MANAGEMENT TECHNIQUES FOR THE EVERGLADE KITE PRELIMINARY REPORT

by

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ABSTRACT

Habitat management for the everglade kite (*Rostrhamus sociabilis plumbeus*) began at Loxahatchee National Wildlife Refuge in April 1971. The kite feeds almost exclusively on the apple snail (*Pomacea paludosa*), and efforts have been aimed at producing conditions similar to kite feeding areas in the everglades. The management unit received kite use from March to May, 1973. Investigations are now underway to determine which environmental factors limit apple snail growth and densities. This management approach shows excellent potential for long term success.

The endangered everglade kite is one of the most unusual raptors found in the United States. Feeding almost exclusively on a single species of snail and confined to peninsular Florida (Figure 1), this bird is now in peril because of man's interference. Bent (1937) reported a population decline as early as 1929-30 as a result of drainage and development associated with Florida's land boom. Habitat conditions have continued to deteriorate, and today the kite represents one of the rarest birds in North America.

Bent (1937) on his first visit to Florida in 1904 observed kites using the area now composing Loxahatchee National Wildlife Refuge. Intermittent kite use has been recorded (Stieglitz and Thompson 1967) on this area since the refuge was established in 1951. Kite management of Loxahatchee's fee title lands (Figure 2) was conceived after a close analysis of refuge habitat and objectives. Burgeoning water demands from South Florida's exploding human population caused widely fluctuating water levels on the 143,000-acre, leased portion of the refuge. This situation resulted in significant loss of habitat and declining kite use. Action was initiated in April 1971 to transform part of previously diked, fee title lands into suitable kite habitat. Natural production of the apple snail was of primary concern because of its unique relationship to the kite.

Consideration was given to the possibility of harming the kite by altering behavior through management. The kite is nomadic and quickly locates new snail concentrations. It feeds by hovering at the water's surface and dexterously plucking snails from submerged vegetation with its talons. The snail meat is then extracted with its specially adapted beak while on a perch. Production of snails under natural conditions will not alter the kite's ability to quickly locate and utilize traditional food sources.

Kites display a high tolerance for human disturbance, are gregarious, and tend to nest in loose colonies, (Howell 1932, Bent 1937, and Stieglitz and Thompson 1967). For these reasons the kite was considered an excellent candidate for management. The purpose of the refuge management unit is to provide a feeding area which takes into account the natural habits of the bird. Most importantly, this area will be permanently maintained in a flooded condition.

Most habitat suitable for everglade kite use has been destroyed by drainage, development, or invasion by exotic species. The little remaining habitat is subject to periodic loss caused by natural droughts and water level manipulations. If this unique bird is going to survive as part of our natural resource, habitat management techniques must be developed and implemented.

We gratefully acknowledge the assistance of the following individuals: Mr. Paul Sykes, Dr. Taylor Alexander, Dr. William Coyle, and Mr. Ron Willocks. We wish to extend special appreciation to our supervisors who gave wholehearted support to the project at a time when there were many doubts, and finally to the refuge staff whose efforts were essential to accomplish the job.

METHODS

The 352-acre study site (Figure 3) is situated on those fee title lands called the Headquarter's Management Unit. This parcel originally formed a transitional zone between a cypress strand to the east and typical everglades to the west. Now this unit is divided into a series of impoundments which were constructed some fifteen years ago for waterfowl management. From 1957 to 1971, these management efforts met with varying success. During this period occasional kites were observed on the area, but there was no extended use.

Early management was directed at controlling water levels for creating stages similar to pristine everglade slough conditions. Because of deterioration of water control facilities (Figure 3) it was necessary to replace six culverts and flashboard risers and the engine for the supply pump. Staff gauges were installed at appropriate points and monitored on a regular basis. Bottom elevations were established along two lines in each of five pools. All operational techniques and costs were documented for this study phase.

Vegetative transitions were analyzed using two techniques. Photos have been taken at six-month intervals since June 1972 from a number of permanently marked points. This photo series is expected to provide a pictorial essay covering a number of years. Reference photos have also been made of other areas in the state that have a history of kite use. Vegetative analysis was also conducted using the point transect method described by Sincock and Powell (1957). Transect sampling was completed for each pool in April 1973.

