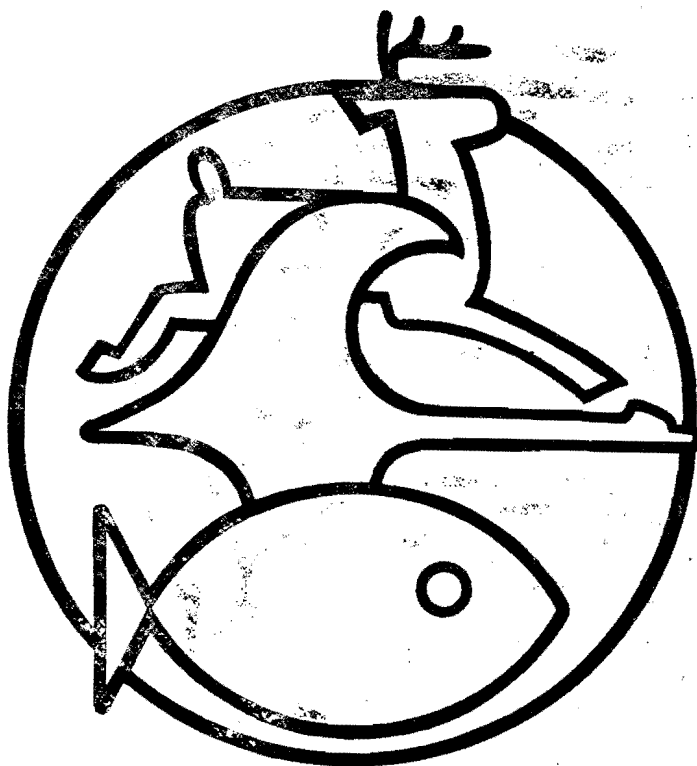


Cooperative Fish & Wildlife Research Unit

STATUS SURVEY OF THE SCHAUS SWALLOWTAIL

IN FLORIDA IN 1984

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TECHNICAL REPORT NO. 14

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ABSTRACT

The purpose of this research was to determine the 1984 population status and geographic distribution of the Schaus Swallowtail butterfly, Papilio (Heraclides) aristodemus ponceanus Schaus, a large and colorful endemic insect in south Florida that is currently on the United States List of Endangered Species and appears to be close to extinction. Its range has steadily declined during the past century. Intensive surveys were carried throughout the Florida Keys and the south Florida mainland to determine the location of extant colonies of the butterfly species and its larval food plants, to determine approximate population sizes, and make ecological observations on its population biology.

The Schaus Swallowtail was at extremely low population levels in 1984. On northern Key Largo, only one adult Schaus was observed. In Biscayne National Park, the total population size was estimated to be thirty adults on Elliott Key, twenty-four adults on Old Rhodes Key, and sixteen adults on Totten Key. The adult flight period extended from the first week of May to mid June. No eggs or larval instars were found from May to September 1984, despite intensive surveys. The larval foodplants, torchwood (Amyris) and wild lime (Zanthoxylum), were present in good numbers in the four recorded adult population areas and were found elsewhere in many hammocks on the Keys and mainland where ponceanus does not presently exist.

The occurrence of the butterfly on northern Key Largo (Hammock 13-14 boundary) in 1984 is of special interest because it was not found on Key Largo in intensive 1980 and 1981 surveys

(U.S. Fish & Wildlife Service, 1982). Apparently, a colony has been persisting there since the Schaus Swallowtail's last peak of abundance in 1971-1972.

INTRODUCTION

The Schaus Swallowtail butterfly (Papilio (Heraclides) aristodemus ponceanus Schaus) is considered one of the rarest resident butterflies in the United States and is listed as endangered by both the State of Florida and the federal government. It is Florida's foremost endemic butterfly, being known historically only from the southeastern tip of the Florida peninsula and portions of the Florida Keys.

