# REPRODUCTION AND MORPHOLOGY OF THE WEST INDIAN RUDDY DUCK IN PUERTO RICO

By

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REPRODUCTION AND MORPHOLOGY OF THE

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IN PUERTO RICO

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# BREEDING BIOLOGY, PRODUCTIVITY AND STATUS IN THE WEST INDIAN RUDDY DUCK IN PUERTO RICO

By Alexis Molinares

## INTRODUCTION

The West Indian Ruddy Duck (Oxyura jamaicensis jamaicensis Gmelin) is one of four, perhaps five, native duck species in Puerto Rico. Nesting evidence of the Fulvous Whistling Duck (Dendrocygna bicolor) is inconclusive and its status is still unresolved. Other resident waterfowl includes the West Indian Whistling Duck (Dendrocygna arborea), White-cheeked Pintail (Anas bahamensis) and the Masked Duck (Oxyura dominica).

Accounts on the birdlife of Puerto Rico go back to the nineteenth century (Gundlach, 1878). Gundlach's studies proved to be very useful references with regard to the basic life history information needed for the development of sound management strategies. He found O. j. jamaicensis to be a common duck at Guanica Lagoon (southwestern Puerto Rico) and reported nesting at this locality. Nonetheless, Wetmore (1916) regards the species as a "regular migrant to Porto Rico", though he did not observe any. Later Struthers (1923) found 22 nests at Anegado Lagoon (southwestern Puerto Rico) between December and March 1921-1922. After this date the duck was considered an abundant permanent resident of Puerto Rico (Danforth, 1926, 1931; Wetmore, 1927; Leopold, 1963). By mid-1960's ruddy ducks were considered to be the only native duck which existed in "fair" numbers (Mc Candless, 1962). However recently the species has become increasingly rare (Bond,

1971; Biaggi, 1974; Raffaele, 1974, 1975; Sedwick, 1977; Belitsky, 1978). As a result the take of ruddy ducks was forbidden in the 1975-76 hunting season. This restriction continues at present, due mainly to the steady reduction in numbers observed during the previous decade. In 1973, the species was classified "on the verge of being endangered" (Department of Natural Resources, 1973), a status that changed in 1977 when the species became listed as endangered in the Commonwealth of Puerto Rico (Departamento de Recursos Naturales, 1977). So far two main factors are associated with the drop in numbers of the resident waterfowl, namely, habitat loss and modification and illegal hunting (James Wiley, pers. comm.).

In North America, the basic biology and some aspects of the ecology of the North America form (O. j. rubida) have been studied extensively. Siegfrid (1973, 1976) studied breeding biology and nest parasitism. Social organization has also received consideration (Siegfrid and Roy 1976). Joyner (1978) discussed some aspects of molting and Siegfrid, et al. (1976) deals with incubation. A descriptive study of behavior (Johnsgard 1965, 1966; Joyner, 1977) plus life history summaries (Delacour, 1959; Johnsgard, 1975; Blake, 1977; Bellrose, 1978) also have been reported.

I present here data on duckling attrition, periodicity in breeding activity, site preference, density estimates, distribution and habitat characterization for two study sites: Santa Teresa Lagoon (Humacao) and Buchanan Pond (Cataño). This research will provide baseline information to facilitate a comprehensive restoration program to assure the welfare of the species in Puerto Rico.

## STUDY AREAS

The two study areas were; Buchanan Pond located in the U.S. Army facilities at Fort Buchanan, Cataño, and Santa Teresa Lagoon on state road number 3 , kilometer 75.7, Humacao (Fig. 1). The former was built as a reservoir to provide water to a concrete plant some 0.5 kilometers away. During the past 15 years it has been used exclusively as a wildlife and recreation areas were consumptive and non-consumptive activities are permitted under a set of regulations. Neither swimming nor hunting are allowed. Boating, canoing, fishing and bird watching are permitted but not promoted.

Santa Teresa Lagoon is part of a larger estuarine system drained for agriculture during 1940's. A complicated system of channels, dikes and water pumps was used to maintain the area for sugar cane production and pasture. During 1979 pumping operations ceased after a mechanical failure coinciding with the opening of a dike. As a result the area became flooded and remains flooded at present. Hydrophytic species are becoming more prominent as the area reverts to a more natural condition. Tidal changes occur, but are limited by the reduced connection between Santa Teresa and the Caribbean Sea.

Buchanan Pond's shore vegetation is composed primarily of Cattail (Typha dominguensis), Panicum Grass (Panicum muticum and Eleocharis interstinta, while the predominant shore vegetation of Santa Teresa Lagoon consist of Panicum Grass (Panicum muticum), P. acuaticum, Hymenanchne amplexicaulis, Paspalum virgatum and Eleocharis caribaea. A summary of some physical and biological

parameters is presented (Table 1).

The water bodies surveyed for the distributional study were: Humacao Lagoons, Boquerón Refuge, Lake Bronce, Buchanan Pond, Lake Caonillas, Lake Carite, Cartagena Lagoon, Cataño Marsh, Cayúre Lagoon, Lake Cidra, Dorado Beach Hotel Ponds, Lake Dos Bocas, Lake Five, Lake Guajataca, Lake Guayabal, Lake Melania, Lake Patillas, Lake Ponceña, Lake La Torre, and Vista Alegre Lagoon (Fig. 1). These constitute a "representative" array of the different habitat types available for ruddy ducks in Puerto Rico and those areas from which historically they were known to occur.

## MATERIALS AND METHODS

The summer distribution and population levels of the West Indian Ruddy Duck were determined by direct observation from vehicle, by foot and by boat. To gain access to some areas off-road vehicles were used. Surveys on foot were conducted in those areas for which the type of vegetation cover required a more effective technique. A 16-foot Kayak was used for those areas in which no other type of survey technique could furnish access. A 14-foot "John boat" was used to cover the larger lakes. A spotting scope (Zoom 15-60X) and two binoculars, (8 X 50 and 7 X 35) were used to make all observations. A total of 430 party hours of observations and 17,600 vehicular kilometers (driven between survey sites) were completed in the field. Study areas were surveyed during all daylight hours. This summer distribution study was conducted from June to August, 1979 and is referred to as Phase I.

The second phase of the study extended from January-December, 1980 and involved duckling attrition breeding activity periods, site preferences and habitat characterization for two sites: Santa Teresa Lagoon, Humacao and Buchanan Pond, Cataño. Breeding phenology was determined using brood counts and by back-dating to estimate approximate date of egg laying. I tried to utilize frequency and intensity of courtship displays observed during 12-hours observation sessions (n=25) to assess breeding dates. However, the waryness and the ability of individual ducks to flee and hide, mostly in response to human disturbance, made our estimates incomplete and unreliable, and courtship display counts were discontinued.

After a brood was detected through observation from the blind, the rate at which young disappeared was recorded. Observations were carried out in the early mourning hours when broods were more active. After a preliminary count of ducklings/brood was made, the lagoons shores were intensively searched to find missing ducklings. Only three broods with the complete sequence, from brood detection to the single hen, were used in this analysis. In three instances ducklings were observed in study areas but no data were obtained due to difficulties in revisiting the area or inclement weather. Breeding activity on the two study areas were used to predict breeding chronology and suggest the peaks(s) in production of young by West Indian Ruddy Ducks.

Samples of the predominant shore vegetation were collected from the study areas and identified. Determination of the Santa Teresa Lagoon and Buchanan Pond dimensions were completed using

quadrangles (U.S.G.S., 1966) and a compensating polar planimeter (Lasico Co.). Field inspections were conducted to verify quadrangle estimations. In additions, bathymetry on the Buchanan Pond was completed using direct measurements with a metric rope.

