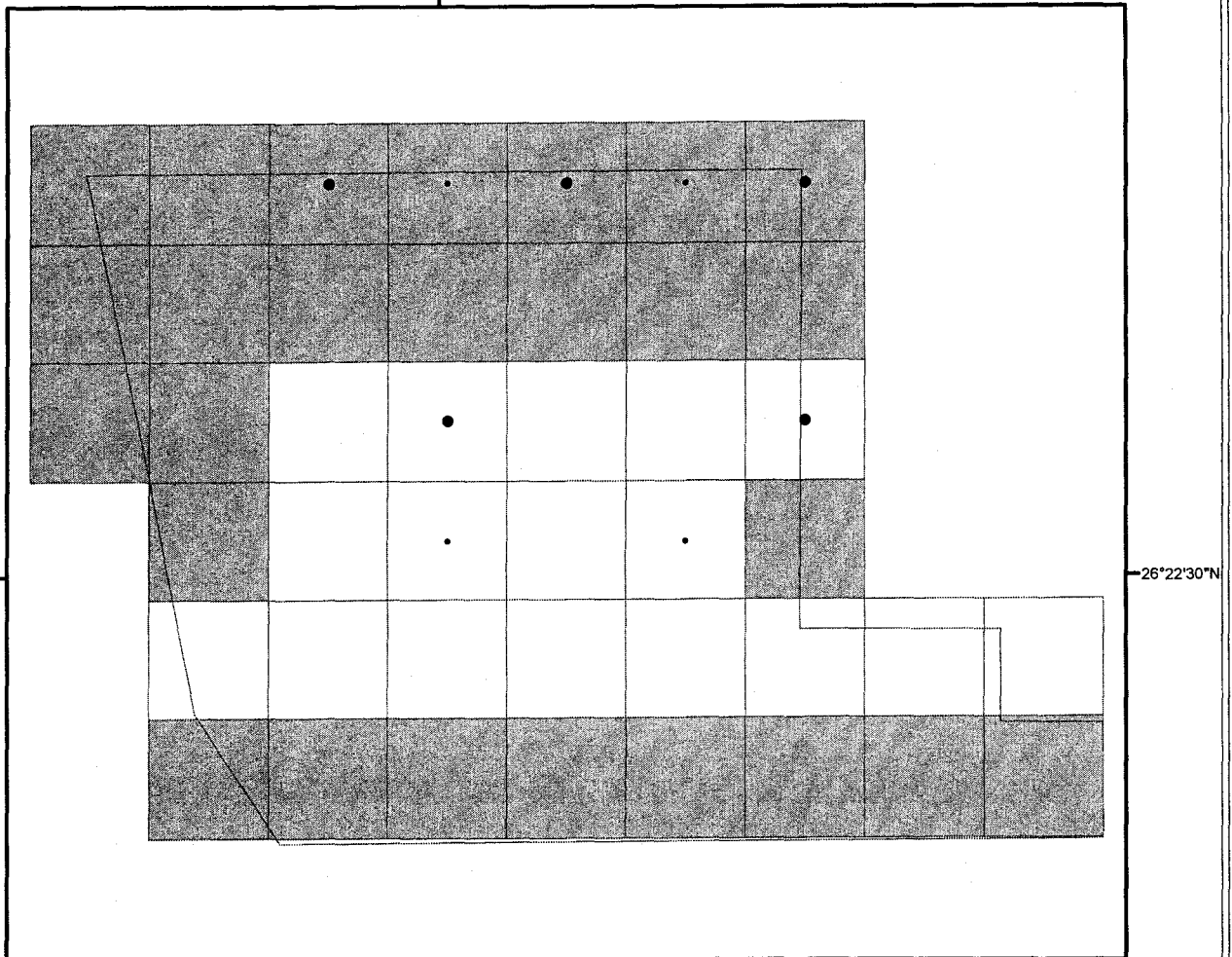


Density Categories Birds Per Square Km

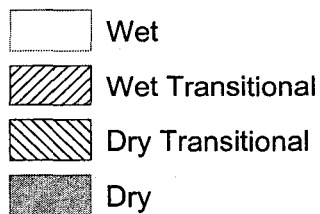
- 1.67
- 1.68 - 342
- 343 - 1025
- 1026 - 2392
- 2393 - 3417