The present population status and present distribution of the butterfly have been uncertain since the last surveys carried out in 1980 and 1981 (U.S. Fish & Wildlife Service, 1982). The overall trends in its historic range and numerical abundance in the last eighty years have been in the direction of decline. It has not been recorded from the mainland since 1924, and from the 1940's to the 1970's, it has been found only on two of the middle and upper Florida Keys and in Biscayne National Park.

The ecological and evolutionary reasons for the limitation of the range of the Schaus Swallowtail butterfly to only a small fraction of its potential range are not understood. Habitat alteration by urban development is believed to have been the primary cause of extermination of the species from the Florida peninsula and is currently threatening the important hardwood hammock habitat for the species on Key Largo. Widespread aerial application of insecticides, overcollection, and natural weather factors have also been implicated in the severe range constriction and population decline during this century.

The U.S. Fish and Wildlife Service (USF&WS) determined that a status review was necessary in 1984 in order to establish the present distribution and relative abundance of the Schaus Swallowtail butterfly in Florida. In 1980 and 1981, the Florida Game and Fresh Water Fish Commission (FG&FWFC) conducted research on the historic and current distribution of the species. In order to complete the survey (published as U.S. Fish & Wildlife Service, 1982) and update the knowledge on the status of the species, the present investigator, in cooperation with the FG&FWFC, the National Park Service, the USF&WS, and the Florida Cooperative Fish and Wildlife Research Unit, conducted surveys during 1984 under the support of the USF&WS to determine the current distribution and relative abundance of the species.

The results of this study should provide information enabling effective management planning and actions, and the identification of areas for increased attention as regards future steps and research to assure the survival of this large, distinctive tropical species in the United States fauna.

METHODS AND RESEARCHERS

Ground surveys were conducted within the butterfly's known recent range, and appropriate hammock habitats outside that range, during the reported usual flight and breeding season (May-June) and subsequent months (July-August-September) to check for a possible second brood. Special attention was paid to the extant hammock habitat on the keys in Biscayne National Park, Key Largo, and Lower Matecumbe Key, the only reported population areas for the Schaus Swallowtail since 1940 (Figure 1). Potential Schaus Swallowtail habitat on the other keys and on the mainland north to Miami and Fort Lauderdale and west into Everglades National Park were searched for previously undetected populations. Transects were established in search areas and distribution surveys were conducted on foot by at least two observers during all daylight hours when normal flight activity would be expected. Additional examination of the larval host plants was made for eggs, larvae, and pupae as indicators of established breeding colonies. Where butterflies were found, information was recorded on the exact locations, wing condition ("age") of adults, if they were netted, sex of adult if identified, and habitat use by the butterfly while under observation.

These surveys were started on May 3 and continued at intervals through September 23, 1985. They were conducted by at least two field workers, the principal investigator (Thomas C. Emmel, Professor of Zoology and Director of the Division of Lepidoptera Research at the University of Florida) and an experienced research assistant (James L. Nation, Jr. of the

Department of Zoology of U.F.). In Biscayne National Park, the survey work was very substantially helped by the participation of Mrs. Lorrie Sprague, Research Management and Terrestrial Section Chief (National Park Service), and Miss Nancy Douglass, Seasonal Park Aide. In addition, Miss Douglass conducted twelve weekly or more frequent surveys on Elliott Key from May 18 through August 7, to ascertain the Schaus population's flight period at times that the other investigators could not be present.

Because of the extremely low population numbers of the adults in 1984, no capture-mark-recapture studies per se were performed on the butterfly. It was felt that the usual paint or dye marking procedures employed in butterfly population studies entailed some risk and were not necessary with such reduced densities. Natural wing damage on each specimen proved to be sufficiently distinctive to identify the butterflies individually upon recapture. Each butterfly was gently netted, examined for several seconds in the hand to record wing condition, sex, and other data, and then released promptly. No injury was incurred by any specimen.