Preference for different sections of the Pond was determined through observations of two individuals over 25 evenly-spaced observation periods in one day. Each observation bout consisted of 10 minutes of observations every 30 minutes. Facial characteristics (marks) were used to identify different individuals (Molinares, ms.). The data were analyzed using Chi-square test (Duncan et al. 1978). Although expected frequencies less than five were calculated for some cells, this constraints does not impair the power of the test (Cochram, 1954; Hopkins and Glass, 1978).

Population numbers were expressed as average number of ducks observed in each lagoon based on periodic (weekly, bi-weekly or monthly) surveys. A schematic representation of the weather condition during 1980 is presented in the form of Walter's Climatic Diagrams (Walter, 1973).

## RESULTS AND DISCUSSION

### Distribution

During the fiscal years 1973-1978, information concerning the status of the West Indian Ruddy Duck was collected by members of the Commonwealth of Puerto Rico Department of Natural Resources. Raffaele's study in 1974 was affected by a severe drought that impacted the Island's waterfowl, and hence some of his observations

and results must be considered atypical. Sedwick (1977) surveyed more than 40 locations in search of waterfowl, most of which were fresh water bodies. His study, like all the others, was under a major proposal to study several species of native waterfowl.

A total of 20 locations was surveyed intensively for this study. Study sites can be divided in four different aquatic systems: reservoirs, irrigation lakes, fresh water lagoons-ponds and brackish water lagoons. Ruddies were present in only 5 of the 20 survey sites (Table 2). In all the reservoirs visited, no Ruddy Ducks were observed. Reasons for their absence night include: fluctuations in water level, heavy human disturbance, absence of good cover, insufficient submerged vegetation, and excessive quantities of Water Hyacinth (Eichornia crassipes). These lakes could be adequately searched on a single visit, since the extremely poor vegetation cover in the shores and the inability of ruddies to venture inland should have made them visible.

None of these lakes could be considered as potentially "good" areas for future production of Ruddy Ducks. It seems that previous sightings on such lakes are attributable either to wintering O. j. rubida or transient O. j. jamaicensis. The low number of ducks reported by Sedwick (1977), i.e., 1 in Cidra, 1 in lake Guayabal, does not represent an established population. Hence reservoir lakes in inland Puerto Rico do not seem to be a significant component of the summer distribution pattern of the species.

One locality that in the past supported great numbers of Ruddy Ducks, Cartagena Lagoon (Danforth, 1926, 1931) was surveyed

three times, though no oxyurids were seen (Table 2). People living close to the lagoon reported that ruddies no longer occur there. This lagoon, once considered the main breeding habitat of the species, has become less productive each year, as large areas have been invaded by Cattail and Water Hyacinths, the latter an indicator of euthrophic conditions. The absence of Ruddy Ducks from the Boquerón Refuge, only 5 km from Cartagena, may be due to: (1) reduction in habitat along the southwestern part of the Island (2) the overall drop in numbers, or (3) the types of habitat available at the Refuge, which include mostly brackish ponds and mangroves. Both are marginal habitat for the West Indian Ruddy Ducks in Puerto Rico (Raffaele, 1974).

The Cataño Marsh, which lies within the San Juan Metropolitan Area, and some 3 kilometers from the Buchanan Pond, consists of a dense stand of Cattail surrounding a complex of four lagoons. Although only a single Ruddy Duck drake was observed, Mr. Jaime González (pers. comm.) point out that ruddies tend to use this area intensively. The impenetrability and extensive nesting cover may prove to be important elements when considering areas like this one, devoid of protection. Local residents have confirmed that they take eggs of various species from nests in the marsh, but how this affects the Ruddy Duck is not known. Nonetheless, the relative large size of Ruddy Duck eggs makes them a very attractive prey to eggers.

Buchanan Pond is located within the U.S. Army facilities at Fort Buchanan. It has supported a ruddy duck population of 13-15

ducks in some seasons (Ed Hill pers. comm.). During the summer study this area was surveyed four times and an average of 3.5 ducks per visit was seen (Table 2). On all occasions females were observed in the Pond, something that was not a common occurrence during Raffaele's (1974) studies. However no nesting activity has been reported from the pond since 1976 (Sedwick, 1977). The amount of human disturbance around the pond is evident. Two pairs of Domestic Mallards (Anas platyrhynchos) have been released in the pond, and Mongooses are also common around the pond. In July, all the ruddies disappeared and for more than 3 weeks none of them were seen in the pond. Personnel from the Energy and Conservation Office visited the Pond during this period with no Ruddy Duck sightings. A pair, the drake in basic plumage, was observed in the pond on August 5. The disappearance and return of birds suggest some degree of inter-habitat movement.

The Humacao Lagoons System was visited twice and a total of 13 birds were seen (Table 2). This included a recently inundated area and an old marsh systems. Although Sedwick (1977) was unable to find any ducks there, the magnitude and location of the system proclaim it as a potential waterfowl habitat.

A complex of irrigation lakes was surveyed (Table 2). Poorly developed vegetation cover, intensive human use, drastic water level fluctuations associated with irrigation practices and a pronounced wet and dry season reduce the suitability of these lakes for ruddies. Only two lakes, Vista Alegre and La Torre have some kind of aquatic vegetation that may provide cover. Due to the short distance between

these lakes, ruddies may be utilizing, alternatively, one or the other lakes depending on disturbance level or any of the limiting factors mentioned earlier. Lake Five considered a promising site for Ruddy Duck breeding (Raffaele, 1974) and Lake Melania with a 71.5 percent of sighting success (Sedwick, 1977) did not produced the sighting of a single duck during the summer study. Another area of relatively poor value is the Dorado Beach Hotel Pond System, which is surrounded by a golf course and under intensive maintenance regime.

Cayúre Lagoon is located on the western portion of Puerto Rico and is formed by a depression surrounded by mountains. This low-land is covered with emergent and floating vegetation but heavily infested with Water Hyacinths. This lagoon was the only place on the Island where evidence of actual reproduction was obtained during phase I. Two broods of six and 2 ducklings were recorded.

It is clear from this survey that reservoirs are inappropriate for Ruddy Duck's activities even so they represent a considerable amount of the hectares available, and those seen may reflect the temporary use by moving flocks. The following areas are considered of critical importance and should be considered in any further analysis of the problems encountered by the resident waterfowl: Cayure, L. Ponceña, Humacao Lagoons, Cataño Marsh, Buchanan Pond, and Cartagena.

Breeding Biology

Data from several authors suggest year round egg laying activity of the West Indian Ruddy Duck in Puerto Rico with the exception of

June-July (Fig. 2). These studies cover year-long periods so as to produce egg laying dates not biased estimates by the date when the research was conducted. Nonetheless these studies, describe the onset of reproduction but lack any quantification as to determine actual peaks. Two egg laying periods were observed in this study, one during February-May, and another covering October. Backdating from brood detection dates was used to estimate egg laying, since low population numbers and the disturbance associated with active nest location favored the former as a more practical technique.

Breeding activity occurred at Buchanan Pond during both activity periods, however at Santa Teresa Lagoon egg laying was recorded only from the February-May activity period (Fig. 2). This asynchronous pattern between study areas should not be attributed solely to differences in water regime, although Raffaele (1975) has shown, with very little evidence, that Ruddy Ducks and White-cheeked Pintail respond with an increase in egg laying activity after a rainy season. On the other hand, study sites are coastal aquatic systems dominated by a maritime climate. During 1980 both study sites maintained stable water levels, even so, June and July resulted in a below average precipitation at Buchanan, producing a slight drought (Fig. 3). Conversely, Buchanan Pond is a fresh water pond while Santa Teresa is considered an estuarine lagoon (Colón et al. 1980, Table 1). Ruddies are essentially fresh water ducks (Bellrose, 1978; Johnsgard, 1978; Raffaele. 1974) using brackish water ponds as marginal habitat. In the past, severe dry seasons have been associated with mass duck migration and abandonment of breeding areas

(Raffaele, 1974, 1975). However, Santa Teresa Lagoon and Buchanan Pond are permanently flooded basins capable of maintaining optimal water conditions even during extended dry seasons.

