

# BIG CYPRESS DEER/PANTHER RELATIONSHIPS: DEER HERD HEALTH AND REPRODUCTION

by

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# BIG CYPRESS DEER/PANTHER RELATIONSHIPS: DEER HERD HEALTH AND REPRODUCTION

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*Abstract:* White-tailed deer (*Odocoileus virginianus*) track counts, observations, and a fall collection of doe deer were utilized to compare deer herds inhabiting Florida panther (*Felis concolor coryi*) habitat in the Bear Island (BI) and Corn Dance Units (CDU) of Big Cypress National Preserve (BCNP), Fakahatchee Strand State Preserve (FS), Florida Panther National Wildlife Refuge (PR) and Collier Enterprise (CE) lands. Necropsies were used to obtain standard body measurements, kidney fat indices (KFI's), amounts of fat on the tail, kidney, pericardial lining and heart, abomasal parasite loads, inter-uterine fecundity and physical condition. Although the FS herd increased during this study, deer in FS, CDU and PR were less numerous than deer in BI. Deer in FS and CDU had lower KFI's, tail fat and physical condition values than deer in BI, PR and CE. Deer from FS and CDU had fecundity rates less than 1.0 fawns per adult female while females from other areas produced more than 1.0 fawns per adult female. There was an inverse relationship between physical condition and APC's.

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## INTRODUCTION

White-tailed deer (*Odocoileus virginianus*) are important prey items for the Florida panther (*Felis concolor coryi*) throughout south Florida (Maehr et al. 1990). Because deer herds are an easily manipulated component of panther habitat, it is important to understand the interrelationships between deer and their environment. Deer inhabiting lands representing a range of private and public ownerships, management philosophies, and recreational use levels were studied to examine variation in herd health and reproduction. The objectives of this study were to:

- 1) assess deer herd health and physical condition;
- 2) determine deer herd fecundity rates;
- 3) calculate age and sex structures; and
- 4) estimate deer herd densities.

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## STUDY AREAS

Study areas were located in Collier County, Florida (Fig 1). Climate of the area is tropical savannah (Duever et al. 1986) with average monthly temperatures ranging from 18.6 C in January to 28.3 C in August. Approximately 80% of the 140 mm of rainfall occurs between May and October (Carter et al. 1973).

The 15,335 ha Bear Island (BI) is a mosaic of cypress (*Taxodium distichum*), slash pine (*Pinus elliotti*), oak (*Quercus* spp.) hammocks, prairies of low scrubby saw palmetto (*Serona repens*), wiregrass (*Aristida* spp.) and other grasses in drier sites at 4.5 m above mean sea level (MSL). Drainage from Okaloachoochee slough forms extensive fresh water marshes of sawgrass (*Cladium jamaicensis*), pickerelweed (*Pontederia lanceolata*), fire flag (*Thalia geniculata*), and arrowhead (*Sagittaria lancifolia*) that occupy approximately 20% of the area (Fig. 2) (McPherson 1973). Soils are primarily deep sands and marls (Leighty et al. 1954).

Approximately 50% of Collier Enterprises (CE) lands (3800 ha) consists of agricultural fields and improved pastures of planted cattle forage such as *Aeschynomene americana* and grasses at 7 m MSL.

Forested cover includes slash pine, cypress strands and domes, and oak hammocks. The Okaloachoochee slough consists of fresh water marshes of sawgrass, pickerelweed, and fire flag and covers 20% of the area (Fig. 3). Deep, comparatively fertile sands are the principal soils of CE (Leighty et al. 1954).

The 45,000 ha Corn Dance Unit (CDU) of the BCNP is dominated by broad expanses of small, stunted cypress trees growing in bare mineral soil at 2.5 m MSL. The understory, when present, is scattered clumps of sawgrass or beakrush (*Rhynchospora* spp.) growing on a thin soil of marl or sand (Duever et al. 1986). Cypress domes and strands with larger trees occur through the area and typically contain mid-story species such as wax myrtle (*Myrica cerifera*), pond apple (*Annona glabra*), and cocoplum (*Chrysobalanus icaco*). The central portion of CDU contains slash pine forests with associated saw palmetto and cabbage palms (*Sabal palmetto*) (Fig. 4). Soils are thin, leached, infertile marls and sand (Leighty et al. 1954).