In the survey for immature stages in the Schaus' life cycle, torchwood and Zanthoxylum (wild lime) trees were visually searched from ground level up to about eight feet above the ground. Searching was conducted during daylight hours, and canopy-level foliage of host plants could not be searched; it is quite possible that nocturnal feeding and preferential oviposition on tree-top foliage of torchwood lessened the chances of observing immature stages during this year of extremely low population levels.

RESULTS

STATUS IMMEDIATELY PRIOR TO 1984:

The Schaus Swallowtail, Papilio (Heraclides) aristodemus ponceanus Schaus, has always been confined to the south Florida area, with its northern limit near Miami (described as a new species from there by Schaus in 1911) and its normal southern limit somewhere in the upper keys (from Lower Matecumbe Key north, with only several records from the lower keys, including Key West). The primary host plant, Torchwood (Amyris elemifera), however, occurs in hammocks throughout the lower and upper keys, and on the Atlantic Coast of Florida's mainland north past Miami to Volusia County (Little, 1978). The secondary host plant, Wild Lime (Zanthoxylum fagara), which was first discovered to be a host by Rutkowski (1971), occurs in all the preceding areas and northward to central Florida, as well as south (with Torchwood) into the Bahamas, the West Indies, and Central America (Little, 1978). The ecological and evolutionary reasons for the limitation of the range of the Schaus Swallowtail butterfly to only a small fraction of this potential range are not understood (U.S. Fish & Wildlife Service, 1982). Habitat alteration by urban development is believed to have been the primary cause of extermination of ponceanus from the Florida peninsula, and as noted earlier, is currently threatening the important hardwood hammock habitat for the species on Key Largo. However, habitat destruction in most of the lower keys was not extensive enough between the late 1940's and 1970 to explain the near-sudden absence of the butterfly from those areas at that time. Widespread aerial application of

insecticides for mosquito control by Monroe County, overcollecting by commercial and amateur lepidopterists, and natural weather factors have also been implicated in the severe range constriction and population decline of ponceanus during the recent part of this century (U.S. Fish and Wildlife Service, 1982).

In 1980 and 1981, the Florida Game and Fresh Water Fish Commission conducted research on the historic and the current distribution of the subject species (published as U.S. Fish and Wildlife Service, 1982). In those years, the known breeding colonies of Schaus Swallowtail were restricted to two islands (Old Rhodes and Elliott keys) in Biscayne National Park and one small 100m² area on northern Key Largo in 1980 (three first-instar larvae found on May 27, 1980, but no evidence of breeding found there in 1981). Adult numbers were low in the Park in 1980, and perhaps even lower in 1981. The total observed population on Elliott Key in 1981 was not more than about ten adults (eight observed from May 13 to July 8 by Loftus, and ten observed on May 17 by Krizek). The Torchwood leaf production may have been retarded by a prolonged drought in southern Florida during early to mid-1981. Several areas in southern Biscayne National Park and south to northern Key Largo that could have supported Schaus Swallowtails were not searched in those years (USF&WS, 1982). On May 18, 1982, Covell (1982) informally surveyed ponceanus on Elliott Key in Biscayne National Park and recorded thirty-six sightings, saying also that the species seemed to be "up" in numbers from his previous experience. No other surveys have been reported for 1982 or 1983.

STATUS SURVEY RESULTS FOR 1984:

KEY LARGO:

One small fresh ponceanus, probably a male, was seen on Key Largo (Figure 2) one-half mile south of the Carysfort Yacht Club on May 5 at 10:00 a.m. on a clear warm day. It was flying across an open area, having just left a hammock margin at the eastern end of the border between Hammock 13 and 14 in the Key Largo Beach and Tennis Club property. Two large male Papilio cresphontes were netted here in fresh condition between 9:30 and 10:30 a.m. on this date, along with many pierids, nymphalids and lycaenid butterflies. The entire area of northern Key Largo, both west and east of Highway 905 and north to the Ocean Reef Club entrance, was checked on this same date and no further specimens of ponceanus were seen.