In early 1972 it was apparent that the density of emergent plant growth in management pools would limit the availability of snails for kites. After considering various methods of plant density control, a trail cutter (Figure 4) was selected, and work started in January 1973. This self-propelled craft cut a five-foot wide swath through the marsh. All vegetation and approximately one decimeter of bottom were chopped up and thrown aside.

Five snail egg sampling transects (Figure 3) of 165.8 meters by 1.22 meters were established in May 1972. Seven transects were added in March 1973. All unhatched snail egg clusters (Figure 5) were periodically counted along each transect line. An airboat was used for taking most of the counts (Figure 6), while others were accomplished on foot. Attempts to establish transects on leased portions of the refuge proved impractical because of the paucity of eggs.

On 9 June 1972, 4,800 mature apple snails were introduced into pools one, three, and four. These snails were collected the previous day at Lake Pansoffkee, Florida. This introduction was made because of extremely low snail populations in the pools which resulted from a long history of drainage type management.

During the summer of 1973, water quality tests were conducted on the management area and on other off-refuge sites. Field analyses were made with a Hach Kit, Model AL-36-WR, and laboratory analyses were conducted by a commercial laboratory. This laboratory also made nutrient analyses of soil and leaf samples from the same areas.

During the course of the study a fifteen-gallon aquarium was maintained at refuge headquarters. This aquarium was used to make casual observations relative to snail food preferences, growth rates, and reactions to stress. These snails were also being used in evaluating tagging procedures. Rouse (personal communications) described the snail tagging technique utilized. After drying a snail with a paper towel, the snail was cleaned with alcohol in the area of tag attachment. Numbered plastic tags (Howitt Plastics Co., Molalla, Oregon) were then immersed in a drop of clear, fast setting epoxy (Epoxo 88, Fasco Corp., Miami, Florida) that had been placed on the snail.

Limited snail sampling was conducted during the summer of 1973. An open ended cylinder with a cross sectional area of 25.09 square decimeters was used to isolate a column of water and bottom area. Twenty randomly selected sites were sampled along an offset from the snail egg sampling transect in pool #1. The cylinder, a standard 55-gallon drum with the ends removed, was worked into the muck approximately one decimeter; all vegetation, water, detritus, and several centimeters of muck were removed, washed, and snails collected. All snails were tagged, measured for greatest linear dimension, weighed, checked for volumetric displacement, and returned to the water. Also recorded at each sample station were water depth, dissolved oxygen, water temperature, time, number of unhatched egg clusters, and vegetation present.

Since the study area is located at refuge headquarters, it was relatively simple to make observations of the area in the course of daily routine. Endangered Species Biologist Paul Sykes has made extensive kite observations on other areas in the state (Figure 1), and he made significant contributions to the management program by offering his expertise.

RESULTS AND DISCUSSION

Water level management in Compartment "C" was analyzed for the twelve month period ending 31 March 1973. A typical bottom elevation is shown in Figure 7. The mean elevation for all lines was 4.29 meters (m.s.l.). Water levels during the period ranged from 4.78 meters (m.s.l.) to 5.03 meters (m.s.l.). During the first nine months water depths averaged 0.60 meters, and during the last three months depths averaged 0.69 meters. Higher levels were initiated in order to reduce emergent plant growth and regeneration. The fluctuation of these levels was not generally allowed to exceed one decimeter. This reduced the possibility the snail eggs might be inundated. Pumping operations were inefficient because of worn out equipment and water supply problems. This situation could conceivably lead to the loss of the project during a drought. This problem will be resolved with installation of a new pump which has recently been purchased.

Figure 8, Photo #1 shows a typical field after trail cutter operations in March 1973. Poto #2 illustrates the amount of emergent regeneration that occurred in four months. On the basis of such observations, an ongoing program of emergent vegetative control is considered necessary to insure suitable conditions for kite feeding. The trail cutter was an effective tool. However, continual breakdown of this antiquated equipment precluded any long-term use. Subsequently, a contract was awarded for the design and construction of a cutter specifically suited to present management needs.