Fakahatchee Strand State Preserve (FS) (38,000 ha) is the major drainage of the western Big Cypress Swamp and has an average elevation of approximately 3 m MSL. Prior to 1944 FS was dominated by old growth cypress. From 1944-1950 FS was logged and most of the large cypress was removed (Alvarez 1978). The regrowth of the strand was principally by the previously sub-dominant species. Currently, mixed swamp hardwoods including red maple (*Acer rubrum*), cypress, royal palm (*Roystonea elata*) willow (*Salix caroliniana*) pond apple, sweet bay (*Magnolia virginiana*), myrtle and popash (*Fraxinus caroliniana*) occur most frequently in the heavily forested central portion of FS. Prairies of maidencane (*Panicum hemitomon*), muhly grass (*Muhlenbergia capillaris*), sawgrass and scattered cypress form expansive openings along the eastern and western fringes of the strand (Fig. 5). (McPherson 1973). Soils are poorly drained peaty muck or brown peat 0.3-1.2 m deep under the heavily forested central portion of FS and shallow, poorly drained fine marls along the periphery (Leighty et al. 1954).

The 9,838-ha Florida Panther National Wildlife Refuge (PR) is intermediate between the cypress dominated FS and CDU and the more upland BI and CE. It has an average elevation of approximately 4 m MSL and contains the northern portion of the Fakahatchee Strand where mixed swamp hardwoods and cypress dominate. It also contains upland areas of oak hammocks and pine forests similar to portions of BI (Fig. 6). Soils of PR are a mix of fine sands, loamy fine sand, marl, sandy marl, and muck (Leighty et al. 1954).

## METHODS

Transects 1.6 km (1 mile) long representative of FS (N = 6), PR (N = 6) and CDU (N = 10) vegetation were established to conduct deer track counts (Tyson 1952). Tracks were counted during May-June from 1987-1991. Transects were counted 4-6 times depending on water levels. Data from BI track counts performed by the Commission's Bureau of Wildlife Management personnel was utilized for comparison (Manor et al. 1990). Records were kept on the numbers and sex of deer observed during collections. Deer were spotlighted and collected by rifle from BI, CDU, FS and CE. During 1986-1988, harvested deer from leased land that subsequently became PR were returned by hunters during legal doe harvest days. Carcasses were kept on ice until being refrigerated prior to necropsy. Most necropsies were performed within 10 hours post-mortem. Standard measurements and age (Severinghaus 1949) were determined for each animal prior to necropsy. Post-mortem examinations followed procedures of Nettles (1981). Levels of fat deposits on the tail, pericardium, heart and kidney (Stockle et al. 1978) were assigned a value of 1-9. The ratio of kidney fat weight to kidney weight (kidney fat index, KFI) was determined (Riney 1955). A physical condition value of 1-12 was assigned to each animal based on endogenous fat deposits, coat and muscling qualities and conditions, or abnormalities observed during necropsy. Abomasal parasite counts were determined and analyzed according to Eve and Kellogg (1977). Reproductive tracts of females were removed and examined for fetuses.

A fecal assay of diaminopimelic acid (DAPA) was done to document any nutritional differences among study areas. Levels of DAPA, an amino acid, found in the cell walls of ruminant bacteria, fluctuates directly with levels of digestible energy (Nelson et al. 1982). Approximately 10 fecal pellets were removed from the intestinal tracts of adult deer during necropsy for DAPA analysis. Pellets from adult deer in each area were combined into a single sample for each year and analyzed by the Washington State University Wildlife Habitat Lab.

## Data Analysis

The null hypotheses that track counts did not vary among years and areas was tested using ANOVA. When the null hypothesis was rejected, differences were identified by the Newman-Keuls multiple range test (Zar 1974). The rates of deer observed per hour for each collection night were ranked for all areas and

years. Differences among areas and years were tested for by the Kruskal-Wallis analysis of variance by ranks. When differences existed they were identified by Dunn's multiple comparison procedure (Hollander and Wolfe 1973).

Morphometric values (weight, length, girth), fat level estimates (tail, heart, peri-cardial, kidney, KFI), physical condition estimates, and APC data from adult (> 1 year old) female deer were analyzed by ANOVA to determine if significant differences existed among areas or years. The Newman-Keuls multiple comparison test was used to identify which means were different.

A 5 x 2 (area x possibilities) contingency table was constructed listing the frequencies of occurrence of either 0 or more than 0 fetuses by area. Likewise, a similar table was made listing the frequencies of occurrence of either 1 or 2 fetuses by area. Chi-square analyses were used to test the following null hypotheses:

1. The incidence of pregnancy was the same in all areas; and
2. The intra-uterine fecundity rate was the same for all areas.