The same areas were checked again on May 7-8 with no discovery of further ponceanus. On June 2-3 and on later visits in June, August and September, the entire northern half of Key Largo was checked intensively and the southern half less intensively. No ponceanus adults were found on these dates; however, both male and female cresphontes in fresh condition were seen and netted. Large numbers of young torchwood and wild lime food plants were found in good condition in mature hammock areas across northeastern Key Largo and as far south as the junction of Highway 905 and U.S. 1. No ponceanus immature stages were found on these dates. Large numbers of pierid, nymphalid and lycaenid butterfly species were found throughout Key Largo in June, August,

and September under excellent weather conditions for flight; few butterflies, however, were observed here in May.

THE FLORIDA KEYS SOUTH OF KEY LARGO

During the period of May 5-11, 1984, a comprehensive survey was conducted throughout the Florida Keys from Key Largo south to Key West. The purpose of this intensive survey during the recorded peak of the usual annual ponceanus flight period was to ascertain whether any populations of ponceanus were present in these former areas of its historic range. The following Keys were checked intensively:

South Key Largo	
Plantation Key	20 minutes
Windly Key	
Upper Matecumbe Key	1 hour
Lower Matecumbe Key	1 hour
Fiesta Key	
Long Key	
Conch Key	
Duck Key	
Grassey Key	
Pidgeon Key	
Little Duck Key	
Missouri Key	
Ohio Key	
Bahia Honda Key	

West Summerland Key
 Big Pine Key 30 minutes
 Little Torch Key
 Middle Torch Key
 Ramrod Key
 Summerland Key
 Cudjoe Key
 Sugarloaf Key
 Park Key
 Lower Sugarloaf Key
 Saddle Bunch Keys
 Big Coppitt Key
 Rockland Key
 Stock Island
 Key West

The times given on several of the keys represents the time spent on intensive research of the hammocks for Schaus Swallow-tail butterflies. The keys without times do not have sufficient hammock to support the butterflies and therefore were not researched extensively.

Specific comments on certain of these areas follow:

(1) UPPER MATECUMBE KEY:

Some hammock patches were present here, despite the heavy strip development around Mile Marker 81. In the specifically suitable roadside-park-area hammock to the west side of the highway, we found no signs of torchwood or wild lime food plant or of the butterfly. On side roads off to the east, there was tall

hammock near the Green Turtle Inn but no sign of ponceanus or even of Liguus tree snails (which are usually a good indicator of undisturbed hammock)

(2) LOWER MATECUMBE KEY:

The south end and middle portion of Lower Matecumbe Key had several lot-sized hammock areas between the houses and urban developments. We checked several hammock areas here but found no ponceanus. The Giant Swallowtail Papilio cresphontes was reasonably common on Lower Matecumbe Key in the Columbus Drive area. This key, where the butterfly once occurred (until at least 1949, and possibly to 1964), has extensive housing and business development throughout its length and there appears to be little chance the butterfly could survive here today.

(3) LONG KEY:

Of all the keys accessible from the highway in the lower Florida Keys, Long Key State Recreation area (along the nature trail) seem to provide the geographically closest potential habitat to Key West, site of a very old (1885) record for ponceanus. The Long Key State Recreation area has some short tropical hammock, along with scrub and mangroves, but there were no signs of any ponceanus population on this island.

(4) BIG PINE KEY:

This Key was intensively checked because of the fair amount of natural vegetation still left on the key. We found several rare tropical butterfly species, such as Strymon acis bartrami,

here in the pines and palmettos; however, there was no sign of ponceanus or of suitable tropical hardwood habitat for ponceanus.

(5) CUDJOE KEY and SUGARLOAF KEY:

These two keys have low hammock vegetation with reasonably abundant torchwood (U.S. Fish and Wildlife Service, 1982), but we found no mature tall hammock that would match the more northern tropical hardwood hammocks which ponceanus presently occupies. Historically, no Schaus adults or immatures have ever been found here.