Table 1 relates the results of the vegetative transects run in April 1973. This survey confirmed that the predominance of emergents (*Pontederia lanceolata, Sagittaria lancifolia,* and *Panicum hemitomon*) was greater than desired. Figure 9 shows conditions that are considered prime kite habitat. Such conditions provide a dominance of submergent plant growth with adequate emergents for snail egg laying and kite feeding.

Data obtained from snail egg cluster transects is displayed in Table 2. Of primary concern is the relationship between numbers of egg clusters and the total snail population. Preliminary studies suggest that snail egg laying is subject to seasonal fluctuation. Other variables which may affect egg laying are available nutrients, water temperature, dissolved oxygen, and snail densities. More data collection is necessary to analyze these factors.

The introduction of mature snails had little apparent effect on snail populations on the study area. Populations were estimated by counting snail egg clusters. This observation, however, assumes that snails have rather limited home ranges. This possibility will be considered during a second stocking effort in which tagged snails are released. The recapture of tagged snails should provide information relative to growth rates, movements, and mortality.

Investigations are now underway to determine which environmental factors are limiting snail densities. High snail populations have been observed in some areas of the state. The magnitude of one such population can be illustrated by an egg cluster transect and snail cylinder sample which were taken at Lake Okeechobee in June 1973. This transect contained 2,016 unhatched egg clusters. Study area transects have never resulted in more than 82 clusters on a single count (Table 2). Similarily, the cylinder snail sample at Okeechobee contained 98 snails, while 20 samples on the study area resulted in only 2 snails. Bartelt (1960), Nolan (1955), Rich (1971), and Rouse (1971) have indicated that water quality can seriously affect growth and reproduction in *Marisa cornuarietis*, another freshwater snail. Hurdle (personal communication) also believes that water quality plays a significant role in the life history of the apple snail. Rich (1971) indicates that algae as a sole food source affects *Marisa* adversely, and Eisenburg (1966) believes that food quality is important to the freshwater pond snail, *Lymnea elodes*. Preliminary analyses of water, leaf, and soil samples from the study area are now being compared to other sites showing high snail densities. Snail cultures will be established in the future. Regulating environmental conditions may provide insight into causes of these dense populations. Sampling and other data collection have not yet progressed sufficiently to form substantive conclusions.

Everglade kites were observed in the management area from 2 March to 4 May 1973. Heaviest use occurred in March when a peak of 21 birds were observed feeding. Courtship displays and nesting behavior were noted, but no nests were built. Almost all feeding was concentrated in pools one through five of Compartment "C". Management of these pools had shown the greatest degree of progress relative to snail production and availability. These same pools showed a reduction in snail egg laying during the summer of 1973. One may speculate that kites in concert with boat-tailed grackles (*Cassidix mexicanus*), limpkins (*Aramus guarauna pictus*), and other wildlife significantly reduced the number of adult snails. Some other environmental factor may have caused the reduction (e.g., reduced levels of dissolved oxygen during night periods). It may also be possible that as adult snails increase in numbers beyond an unknown point, egg laying correspondingly decreases.

CONCLUSIONS

Water levels can be economically controlled to approximate high water conditions in the everglades prior to drainage. Snail populations on the management unit have not approached the high densities seen in other areas of the state, but have far exceeded densities observed on the leased portion of the refuge. Kite response to management was unexpectedly rapid, and kite use much greater than was thought possible on a relatively small area at this stage of maturity.

A food chain that is as unusual as the apple snail - everglade kite relationship is seldom found in nature. It offers an ideal opportunity for intensive research and management. Continued research into the life history of the apple snail and kite is of utmost importance if management techniques are to be fully developed. The everglade kite can remain a viable part of the fauna of this country, but only through careful attention to maintenance of natural habitats and through sound management practices.

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Table 1. Frequency and occurrence of plants sampled in management pools.