Of the six broods detected in 1980, three occurred on Buchanan and three on Santa Teresa Lagoon (Fig. 4). Three (3) of them were followed and the rate at which ducklings "disappeared" was recorded (Fig. 5). Some of this attrition may have resulted from disturbance associated with brood searches. Nevertheless, no recruitment was observed from both study sites during 1980, from a total of 25 ducklings produced (13 at Buchanan and 12 at St. Teresa). Direct evidence of this come from the fact that no juveniles were observed for more than 9 days following initial detection. Also, substantial human disturbance around study sites' shores occurs daily especially at Buchanan. Differences in developmental stages of ducklings enabled positive identification of individual broods. Bellrose (1978) reported an average brood size of 5.69 for Class I broods. Danforth (1926) observed an average clutch size of 6 to 7 for ruddies nesting at Cartagena Lagoon, but did not mention brood sizes. The average brood size for Class I broods observed in the two study sites was 4.16 ducklings/brood.

Clutches and, consequently, brood sizes, are smaller in tropic zone birds vs. temperate zone birds (Cody, 1966), yet neither egg production nor hatching success seems to be the main problem causing the low recruitment rates of resident ruddies. Ruddies seem to be producing full clutches, evidenced by observed brood sizes and compared with those for the North American Ruddy Duck (Bellrose,

1978). However, ducklings are having difficulties surviving under the set of pressures to which they are subject at present. In Buchanan Pond as well as St. Teresa Lagoon, ducklings of the broods studied disappeared progressively in the first 10 days after brood detection, which means during the first 3 weeks after hatching. To maintain numbers, Buchanan Pond must receive an influx of individuals from other localities such as Cataño Marsh. The abandonment of St. Teresa Lagoon by ruddies during the September-December period suggest inter-habitat movement with Culebra or Vieques. The latter reported as a new breeding location by 1978 (Belitsky, 1978).

Other than illegal hunting and destruction of habitat, some additional factors depress somewhat the production of ducks. Ruddy Ducks always have been considered a highly-prized kill. The contribution to the hunters bag declined from 68.87 (885) percent in 1960 to 11.6 (224) in 1973 (Márquez, 1973). This decline is attributed to a reduction in numbers of the duck and not to changes in hunter preferences since they continually question the prohibition, and plea for the release of the prohibition concerning this species.

At Buchanan Pond some four exotic waterfowl species have been released; these utilize the pond intensively and breed successfully there. Species present includes Mallard (Anas platyrhynchos), Muscovy Duck (Cairina moschata), domestic geese and unidentified hybrid ducks. During Phase I two pairs (one Mallard, and one domestic geese) were observed at Buchanan, this number increase to 11 by August 1980, and at present there are 23 birds, not including ruddies. From a single hen found nesting in the Island at the

center of the pond during May, eight out of a clutch of nine hatched. Four weeks later seven were counted.

Aggressive interactions between escorting Ruddy Duck hens and exotic species were recorded in many instances. Ducklings of the latter were obviously frightened by the approaching Muscovies, which are capable of catching, injuring, or even killing young. No actual fights were observed. In these interactions the hen attending the brood abandoned it to pursue the approaching birds.

The direct effect of human disturbance is altering the normal behavior and activities of Ruddy Ducks in a small pond like Buchanan. Ruddy ducks are showing preferences (Table 3) for deepest sections of the pond (Fig. 6) when human disturbance is moderate, as it is most of the time, and moving ashore to conceal themselves when the disturbance is greater. The deepest sections also correspond to the more distant points from shore, so it may be either a preference for deep waters or a strategy to tolerate some degree of disturbance.

In 1979 Buchanan Pond was enclosed with a fence and the littoral zone shore vegetation was permited to grow. During the next breeding season (1980) ruddies produce young. Reproductive activities have taken place since then. This suggests that isolation is an important mechanism to induce reproduction on small lakes. At Santa Teresa Lagoon, a much larger water body, isolation is attained by means of a buffer zone of the grass Paspalum virgatum. Here water quality, estuarine (Colón et at. 1981), and early successional stages presumably prevent the lagoon from sustaining a larger

population of ruddies. Buchanan supported double the number of ducks when compared with Santa Teresa (Fig. 7), although the latter is ten times larger than the former.

Although mongooses (Herpestes auropunctatus) are presumed to be a most serious threat to Puerto Rico's wildlife, preliminary evidence of a stomach contents from one mongoose trapped at Buchanan during July 1980 (when duckling losses were recorded) proved to be negative (Ed. Hill pers. comm.), and new data must be gathered in this respect. Seaman (1952) reported that evidence of eggs, wild birds, or domestic fowl in the diet of mongooses was very meager. Mongooses also prey heavily upon lizards, snakes, and insects. Even so, the ability of mongooses to swim complicates reproduction for ruddies, which are platform nesters. At Buchanan Pond, one of the best vegetated areas within the army base, predators such as the Black Rat (Rattus rattus), the Norway Rat (Rattus norvegicus), and the mongoose are very abundant.

At present the effect of mammalian predators upon duck production is not clearly understood, since exotic ducklings do not seem to be severely affected by those predators. Even so, they spend more time on firm land and therefore they are expected to be more susceptible to predation, something that is not consistent with the number of ducklings surviving to fledge or to the observed increase in numbers. However, exotics receive a considerable amount of food from curious people that visit the pond, food that is not available for ruddies, since their food habits and behavior impose a barrier to exploit this alternate food source. Also young and adults of these

domestic species receive some degree of protection through this intimate contact with humans.

One of the most common species capable of affecting breeding success at Buchanan seems to be the Antillean Painted Turtle (Pseudemys terrapen). The turtles sun on many excellent spots that can be used for nesting. Also I have observed frequently Ruddy Duck ducklings being harrassed and bitten by turtles, but not killed. A specimen of the turtle present was captured and positively identified by the author as Pseudemys terrapen. Sedwick (1977) reported the turtle found in high density as Musk Turtle (Staurotypus sp.), an identification which proved to be erroneous. There is at least one other turtle present in the Pond which may be either slider or musk, both of the commonest species sold in pet shops (Zim and Smith, 1956).

Another potential predator is the introduced Bullfrog (Rana catesbiana) which is certainly capable of taking ducklings. These are also quite common at the pond.

Although there are many management alternatives to help our waterfowl reproduce, most of them are limited by the lack of resources (mostly funds). In the near future research projects should be initiated to provide additional data and solutions to all of Puerto Rico's endangered wildlife. The West Indian Ruddy Duck exemplifies the way in which stressing forces on a limited resource may affect recruitment.

Waterfowl in general are suffering from reduced populations on the Island, which in fact restricts the options for research and

increases species' vulnerability. The welfare of the Ruddy Ducks in Puerto Rico is going to depend largely upon implementation of practices to increase the quantity and quality of the habitat in which they live, promotion of a better understanding of the natural history of species and to try to determine the primary causes of brood attrition.

Measures to regulate vigorously the use of wetlands, and to maintain the quality of the waters by coordinated actions with farmers and developers must be stressed. Actions to help in the recovery of the O. j. jamaicensis must be initiated in three fronts, administrative, investigative and operational. Regulations and prohibitions on the take of the duck should be maintained since population levels now do not show any appreciable increase. At present there should be approximately 140 resident ruddies in the Island, as indicated by the survey in phase I of 2,216 hectares of the approximately 18,303 hectares of wetlands (Commonwealth of Puerto Rico, 1980), and observed an average of 17.28 ducks. This population would not be able to tolerate the high kill rate observed in previous years without detrimental effects to the species. Efforts must be continued as to determine with accuracy the habitat requirements and establish the contribution of migratory ruddies.