(6) KEY WEST:

South of Sugarloaf Key, we found no suitable or even marginal habitat for ponceanus on any key. On Key West, site of an 1885 record with the specimen currently in the Carnegie Museum, no potential habitat for ponceanus remains today.

BISCAYNE NATIONAL PARK

(1) ELLIOTT KEY:

Sixteen survey trips were made to Elliott Key (Figure 3) during 1984, four by the U.F. personnel (May 10, June 4 and 5, September 22) and twelve by Nancy Douglass (May 18, 21, 22, 24, 25; June 11, 12, 20, 26; July 10; August 1, 7). Schaus Swallowtail adults were observed from May 10 through June 5 but not thereafter. No immature stages were found. Heavy rains and flooding after June 5th made the southern portion of the Key inaccessible much of the time to foot travel. These rains may have materially contributed to the short flight season of the

adults, as we observed rapid deterioration in wing condition of wild adults even in May under relatively dry conditions.

The total flying population in the 1984 season on Elliott Key was estimated to be thirty adult Schaus Swallowtails, from recaptures of naturally-marked butterflies. The maximum number observed on any one day was seven (May 10th). Only males were found in early May; by June 4-5, the population had declined to about 5-6 relatively old adults, but females now represented half of those seen. All specimens seen were along the Petrel Point Trail in the southern part of the Key; none were encountered on Spite Road itself. More than fifty torchwood trees were checked for larvae and eggs on the short (800 feet) Petrel Point trail, as were forty-five more scattered torchwood and Zanthoxylum along several miles of Spite road. Adult activity was encountered between 9:10 a.m. and 1:10 p.m. Later in the afternoon, no adults were seen. Early in the morning (9:10 a.m.), one female Schaus was observed feeding on the small white flowers of Cheese Shrub (Morinda royoc). Much of the time of adult males was spent in apparent thermoregulating, landing on sunlit branches of torchwood with wings outspread for several minutes at a time. Hindwings frequently had bird beak marks across the scaling or had tears in the wing margins and had missing tails. All adults on Elliott Key were encountered in an area of about 700 linear feet of the Petrel Point trail starting at Spite Road, indicating perhaps site fidelity and little wandering from their home hammock area in this year of extremely low population levels.

(2) OLD RHODES KEY:

The Schaus Swallowtail population on this key (Figure 3) south of Elliott Key was estimated to be a maximum of twenty-four adults in 1984. The maximum number on any one day was on June 4th when nine ponceanus males and one female were censused. The population was apparently at the peak of its flight season, with a normal age distribution curve of two nearly-freshly-emerged adults, six intermediate-condition adults, and two worn adults (one male, one female). In September, the abundant torchwood here showed old feeding damage but no larvae were present. Liguus tree snails and the tropical Florida Purplewing butterfly (Eunica tatila) were found in numbers in the mature hammock here. The Giant Swallowtail, Papilio cresphontes also occurred here.

(3) TOTTEN KEY:

The Schaus Swallowtail population on this key across Caesar's Creek south of Elliott Key (Figure 3) was estimated to be 12-16 adults in 1984. The peak of the flight season was apparently in May. Two worn males were netted here, plus two other adults observed, during a June 4th visit. Four Giant Swallowtails (Papilio cresphontes) in freshly emerged condition were found among the forty acres of planted wild key lime trees (genus Citrus) present near the landing site on this key. Torchwood and Zanthoxylum, wild lime trees were located here in abundance. On the September 22nd visit, a second-instar Papilio larva was found here on Zanthoxylum. Photographs of it were later identified by H. David Baggett as of a second-instar Papilio cresphontes larva. Two adult Papilio cresphontes were seen here

on September 22, but no ponceanus adults or immature stages were encountered on that date.

(4) EVERGLADES NATIONAL PARK:

The eastern portion of Everglades National Park, including the Royal Palm visitor center area hammock and local hammocks to the west, were found to be potentially suitable habitat where Papilio aristodemus ponceanus could possibly occur, but no adults or immatures were encountered in May surveys. The Giant Swallowtail Papilio cresphontes was observed in fair numbers here.