Plants	Total Sampled	Percent
Pontederia lanceolata	2169	28.7
Sagittaria lancifolia	1828	24.3
Panicum nemitomon	1089	14.4
Unoccupied space	913	12.1
Utricularia spp.	464	6.2
Bacopa caroliniana	374	5.0
Cladium jamaicensis	164	2.2
Unidentified	105	1.4
Chara sp.	97	1.3
Eleocharis elongata	76	1.0
Panicum paludivagum	67	0.9
Crinum americanum	44	0.6
Nymphaea odorata	40	0.5
Eighteen species sampled less than twelve times each	102	1.4
	7532	100

Table 2. Number of unhatched snail egg clusters sampled in management unit since May, 1972.

Date	Snail Egg-Clusters/Transect											
	#1	#2	#3	#4	#5	#6	#8A	#8B	#9	#10	BS	BN
5/72	3	9	3	3	1	--	--	--	--	--	--	--
7/72	9	3	5	1	0	--	--	--	--	--	--	--
9/72	68	52	11	9	25	--	--	--	--	--	--	--
3/73	32	52	82	27	33	70	14	20	8	37	1	0
4/73	50	49	38	18	25	46	14	2	4	20	10	0
6/73	10	32	29	19	23	29	20	18	17	41	24	3
7/73	12	17	18	20	17	17	17	16	38	40	22	3

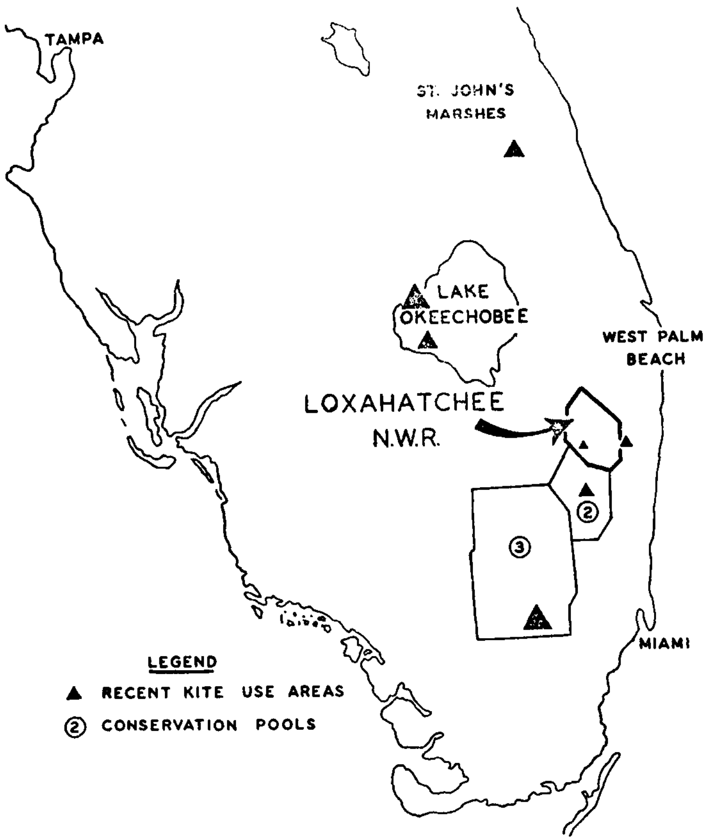

Figure 1. Location of areas with a recent history of everglade kite use.