Chi-square values were derived using the Bonferroni adjustment and therefore are conservative (Johnson and Wichern 1982).

## RESULTS

The 1989 and 1991 mean tracks per transect (3.2, 4.8, respectively) in FS were significantly higher than 1987 (1.5) and 1988 (1.3) ( $p < 0.05$ ) (Fig 7). There were no other yearly differences found within areas. The mean number of tracks per transect in BI during 1985-1987 (11.5, Schortemeyer et al. 1991) was significantly greater than CDU and FS. No other area differences were observed. Estimates of density derived from track counts (Tyson 1952) were 1 deer/67-102 ha in CDU, 1 deer/74-91 ha in PR, 1 deer/17-27 ha in BI and 1 deer/54-81 ha (1989 and 1991 data) in FS.

The mean number of deer observed per hour in FS during collections was 0.351, lowest of all areas, but was significantly different only from CE (5.45) ( $p < 0.05$ ) (Fig. 8). The numbers of deer observed per hour in FS increased from 0.270 in 1986 to 0.683 in 1990, although this increase was not significant ( $p > 0.05$ ). No other area had notable trends. The adult sex ratio was lowest in FS (1 male:1.2 females) and highest in CDU (1 male:3.6 females) (Table 1).

One hundred fifty-one deer were collected and 21 were returned by hunters from PR (hunt club leased lands). One hundred twenty were adult females, 19

were adult males, 16 were yearling females and 18 were yearling males. The morphometric values of all deer are in Appendix 1 (*NOTE: Appendix 1 was not included in the Florida Panther Conference Proceedings. Information regarding Appendix 1 can be obtained from the author*). There were significant area differences for mean morphometric values of adult females (Table 2). The mean weights and lengths of female deer from FS and CDU were significantly less than the means of BI, CE and PR ( $p < 0.05$ ). Although mean weights of adult females from all areas tended to increase with age, deer from CDU and FS weighed less than deer from BI, CE and PR in most age classes (Fig. 9).

There were significant area differences in mean fat and physical condition indices (Table 3). Deer from FS and CDU had lower levels of fat than did deer from CE and BI. PR deer had a few fat level estimates similar to both groups. The mean KFI's of adult females from FS and CDU were less than those of BI and CE ( $p < 0.05$ ). The mean KFI of PR deer was not significantly different from either group ( $p > 0.05$ ). There were no differences among yearly KFI means for CDU, FS and PR deer. However, the mean 1988 KFI's for BI and CE were significantly greater than other years ( $p < 0.05$ ) (Fig. 10). The mean tail fat indices and physical condition values of PR, FS and CDU were less than those of CE and BI ( $p < 0.05$ ). Fat indices and physical condition values of all deer are in Appendix 2 (*NOTE: Appendix 2 was not included in the Florida Panther Conference Proceedings. Information regarding Appendix 2 can be obtained from the author*).

The pregnancy rate of FS deer (68.2%) was significantly lower than other areas ( $p < 0.05$ ). However, the mean number of fetuses per pregnant doe (1.33) was high enough that net productivity of FS deer (0.91) was not significantly different than other areas ( $p > 0.05$ ) (Table 4). There were no yearly differences observed within areas for any reproductive parameter. Reproductive data for all adult female deer are in Appendix 3 (*NOTE: Appendix 3 was not included in the Florida Panther Conference Proceedings. Information regarding Appendix 1 can be obtained from the author*).

Mean APC for BI (726) was lower than CDU (1270) ( $p < 0.05$ ). There were no other area differences (Table 5). There was an inverse relationship between APC's and physical condition (Fig. 11).

There was no significant difference among areas for DAPA values ( $p > 0.05$ ). Although PR and CE were ranked higher than other areas there was no significant difference among areas for DAPA values ( $p$

> 0.05) (Table 6).