DISCUSSION

GENERAL ECOLOGY OF THE SCHAU SWALLOWTAIL: The adults are remarkably adapted to the tropical hardwood hammock habitat. Of all butterflies known to me, they resemble the tropical nymphalid genus Heliconius most in their highly modified flight behavior, their obvious ability to navigate slowly and carefully around fine obstacles such as branches and spider webs, and their apparently high degree of learning ability ("intelligence") in terms of remembering a territorial flight path and travelling along it on a regular, predictable circuit. They alight frequently on torchwood leaves about 3-4 feet off the ground and "bask" with outspread wings in the sunfleck for a few minutes; they feed on nectar of small white-flowered shrubs; they investigate other ponceanus that enter their territory and fly closely (but slowly) around them for a few moments; etc. They avoid entering open areas unless they are alarmed by someone pursuing them too closely. The frequent tears in the wings suggest a daily toll of damage resulting from maneuvering through the hardwood hammocks, while beak marks and missing tail sections cleanly snipped off suggest rather frequent bird attacks. It is likely that they live only two weeks at most as adults at this rate of wing wear and apparent predation attempts. Yet the extended flight season from the end of April to mid-June suggests that the overwintering (diapausing) pupae do not emerge synchronously, but that adults emerge over at least a 3-4 week period. It is remarkably easy to observe and follow this large and colorful swallowtail through the hammocks or along the trails. I took close-up photographs at distances of six inches

with no great difficulty. The wing-color resemblance in flight to the sympatric, common and distasteful heliconiine butterfly species, the Zebra (Heliconius charitonius), is remarkable also and the similarity in behavior as well as color pattern during flight suggests selection for an incipient mimetic relationship that would protect the adult Schaus Swallowtails against bird attack.

It is clear that suitable torchwood plants for oviposition, with new growth following the late spring and summer rains, occur within the mature hammocks as well as along trails cut through the hammock. In fact, a greater diversity of torchwood trees, from very young to mature canopy-level trees, occurs within the mature hammocks as compared to areas undergoing succession (cf. Rutkowski, 1971). From talking with a number of lepidopterists who have observed the immatures in nature and seen the adults ovipositing, the adult females appear to prefer ovipositing on torchwood or wild lime under the canopy of taller hammock where dappled sunlight comes through, but not intense sunlight or total shade. This habit probably relates to a narrow range of thermoregulatory preference or tolerance on the part of the adult. Time budgets on males and females observed in May and June of 1984 indicated as much as 55% of their time between the peak flight hours of 10:00 a.m. and 1:00 p.m. is spent in basking behavior, sitting with wings outspread on torchwood leaves in a sun fleck.

ELLIOTT KEY POPULATION: The peak of the 1984 flight was in early May. Seven ponceanus males were actually observed in the hand, or at very close range on May 10th, and from capture-recapture data,

the population on that day can be extrapolated to have consisted of approximately 15 males. Assuming a 1:1 sex ratio in eventual emergence (females emerging later than the males), the total population size during May was about 30 individuals in the south-central part of Elliot Key around Petrel Point. Adults were not flying elsewhere on the island at this time, or at any later date (Biscayne National Park naturalists checked these sites weekly, in addition to our U.F. personnel visits). One male and one female were actually observed here in the hand on June 5th under good weather conditions, a record represented two-thirds of the flying population seen at Petrel Point on this visit. None was seen subsequently. Despite diligent searching in May, June, July, August, and September, no immatures were found. The torchwood and key lime were in good shape. Heavy continuous rains at intervals of a week or so in May and June may have limited adult activity this year to lower levels; however, the lack of adults in any numbers on Key Largo where less rain fell suggests another as yet unidentified cause of population decrease.