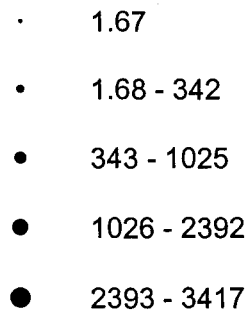
Combined Species Holey Land March 2002



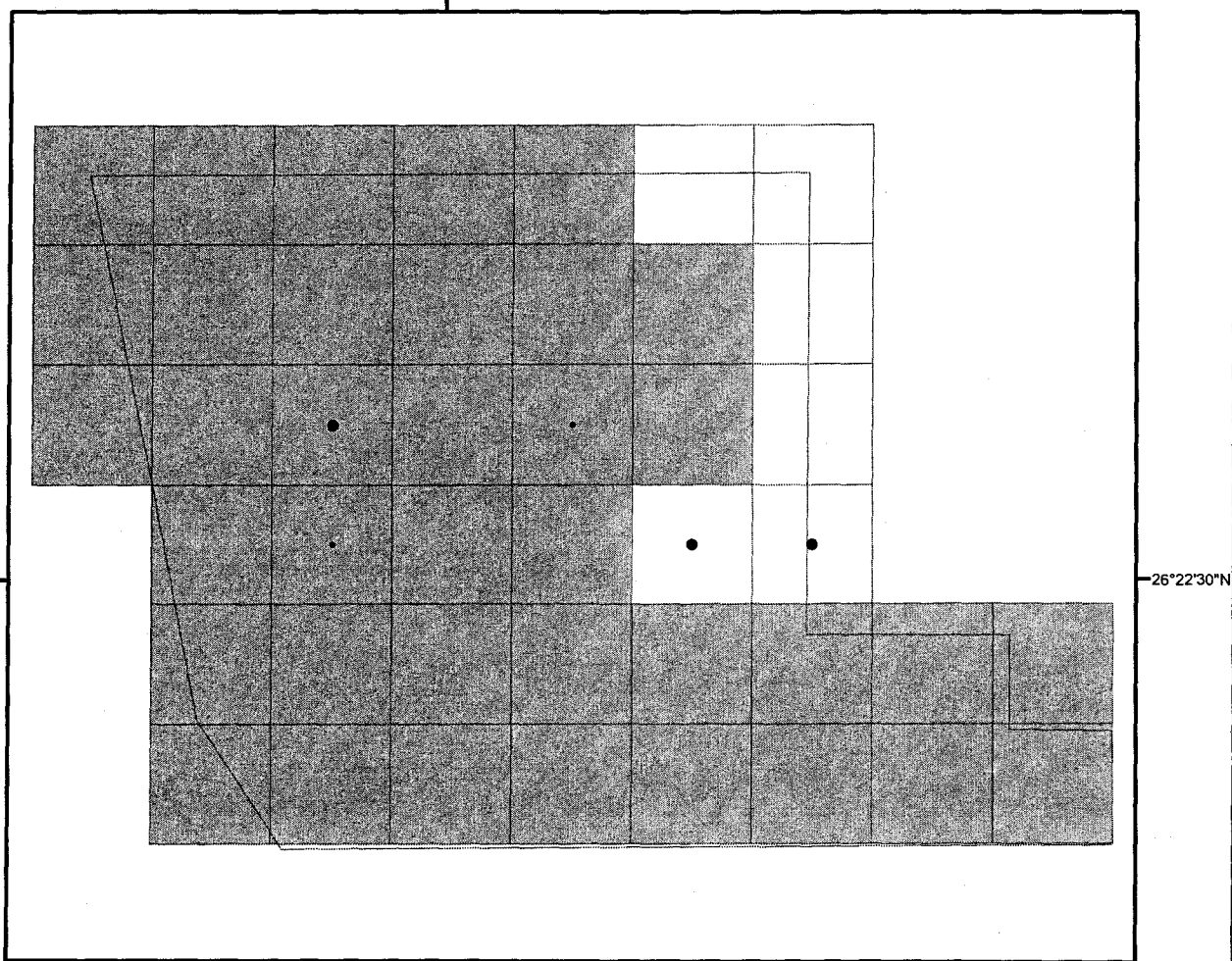
Water Conditions



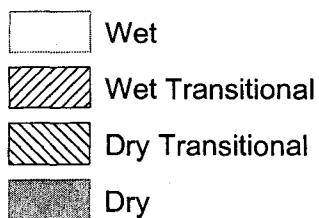
Density Categories Birds Per Square Km