## DISCUSSION

Density estimates from deer track counts should be viewed with caution because they are most appropriately used as long-term trend indicators. However, when examined over the relatively short period covered in this study, herds appear to be stable in CDU and PR and increasing in FS. Track count results in these cypress-dominated habitats were very similar with a range of mean tracks per transect of only 1.25 to 4.8. In contrast, the mean tracks per transect in the more upland BI ranged between 9.55 and 14.88 (Manor et al. 1990). Problems with transect methodology and naturally occurring events may have contributed to the suggestion of an increasing herd in FS. After the virtual elimination of off-road vehicle traffic in FS in 1987, deer track count transects, which had been placed along muddy trails, began to revegetate rapidly. Transects were shifted yearly to compensate for loss of the trackable medium. In 1989, track counts were conducted along bulldozed fire lines created during an April 1989 fire. Tracks increased from a mean of 1.25 in 1988 to 3.2 in 1989. It is possible that deer may have been attracted to fire lines by the more palatable new growth of forage and ease of travel through previously dense vegetation. By 1990, revegetation prevented tracks from being counted anywhere in FS. In 1991 however, tram clearing and repair allowed tracks to be counted. The mean number of tracks per transect on these trams was highest of any year (4.8). Observations made during track counts and panther field activities indicate that much of the tram usage was by does with young fawns temporarily stranded by high water levels. Given the above caveats, it is possible that the significantly higher 1989 and 1991 track counts reflect a true herd increase. This is further supported by the increase in the mean rate of deer observed per hour during collections from 0.270 in 1986 to 0.683 in 1990 and by personal observations made in FS since 1984.

Increases in FS, CDU or PR deer densities approaching BI can not be expected. Cypress forests and prairie habitats support fewer deer than pine flatwoods, hardwood hammocks or marshes (Harlow 1959). Harlow (1959) estimated the potential deer density in cypress swamps to be 1 deer/ 45 ha (approximately the density indicated by the FS 1991 track counts) and 1 deer/ 283 ha in prairies. The potential deer density in the cypress-dominated areas of FS and CDU is probably within these estimates. The potential deer density in PR, with a mix of cypress swamps, prairies and more upland plant

communities is likely somewhat higher.

The adult sex ratio of all areas was comparatively low. The sex ratio was lowest (1 male:1.2 females) in the un hunted FS herd but was not notably different from hunted herds. Similar mean ages of collected adult females (2.4 - 3.3) suggest equivalent mortality rates for all areas. The more heavily hunted Everglades Wildlife Management Area had a somewhat higher ratio (1 male:4.6 females) during the time of this study (Crossett and Johnson 1990).

Deer weights have long been used as habitat condition indicators (Severinghaus 1955). Heavier deer result from better available nutrition (Verme 1963). Differences observed in morphometrics of adult females are probably habitat/diet related. Deer from CDU weighed less, and had smaller lengths and girths than deer from other areas. Deer from FS weighed more and were bigger than CDU deer but weighed less and were smaller than other areas. Weights were negatively influenced by poor quality of available forage caused by infertile, shallow soils and long hydroperiods in CDU and by long hydroperiods in FS. Heavier deer are characteristic of healthier, more reproductive animals. The productivity of white-tailed deer is directly affected by diet quality. Productivity doubled when females were switched from a low quality to a high quality ration in a captive study (Verme 1965). Although not significantly different from other areas, the net productivity of the herds from cypress-dominated areas (FS and CDU) was < 1.0 fawn per adult female, while the other areas had a net productivity > 1.0 fawn per adult female (Table 4).

Rumen analysis has suggested that BI deer have a diet higher in crude protein, phosphorus, and calcium than do CDU deer (McCown 1988). Fawns consuming adequate amounts of protein grow faster, become bigger (Ullrey et al. 1967), have increased chances of survival (Verme 1962) and are more productive as adults (Verme 1965) than are comparable fawns on a protein deficient ration. It is possible that differences in dietary protein are responsible for area differences in sizes and productivity of deer.

Although storage of body fat is not necessary for over-winter survival of sub-tropical deer, the ability to store fat reflects habitat conditions. The lower mean fat level values of CDU and FS females is additional evidence that forage quality is sub-optimal in cypress-dominated habitats. Low KFI and tail fat values of FS and CDU deer are particularly useful because these fat depots are among the first catabolized by deer during under nutritional stress. The significant 1988 increase in the KFI's in BI and CE where oaks are common is

believed related to the heavy acorn production that year.

The inverse relationship between physical condition and APC's has been previously noted for BI and CDU deer (McCown 1988) and for other southeastern deer (Davidson et al. 1982). Abomasal parasites do not usually directly affect physical condition because, with the exception of extreme intensities of *Haemonchus contortus*, they are not pathogenic (Davidson et al. 1980). Rather, the relationship is associative and reflective of range conditions. Deer in good physical condition tend to have low APC counts while those in poorer condition have higher APC counts.