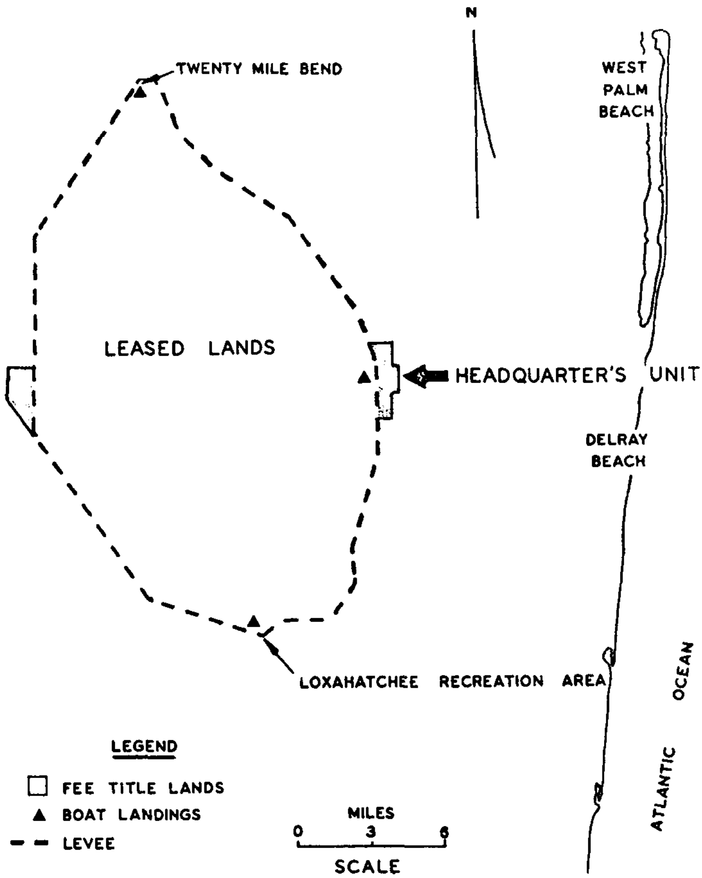

Figure 2. Relationship of the management area to other refuge lands.

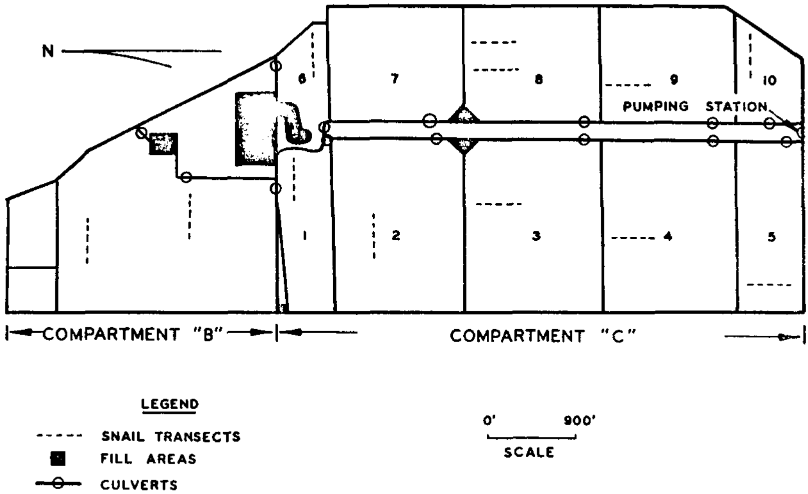

Figure 3. The kite management unit with associated water control structures and snail egg cluster transects.

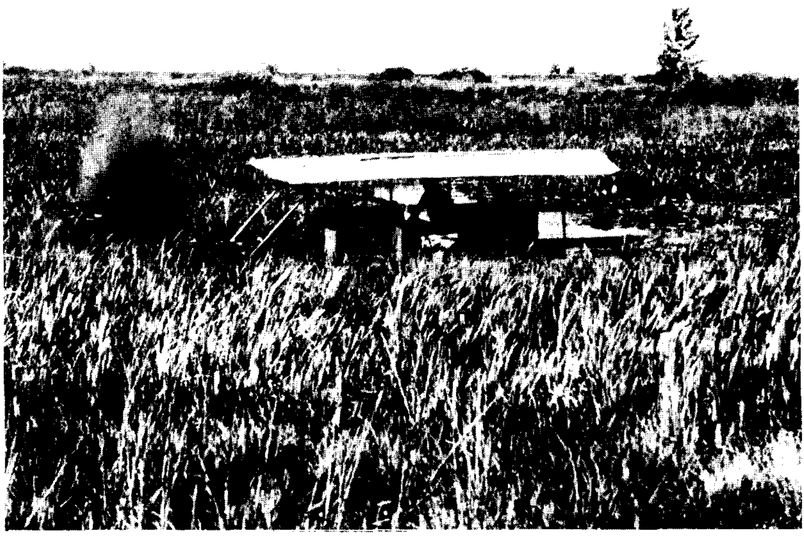

Figure 4. Trail cutter used for reducing emergent plant growth.