Combined Species Holey Land April 2002



Water Conditions

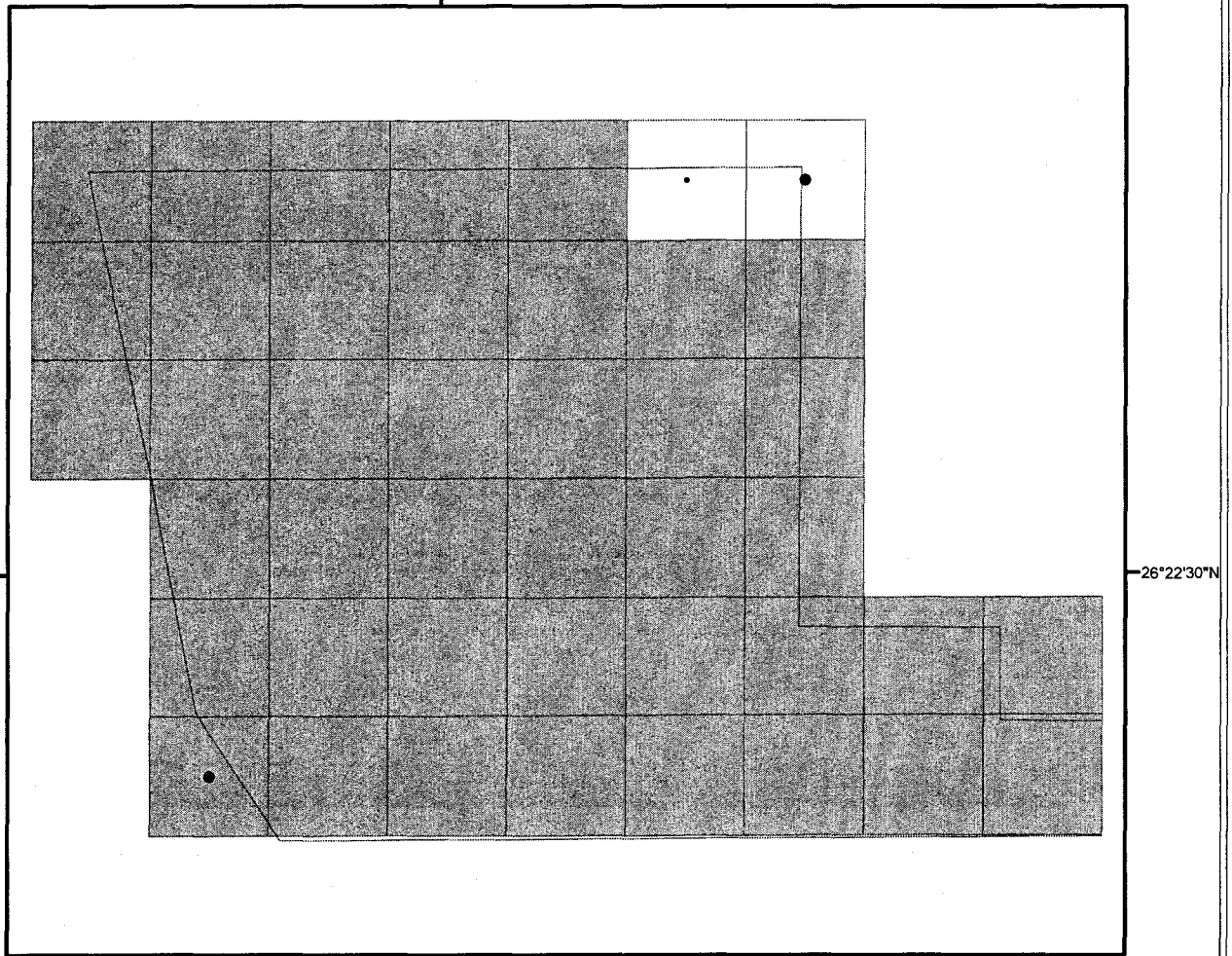


Density Categories Birds Per Square Km

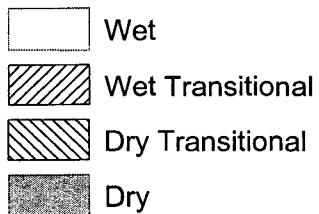
- 1.67
- 1.68 - 342
- 343 - 1025
- 1026 - 2392
- 2393 - 3417