Since isolation seems to be one of the most important factors affecting reproduction, increased interspersion of open water and emergent vegetation should increase isolation, reduce disturbance and, through an increment in nest density, produce more ducks. Measures to control predators in small productive ponds in highly recommended. Unless these actions are not commenced the survival of the subspecies in Puerto Rico will be in jeopardy in the foreseeable future.

## SUMMARY

The study of their summer distribution has shown that Ruddy Ducks prefer coastal fresh water ecosystems. Reservoir types of lake cannot be considered to be a significant component of the summer distribution pattern of the species. There are two periods of activity in egg laying for the Ruddy Duck in Puerto Rico. One extends from February-May and the second occurs during October. High duckling mortality after hatching and before Class II seems to be the main reason for the low recruitment of ruddies on study areas.

Human disturbance, predation by Antillean Painted Turtles, Bullfrogs, exotic terrestrial mammals, as well as interaction with domestic waterfowl, the marginal nature of brackish water systems and the absence of effective isolation could be the actual causes of the high attrition of ducks on study areas.

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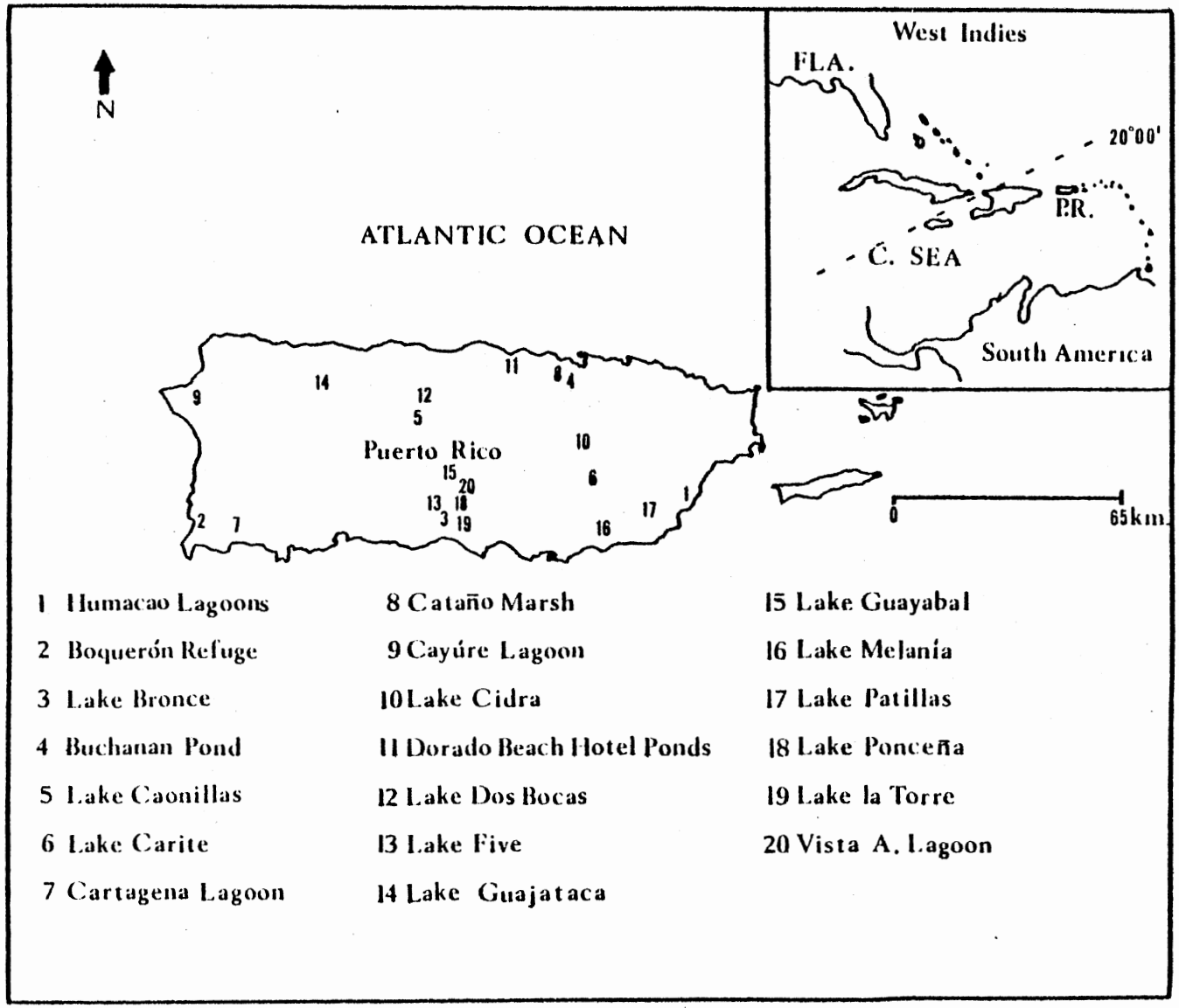
Figure 1. Location of study areas of Phase 1 and Phase II.




1 Humacao Lagoons
2 Boquerón Refuge
3 Lake Bronce
4 Buchanan Pond
5 Lake Caonillas
6 Lake Carite
7 Cartagena Lagoon
8 Cataño Marsh
9 Cayúre Lagoon
10 Lake Cidra
11 Dorado Beach Hotel Ponds
12 Lake Dos Bocas
13 Lake Five
14 Lake Guajataca
15 Lake Guayabal
16 Lake Melanía
17 Lake Patillas
18 Lake Ponceña
19 Lake la Torre
20 Vista A. Lagoon

TABLE 1.

PHYSICAL AND BIOLOGICAL PARAMETERS OF STUDY SITES MEASURED DURING 1980.

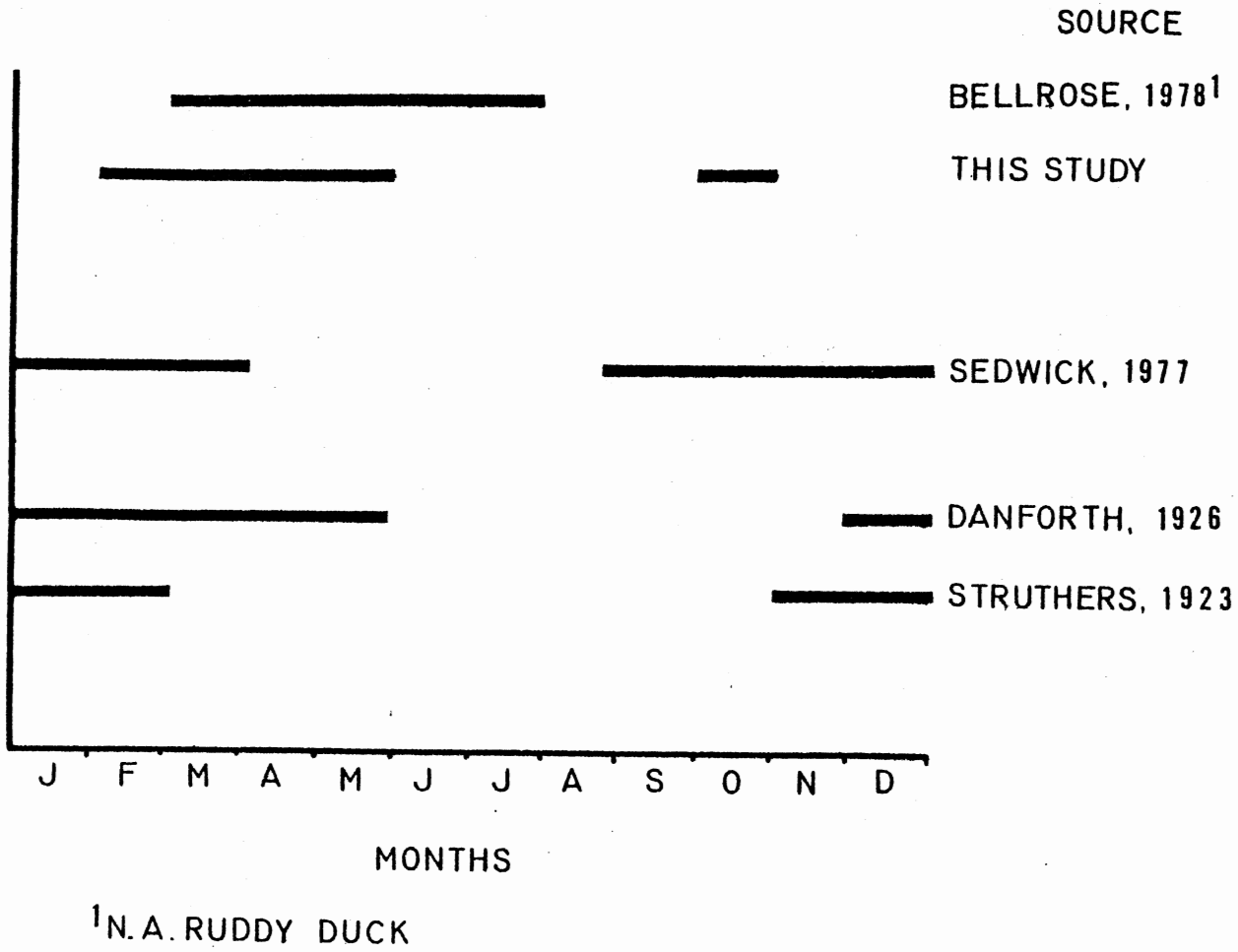
| | BUCHANAN P. | ST. TERESA L. |
|---|---|---|
| Size | 3.2-ha | 33.1-ha |
| Classification | fresh water pond | estuarine lagoon |
| Mean Depth | 3-5m | 1.5m |
| Percent Open Water | 90 | 80 |
| Emergent Vegetation | cattail/grasses | grasses |
| Protection From Human Disturbance | fence | tall grass |
| Mongoose | present | present |
| Rats | present | present |
| Turtles | present | none |
| Exotic Waterfowl | 4 spp. present | none |
| Number of Resident Ruddies | 7.9 | 4 |
| Broods Produced | 3 | 3 |