Figure 5. Apple snail egg clusters.

Figure 6. Snail egg-cluster sampling technique.

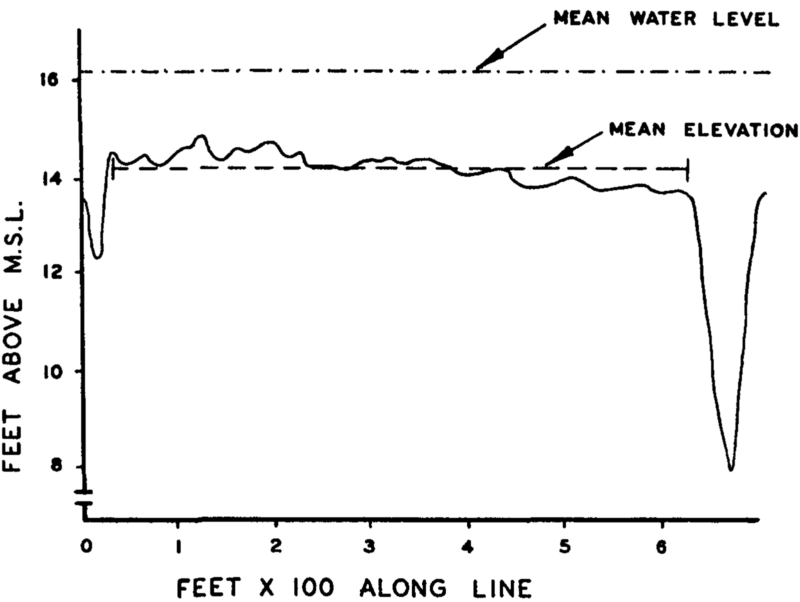

Figure 7. Typical bottom elevation along a north-south line in Pool #1.

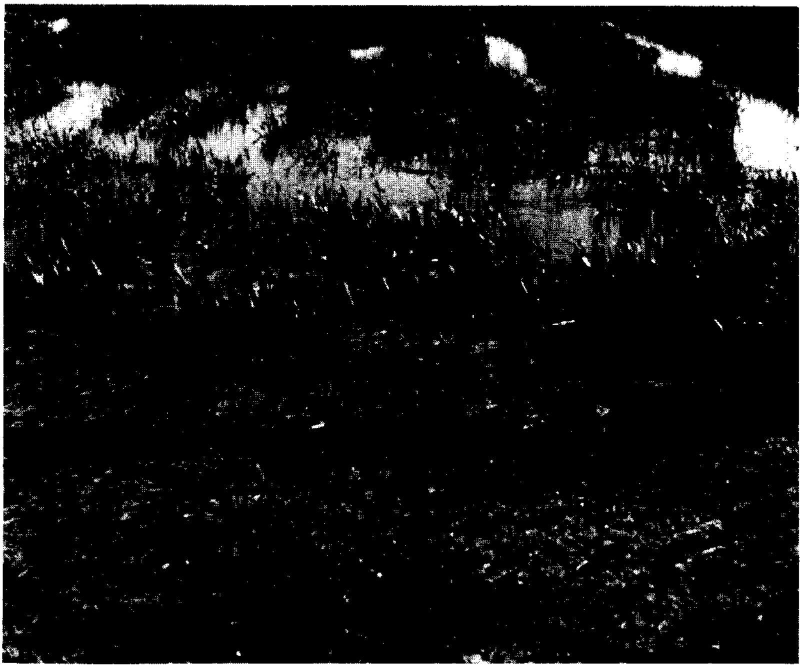

Figure 8. Photo #1 - Pool #9 immediately following trail cutter operations.
Photo #2 - Pool #9 four months following trail cutter operations.

Figure 9. A preferred kite use area.