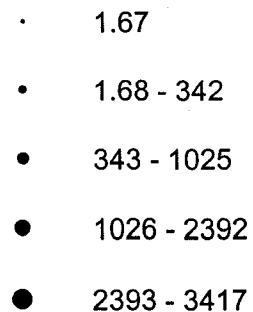
Combined Species Holey Land May 2002



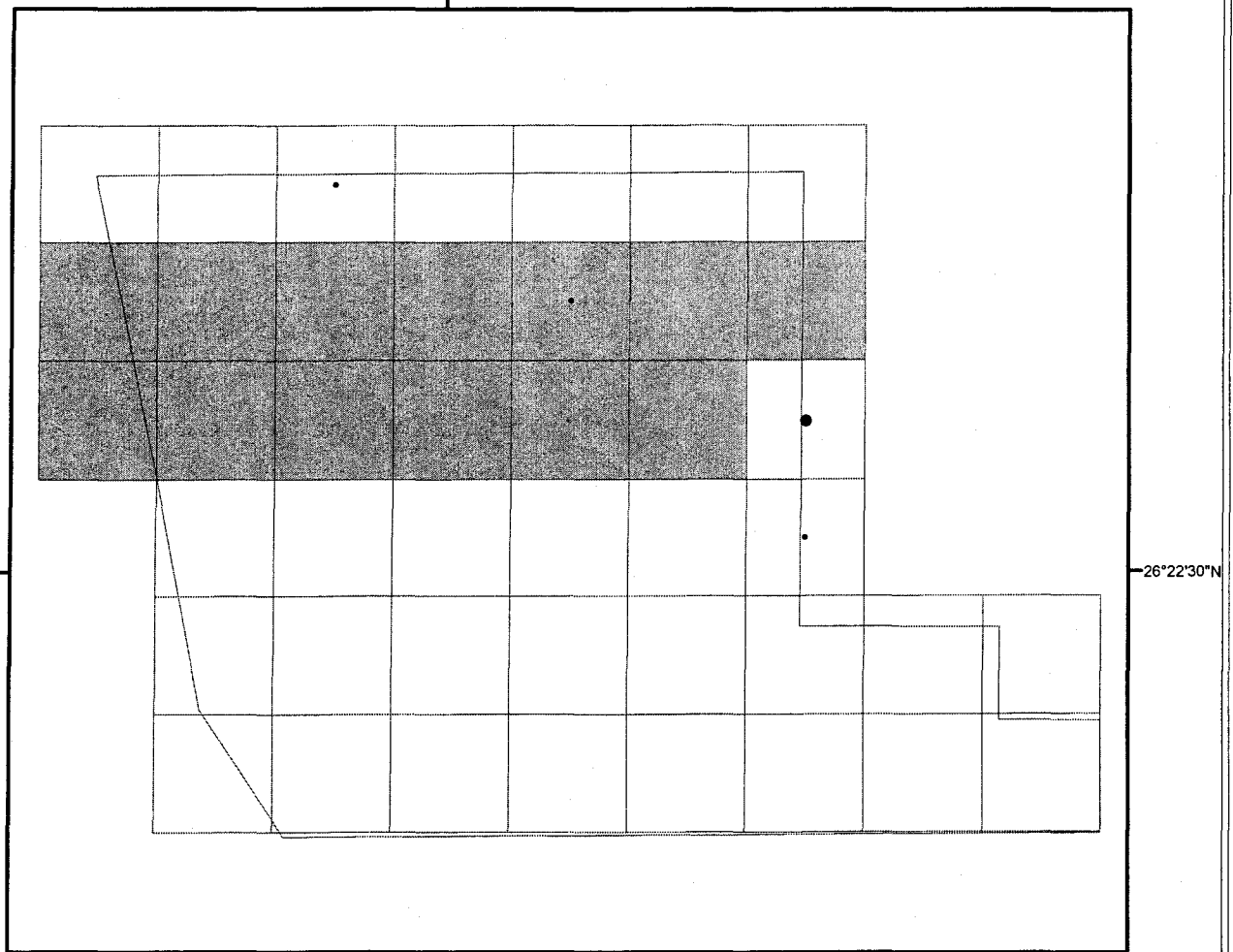
Water Conditions



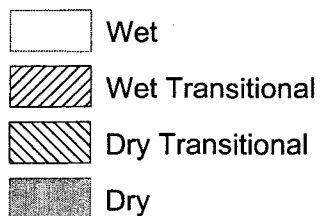
Density Categories Birds Per Square Km



Combined Species Holey Land June 2002



Water Conditions



Density Categories Birds Per Square Km

- 1.67
- 1.68 - 342
- 343 - 1025
- 1026 - 2392
- 2393 - 3417