TABLE 2.

RUDDY DUCKS PRESENT IN WATER BODIES IN INLAND PUERTO RICO DURING SUMMER 1979.

| SITE | SIZE (ha) | Times Visited | Total No. of Ducks | Average No. of Ducks/Visit |
|---|---|---|---|---|
| Large Reservoirs | | | | |
| Lake Caonillas | 280 | 1 | 0 | .0 |
| Lake Carite | 133 | 1 | 0 | .0 |
| Lake Cidra | 170 | 1 | 0 | .0 |
| Lake Dos Bocas | 250 | 1 | 0 | .0 |
| Lake Guajataca | 320 | 1 | 0 | .0 |
| Lake Guayabal | 125 | 1 | 0 | .0 |
| Lake Patillas | 125 | 1 | 0 | .0 |
| Irrigation Lakes | | | | |
| Lake Bronce | 10 | 2 | 0 | .0 |
| Lake Five | 15 | 3 | 0 | .0 |
| Lake Melania | 15 | 2 | 0 | .0 |
| Lake Ponceña | 20 | 5 | 6 | 1.20 |
| Lake La Torre | 5 | 1 | 0 | .0 |
| Vista Alegre Lagoon | 5 | 1 | 0 | .0 |
| Fresh Water Lagoons and Ponds | | | | |
| Buchanan Pond | 3 | 4 | 14 | 3.50 |
| Cartagena Lagoon | 30 | 3 | 0 | .0 |
| Cayúre Lagoon | 20 | 4 | 23 | 5.75 |
| Cataño Marsh | 20 | 3 | 1 | .33 |
| Dorado Beach Hotel Ponds | 10 | 1 | 0 | .0 |
| Brackish Water Lagoons | | | | |
| Boquerón Refuge | 170 | 2 | 0 | .0 |
| Humacao Lagoons | 490 | 2 | 13 | 6.50 |
| TOTAL | 2216 | 40 | 57 | 1.43 |

Figure 2. Summary of egg laying activity periods for the West Indian Ruddy Duck in Puerto Rico




[1]N.A. RUDDY DUCK

Figure 3. Water's Climatic Diagrams for Santa Teresa Lagoon and Buchanan Pond (N.O.A.A., 1981)

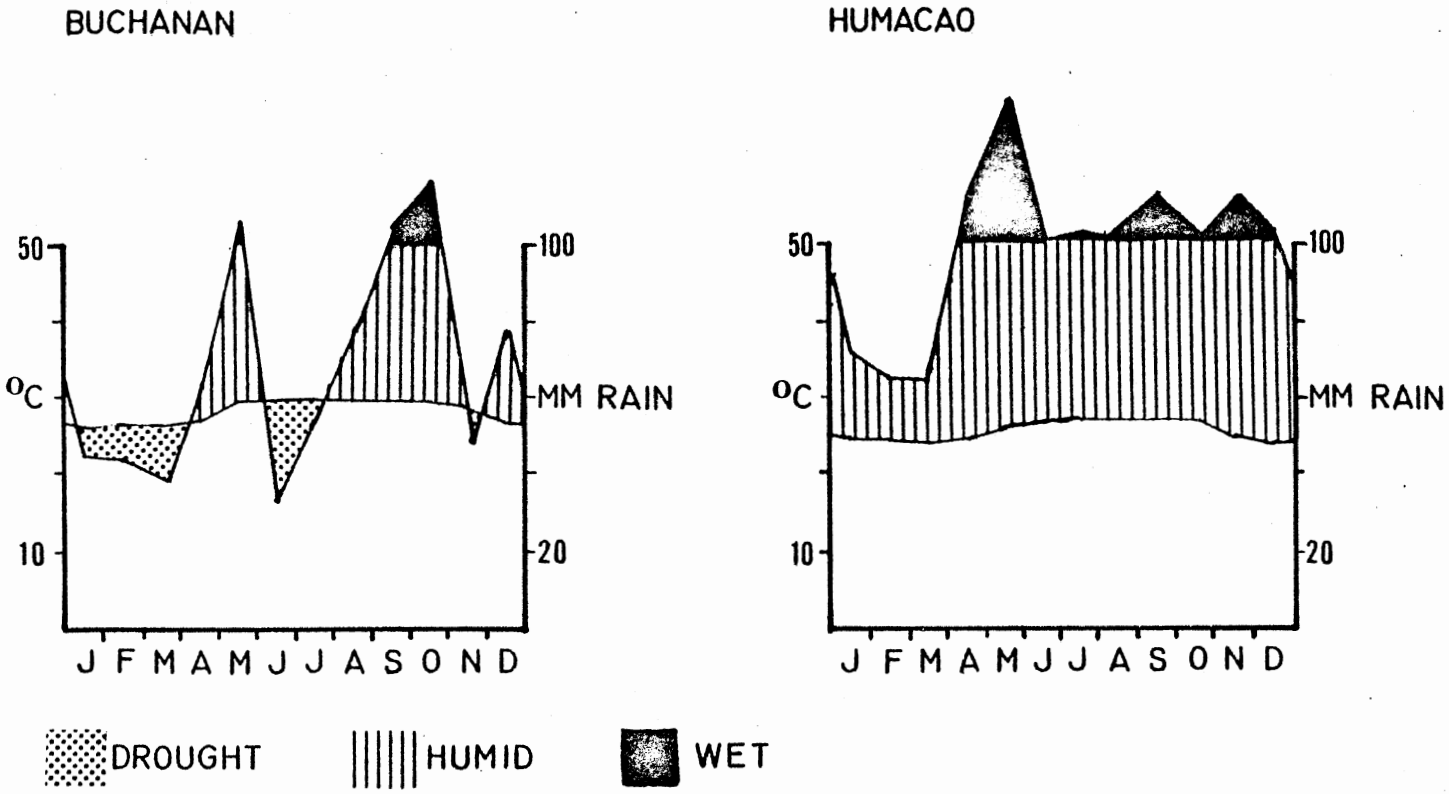

BUCHANAN
HUMACAO
50
10
°C
100
20
MM RAIN
J F M A M J J A S O N D
DROUGHT
HUMID
WET

Figure 4. Chronology of Class I broods produced on study sites.