Although a small sample size (N = 45) of captured panthers in several different areas prevents significant differences from being indicated, area differences in panther health indices, reproduction and densities were similar to those of deer (Roelke 1990).

Blood values useful for assessment of physical condition in panthers were lower in FS panthers than in panthers in PR, BI, CE and other ranchlands north of I-75. Lower packed-cell volume, hemoglobin count, red blood cell counts and serum iron levels suggest that FS panthers are more anemic than panthers in BI, PR and CE, probably due to lowered nutritional status and heavier parasite loads. The mean physical condition of female panthers was estimated to be lower in FS than in BI, PR and CE (Roelke 1990). Possibly as a result of fewer large prey items in their diet (Maehr et al 1990), mean body weights of adult panthers were 14% less for males in FS and 22% less for females in FS than in areas north of I-75 (Maehr 1990). Average documented litter size of panthers residing in FS (1.33, N = 3) was well below the average for all panthers (2.0, N = 14) (Maehr et al. 1991). No birth (or reproduction) by a collared panther was documented during the study period in CDU (N = 2) (D. Jansen, pers. commun.). Panther densities in FS and CDU are much lower than in PR, BI and CE. Currently, only 3 collared panthers inhabit the 83,000 ha of FS and CDU while 9 collared panthers inhabit or frequently use the 29,000 ha of BI, PR and CE.

## **CONCLUSIONS AND MANAGEMENT IMPLICATIONS**

Deer and panthers in the cypress-dominated habitats of CDU and FS are smaller, leaner, less thrifty, less productive and less numerous than in BI and CE. These characteristics are largely attributable to the nature of the habitat. Given the endangered status of the Florida panther and its dependence on deer, a program to significantly increase the quantity

and quality of deer forage in FS and CDU is recommended. This can be accomplished through a combination of prescribed burning, planting of native food crops and the creation of openings. Prescribed fire can be used inexpensively to treat prairies and pinelands in FS and CDU. Growing tissue is more palatable, digestible and nutritional than mature tissue (Short et al. 1972). Crude protein, important to deer for body growth and maintenance as well as maintenance of healthy ruminant micro-flora, may increase 2 to 3 fold in new growth of for up to 3 months after a burn. In addition, levels of calcium and phosphorus, necessary for skeletal growth and energy availability, more than doubled in new growth of forage after a fire (Stransky and Harlow 1981). Establishment of food plots of native species such as joint vetch (*Aeschynomene americana*) could increase herd condition if done on a large scale. Joint vetch is a legume high in crude protein and minerals, reseeds itself for 2 years after the initial planting and mature plants tolerate inundation. In 1987, the Florida Department of Natural Resources planted small plots of joint vetch in FS totalling less than 1 ha that were browsed heavily by deer. Plants inside deer proof wire enclosures were approximately 3 times taller and much more dense than surrounding plants. During collections and track counts deer were frequently observed browsing in the plots. Food plots should be expanded in FS and created in CDU to include up to 0.5 % of the areas. Food plots should be planted in December-February to benefit females during the latter stages of gestation and fawns during early stages of growth. Because the dense canopy prevents growth of forage species in much of FS, wildlife openings should be created to allow early successional species to grow. The effect of openings on deer in FS was demonstrated by the clearcutting of the area in the 1940's. Benefitting from the tremendous increase in available forage, deer were 7 times more abundant than today (C. Chappell, pers. comm.). Clearcutting FS today would eliminate many unique areas of tropical flora, possibly extirpate many unique species and clearly would be irresponsible. However, a much smaller, more practical way to create openings would be to clear existing trams and the many older willow and myrtle thickets within the strand. A vegetation survey should precede clearing to avoid trams containing rare or endangered plants.

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Table 1. Adult male:adult female ratios in Corn Dance Unit (CDU), Bear Island (BI), Fakahatchee Strand State Preserve (FS), Collier Enterprises (CE), and Florida Panther National Wildlife Refuge (PR), from spotlight observations, 1984-1990.