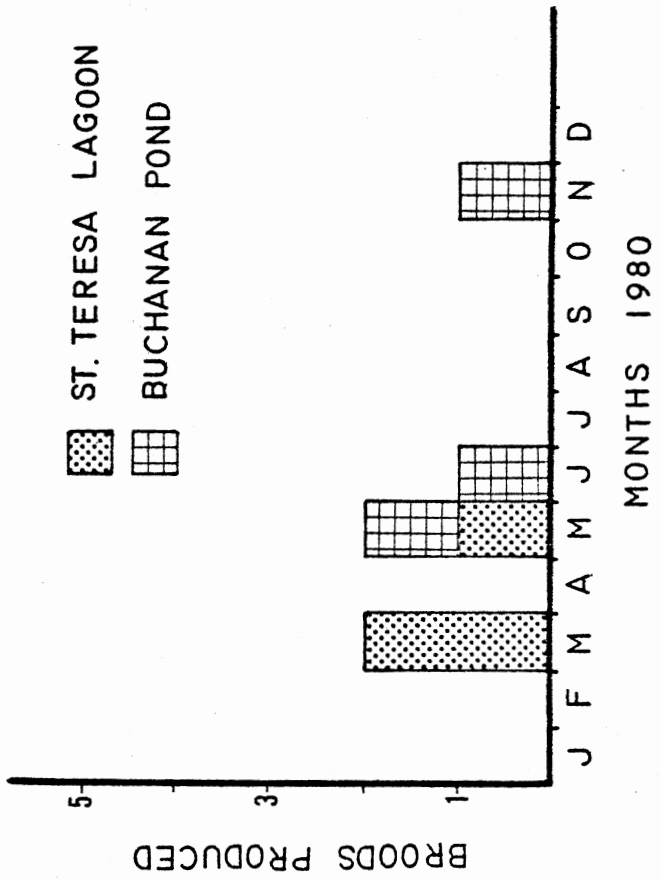

ST. TERESA LAGOON
BUCHANAN POND
BROODS PRODUCED
5
3
1
J F M A M J J A S O N D
MONTHS 1980

Figure 5. Duckling attrition among three broods of ruddies.

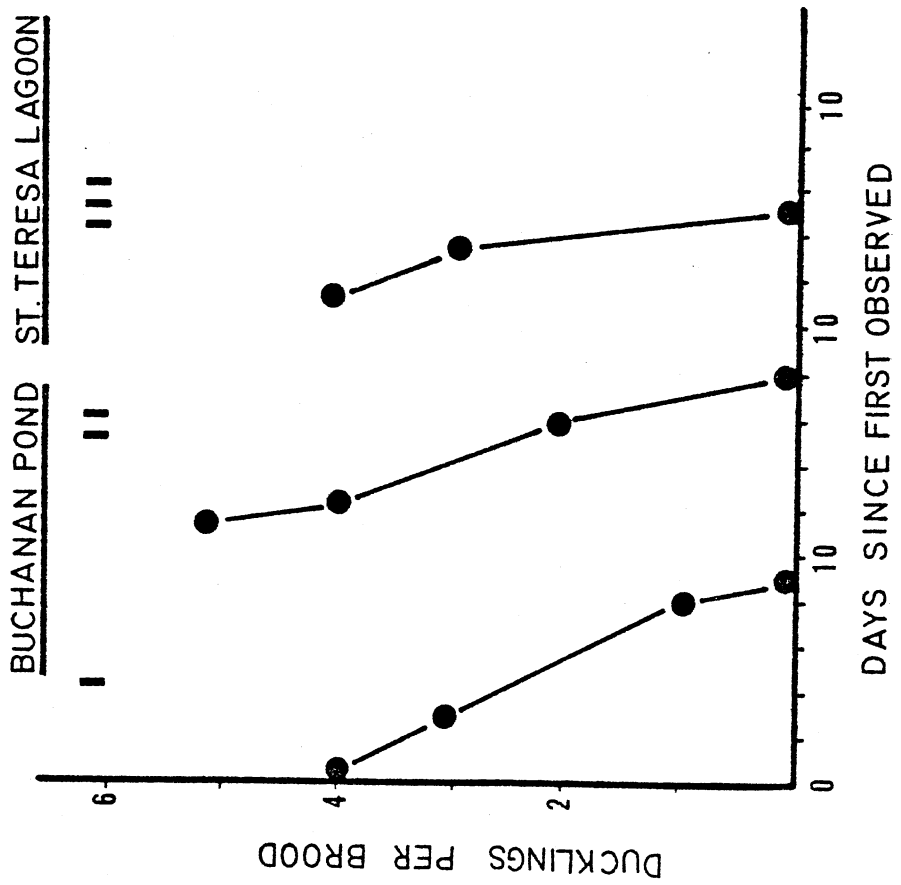

BUCHANAN POND
ST. TERESA LAGOON
I
II
III
DUCKLINGS PER BROOD
6
4
2
0
10
10
10
DAYS SINCE FIRST OBSERVED

TABLE 3.

CHI-SQUARE TEST FOR PREFERENTIAL USE OF THE BUCHANAN POND BY RUDDIES: SECTION SUBDIVISION.

| MALE[1] | | | | FEMALE[2] | | | |
|---|---|---|---|---|---|---|---|
| SECTION[3] | OBS. | EXP. | $\frac{(O-E)^2}{E}$ | SECTION | OBS. | EXP. | $\frac{(O-E)^2}{E}$ |
| I | 7 | 4 | 2.25 | 1 | 4 | 4 | 0.00 |
| II | 13 | 4 | 20.25 | 2 | 14 | 4 | 25.00 |
| III | 3 | 4 | .25 | 3 | 1 | 4 | 2.25 |
| IV | 1 | 4 | 2.25 | 4 | 2 | 4 | 1.00 |
| V | 0 | 4 | 4.00 | 5 | 0 | 4 | 4.00 |
| VI | 0 | 4 | 4.00 | 6 | 3 | 4 | .25 |

[1] $X^2 = 33.0$, $d_f$ 5; h.significant $P < .005$
[2] $X^2 = 32.5$, $d_f$ 5; h.significant $P < .005$
[3] subdivision of pond
[4] based on presence at the beginning of observation bouts

Figure 6. Bathymetry of the Buchanan Pond: section subdivision.

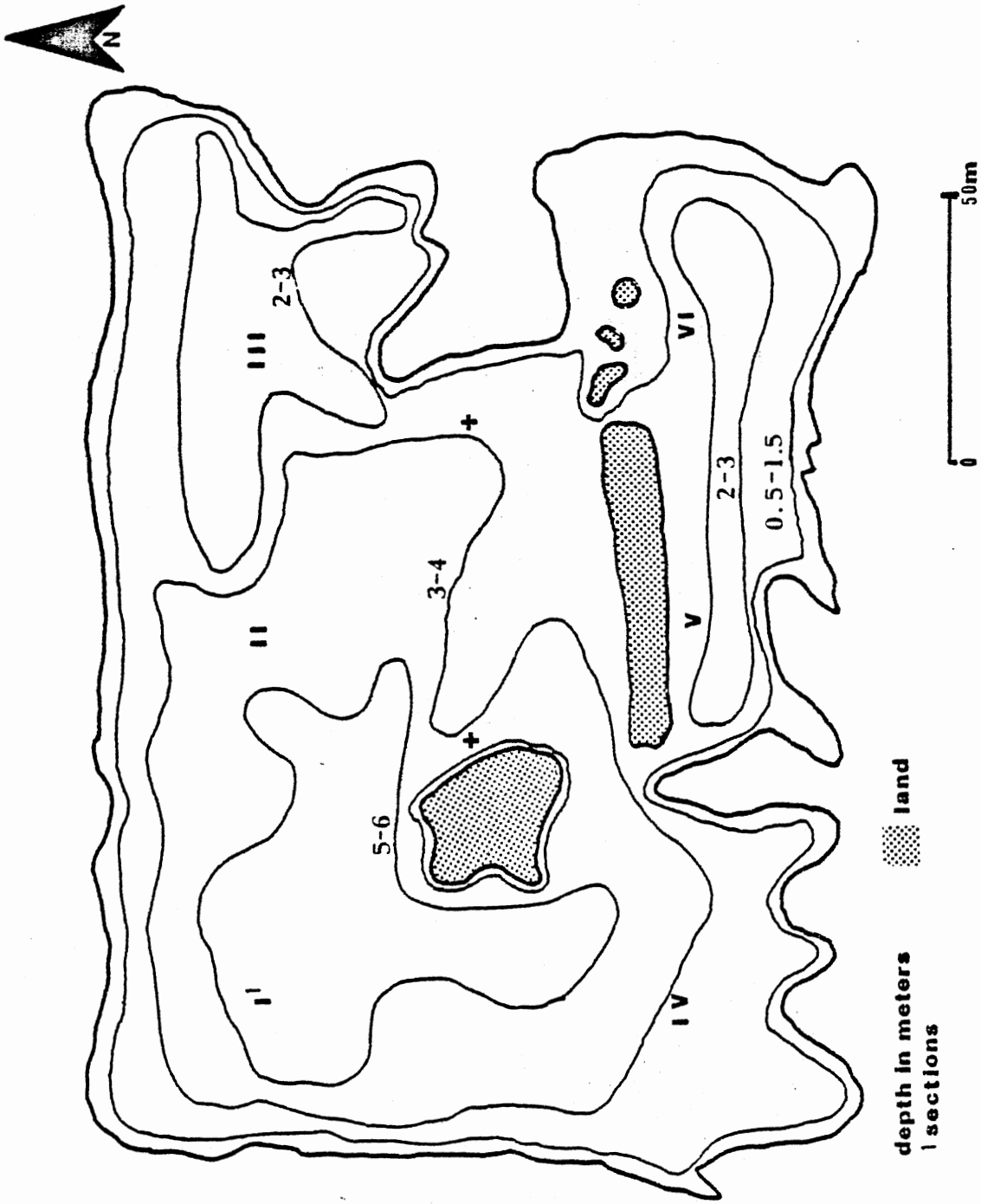
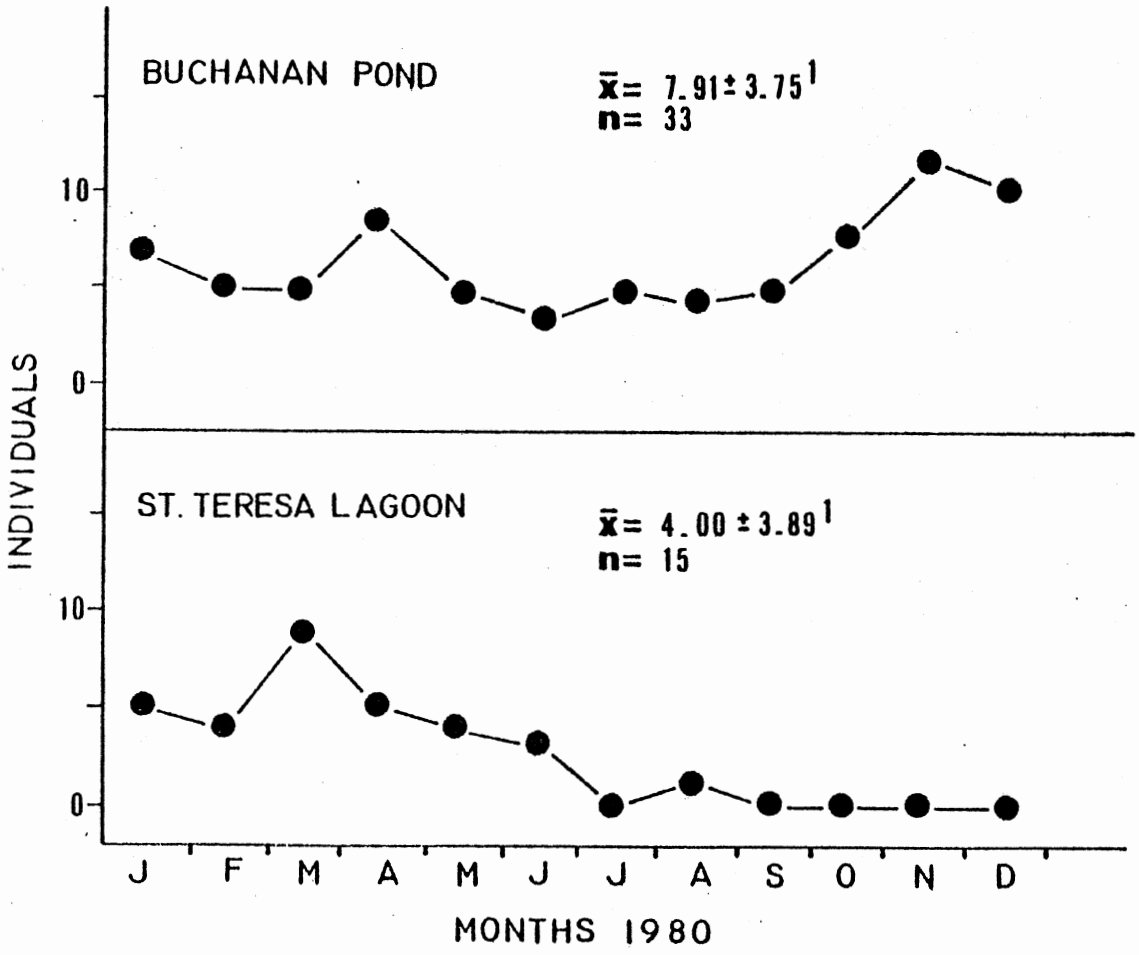

N
I'
II
III
IV
V
VI
5-6
3-4
2-3
2-3
0.5-1.5
land
depth in meters
I sections
0
50m

Figure 7. Fluctuation in average number of ducks observed on study sites.




[1] **standard deviation based on periodic surveys**

# SUBSPECIES AND INDIVIDUAL RECOGNITION OF THE RUDDY DUCK IN PUERTO RICO

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## ABSTRACT

North American and West Indian Ruddy Ducks differ significantly in wing length ($P<.01$). The characteristic alone can be used as a key to subspecies identification. The black spotting pattern that appears associated with resident ruddies can be used as an effective discriminant character for individual recognition of adult males. A technique to codify the amount, frequency and location of the cheek marks is recomended as to clarify the subspecies classification.

## INTRODUCTION

The West Indian Ruddy Duck (Oxyura j. jamaicensis Gmelin) is the most abundant permanent resident duck of Puerto Rico (Leopold, 1963; Biaggi, 1974). Although, numbers have been drastically reduced in the last twenty years, other resident duck species have also suffered from reduced populations. At present it is thought that the populations of ruddies occurring in the island may be made up of both the resident form and North American migrants (O. j. rubida Wilson). Bellrose (1978) reports the North American form as a West Indian migrant. The presumed impact of these migrants is not known, nor to what extent we are counting migratory ruddies as residents. Special care should be taken in using life history information obtained from migratory birds in the design and consideration

of management strategies. Our estimates of population numbers may be in this way biased as well as our conclusions regarding status.