AREA	YEARS	N	MALES	FEMALES	FAWNS & UNID	MALE:FEMALE RATIO
CDU	84-90	357	44	157	156	1:3.6
BI	84-90	370	63	145	162	1:2.3
FS	86-90	107	27	32	48	1:1.2
CE	86-90	195	22	60	113	1:2.7
PR	89-90	63	11	24	28	1:2.2

Table 2. Mean morphometric values of adult does collected in October 1986-1990 in Bear Island (BI) and Corn Dance Units (CDU) of Big Cypress National Preserve, Collier Enterprises (CE), Florida Panther National Wildlife Refuge (PR), Fakahatchee Strand State Preserve (FS). Values followed by the same subscript were not significantly different ( $p < 0.05$ ).

AREA	NO.	AGE	WEIGHT (kg)	LENGTH (cm)	GIRTH (cm)
BI	29	2.8	42.0 a	126.7 a	76.3 ab
CE	23	2.9	41.6 a	122.5 b	76.8 a
PR	24	3.3	40.7 a	124.7 ab	78.4 a
FS	22	2.5	37.6 b	119.1 c	73.2 b
CDU	22	2.4	31.5 c	108.9 d	66.9 c

Table 3. Mean physical condition values of adult does collected in Collier Enterprises (CE), Bear Island (BI), Florida Panther National Wildlife Refuge (PR), Fakahatchee Strand State Preserve (FS), and Corn Dance Unit (CDU), 1986-1990. Column values followed by the same subscript were not different ( $p < 0.05$ )

Area	No.	Age	Kidney fat index <sup>1</sup>	Tail fat <sup>2</sup>	Heart fat <sup>2</sup>	Peri-cardial fat <sup>2</sup>	Kidney fat <sup>2</sup>	Physical condition value <sup>3</sup>
CE	23	2.9	42.8 a	6.1 a	6.1 a	6.9 a	7.0 a	9.1 a
BI	29	2.8	40.4 a	5.6 a	5.3 ab	6.1 ab	5.5 b	8.7 a
PR	24	3.3	27.6 ab	4.0 b	4.3 b	4.9 abc	4.3 bc	7.1 b
FS	22	2.5	21.7 b	3.7 b	4.0 b	4.6 bc	4.3 bc	7.4 b
CDU	22	2.4	19.5 b	2.9 b	4.0 b	3.8 c	3.4 c	6.5 b

<sup>1</sup> Kidney fat index is calculated by the following: weight of the kidney fat/weight of the kidney X 100. It is expressed as a percentage.

<sup>2</sup> Fat levels were ranked from 1 - 9 with 1 representing very low or absent fat.

<sup>3</sup> Physical condition was ranked from 1 - 12 with 1 representing very poor condition.

Table 4. Mean reproductive condition of adult does collected in October 1984-1990. Asterisk indicates significant area difference ( $p < 0.025$ ).

AREA <sup>1</sup>	NUMBER	AGE	PERCENT PREGNANT	FETUS/ PREG DOE	NET PRODUCTIVITY
FS	22	2.5	68.2*	1.33	0.91
CDU	21	2.4	85.7	1.06	0.90
PR	24	3.3	91.7	1.14	1.04
BI	29	2.8	93.1	1.26	1.17
CE	23	2.9	95.6	1.31	1.26

<sup>1</sup> FS = Fakahatchee Strand State Preserve  
 CDU = Corn Dance Unit of Big Cypress National Preserve  
 PR = Florida Panther National Wildlife Refuge  
 BI = Bear Island Unit of Big Cypress National Preserve  
 CE = Collier Enterprises

Table 5. Mean APC's of adult deer collected in Bear Island (BI), Fakahatchee Strand State Preserve (FS), Corn Dance Unit (CDU), Florida Panther National Wildlife Refuge (PR) and Collier Enterprises (CE) 1986 - 1990.

	BI	FS	CDU	PR	CE
1986	847	1561			
1987	629	495	1060	1058	2422
1988	448	987	2158	1289	816
1989	1123	596	913	210	424
1990	582	713	948	893	538
MEAN	726	870	1270	863	1050

Table 6. Mean DAPA levels of adult deer collected in Fakahatchee Strand State Preserve (FS), Bear Island (BI), Corn Dance Unit (CDU), Florida Panther National Wildlife Refuge (PR), and Collier Enterprises (CE) 1986 - 1989.

	FS	BI	CDU	PR	CE
1986	0.726	0.730		0.782	
1987	0.664	0.552	0.616	0.761	0.605
1988	0.626	0.697	0.783		0.791
1989	0.760	0.693	0.753	0.751	0.783
MEAN	0.694	0.668	0.717	0.765	0.726