Danforth (1926) in his study of Cartagena Lagoon described the Ruddy Duck he observed there as a new species based on a shorter tail and wing, longer tarsus and darker coloration. He also supports his distinction on the "absence" of the eclipse plumage. He called the species Erismatura alleni Danforth. Wetmore (1927) after a critical analysis of the type specimen E. alleni, and referring to the lack of an eclipse plumage concluded "Danforth's statement that the ruddy duck in Puerto Rico does not possess this eclipse is seemingly open to question". He also argued in support of the morphological differences between the North American and West Indian birds, the latter being smaller (5 percent of less) on average. This seems to be the only basis for differentiation.

Johnsgard (1965, 1978) stated that the farther south you move on a continental basis (North America through South America) the more black appears on the cheek, showing the jamaicensis, andina and ferrugina forms variable amount of white and black in the cheeks. This characteristic seems to be a useful one regarding subspecies rank, and one that has not been considered in assessing the subspecies composition of the population of ruddies found in the Island. If this characteristic proves to represent a north to south cline, studying frequencies of marked and unmarked ruddies on the Island should yield a reliable estimate of the contribution of migrants.

This research was intended to summarize the information available on wing length for the West Indian and North American Ruddy Duck,

and to test them statistically. It examined the presumed impact of migratory ruddies on the native population and suggest the use of cheek spots, location and magnitude, as indication of the proportion of migrants. It also recommend a method for field identification of individual male ruddies using cheek marks, where other techniques for individual identification are scarce.

## MATERIALS AND METHODS

Specimens of the North American and West Indian Ruddy Duck were secured and measured for wing chord, i.e., from the bend of the wing to the longest primary. When available, the original measurements were utilized. Also each male was inspected for the presence and location of black spots (marks) on the cheek. Cheek templates with transparent 1/16" grids were used to record location of marks and to determine the feasibility of the technique in subspecies or individual recognition of drakes.

Skins were obtained from the biology museum at the University of Puerto Rico, Mayagüez, and the University of Miami, Coral Gables. A series of measurements was obtained from the 1974-1975 hunting statistics (Raffaele, 1975) and was used in the analysis. Wing lengths were compared using an unpaired t-test with unequal sample sizes (Steel and Torrie, 1980). Although **n** is small, the data were tested for normality in W. I. ruddies and in O. j. rubida. For both, averages fell within the documented range.

## RESULTS AND DISCUSSION

There is a clear size difference between North American and West Indian ruddies regarding wing lengths (Table 1). Males and females differ significantly, between and within populations, ($P < .01$). Nonetheless this difference is not detectable in the field. Sedwick (1977) mentions that it is unknown what percentage, if any, of the December Ruddy Duck population is made up of migrants. At present it is still unknown.

Of a series of eleven (11) wing length measurements for W.I. Ruddy Ducks from the 1974-1975 hunting season (Raffaele, 1975) only one individual fell within the range of the North American form. On the other hand female wing length did not overlap the range of O. j. rubida in any case.

It is clear that wing lengths can be used as the fundamental characteristic for subspecies recognition, but its usefulness is limited to the bird at hand, and a key characteristic to field identification is still lacking.

An alternative method for determining the contribution of migrants will be to measure population sizes throughout the year so as to assess peaks in numbers of ducks. This method is limited, though, by the nonsynchronous reproductive pattern of O. j. jamaicensis in Puerto Rico. Two periods of reproductive activity, and hence production of birds, have been documented (Molinares, ms.), both coinciding with the expected arrival and departure time of migratory ruddies.

Unless a major banding effort is started, the real impact, if any,

of migratory birds on the resident population will not be known. The present status of the Ruddy Duck population on the Island is endangered and protected (Departamento de Recursos Naturales, 1977), and most techniques to trap divers are not very successfuly, especially in populations with low numbers. A combination of population size studies, banding data, wing length determinations, and research to determine the presence of absence or the eclipse plumage will help answer the question.

Identification of individual adult males was accomplished using facial patterns. West Indian Ruddy Duck shows different spotting patterns in their white cheek. Johnsgard (1978) reports that males of the North American form always have white cheeks. Also, it seems that the occurrence of spots is a major discriminant characteristic between sympatric ruddies in the West Indies, (skins of the North American Ruddy Duck examined for this study showed no sign of spotting pattern). Conversely, all of the W. I. ruddies examined possesed cheek spots. My observations suggest that this characteristic alone can be used for individual recognition of birds. Templates produced of the cheeks of museum skins (Fig. 1) showed that the spots were very localized (within the cheek), but if a series of rows and columns coded with letters and numbers is used, each bird can be individually identified.

To evaluate the technique, live specimens must be periodically trapped to determine if the black spotting pattern is related to a genetic factor, a molting feature, age of bird or population feature. Koob (1981) reports the utilization of "cheek patch patterns" on

individual recognition of ruddy duck drakes at Minnedosa, Canada, although the exact nature of these patterns is not clearly stated. This suggests that the characteristic may be more widespread than previously though or that in fact it is a local feature of some populations of this broad range species. An intensive marking program should be commenced in the West Indies as to determine if there is inter-island movement since ruddies are presumed to be morphologically identifical within the region.

If the contribution of migrants is, as I think, minimal, and recruitment island-wide is as low as measured during (1980) (Molinares, ms.), then there is no doubt that ruddies are in more danger of extinction than previously thought.

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TABLE 1.

WING LENGTH IN TWO FORMS OF RUDDY DUCK

| | N.A. RUDDY DUCK | | | W.I. RUDDY DUCK | | |
|---|---|---|---|---|---|---|
| | n | $\bar{x}$ | sd | n | $\bar{x}$ | sd |
| MALE [2] | 4 | 146.0 | 6.06 | 17 | 133.3 | 6.74 |
| FEMALE [3] | 3 | 142.6 | 7.74 | 8 | 130.4 | 3.52 |
| TOTAL [1] | 7 | 144.5 | 6.46 | 25 | 131.8 | 6.48 |

[1] populations means differ (t-test $P \leq .001$)
[2] means between males differ (t-test $P \leq .01$)
[3] means between females differ (t-test $\leq .01$)

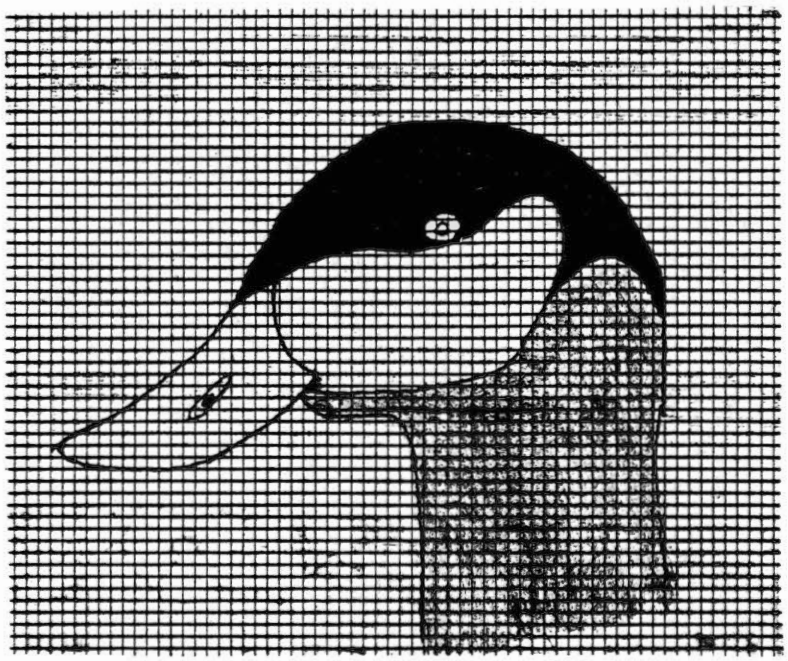


**Fig. 1. Codification of cheek marks in Ruddy Duck drakes.**

2

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