OLD RHODES KEY POPULATION: The peak of the 1984 flight was in late May and the first week of June. Six males and one female were actually handled and identified, with a series of other males and one unmarked female observed at close range. From these observations, the total population size on this date can be estimated to be approximately 12 males and 2 females, with about 24 butterflies representing the total flying adult population of ponceanus on Old Rhodes Key during May.

TOTTEN KEY POPULATION: The peak of the 1984 flight season was in May. By early June, only worn adults (a total of 6) were seen here. The estimated population size from capture-observation data was about 8-10 males for June 4th, extrapolating to a total population of approximately 16-20 ponceanus for the Key area.

KEY LARGO POPULATION: A little more than ten years ago, ponceanus was passing through one of the largest, if not the largest, population peaks ever recorded in any of the cycles for this species. In 1984, the numbers were extraordinarily low, with one male (?) being observed by the present investigators and no adults (as far as known) being collected that season by any of the Papilio collectors visiting the Keys for that purpose. The attached map (Figure 2) plots the known distribution of specimens collected in the 1970's and the location of the 1984 specimen observed at the boundary of Hammocks 13 and 14 one-half mile south of the Carysfort Yacht Club road turnoff. These data were gathered from published records on museum specimens with full data, and from unpublished records taken by collectors who wished to remain anonymous but shared information for the purposes of this status survey. It should be noted that most records (Hammock Nos. L(1)6, 9, 10, 11, 13, 14) are concentrated in the remaining native hammock areas of northern Key Largo, and that the southernmost record known since 1970 is just north of Gulfstream Shores (Hammock No. L(2)5).

From all accounts of experienced collectors of Schaus Swallowtails, the butterfly has always occurred in numbers east of Highway 905 and particularly along trails or inside native

hammocks (with a relatively open understory composed of torchwood, wild lime, poisonwood, and young hardwood saplings) where dappled sunlight penetrates at mid-day. While it flies slowly along the edges of hammocks on occasion, it very rarely flies into open areas. On the other hand, its congener, the Giant Swallowtail Papilio cresphontes is usually flying relatively rapidly across open areas and visiting flowers along roadsides or in fields; female cresphontes frequent the hammocks more than males.

CONCLUSIONS AND RECOMMENDATIONS

The populations on the Keys in Biscayne National Park, while very low for continued species survival if considered individually, form a viable nucleus in the aggregate for the Schaus Swallowtail's existence and for captive-propagation stock. The chief danger of having such a geographically-limited nucleus arises from natural disasters, such as hurricanes, fires, or winter freezes, wiping out the sole remaining viable stocks. Because of their size (larger than the Key Largo population), they are the most suitable populations to continue more intensive studies in the future on the species' population ecology, especially population size, life span as adults, predation and parasitism, and amount of movement of adults (especially between keys or across distances representing such degrees of isolation). These populations are rarely seen by human visitors because few can brave the hordes of mosquitoes and flooded ground conditions during the time of the usual Schaus flight period. Thus few people can enjoy their beauty, whereas on keys from Key Largo south, thousands of visitors a month could potentially see these attractive butterflies during past peak years. It seems important, therefore, to foster the butterfly's continued existence.

On the basis of available torchwood host plants and historical records for Schaus Swallowtail adults, the optimum hammock characteristics for the butterfly on Key Largo are found in:

Hammock L(1)6

Hammock L(1)11

Hammock L(1)9

Hammock L(1)10 B

Hammock L(1)13-14

Hammock L(2)1

as depicted in Figure 2 (sections L-1 and L-2 of Northern Key Largo) of the Recovery Plan of the U.S. Fish & Wildlife Service (1982, p. 55). As far as the preservation of the butterfly is concerned, then, it is important to protect existing habitat on Key Largo by expanding Crocodile Lakes National Wildlife Refuge to include all of hammocks L(1)6, 9, 10 B, 11, 13, and 14 on the east side of Highway 905. The narrow strip of hammock L(2) 1 on the west side of Highway 905 has abundant torchwood in places, but by comparison with the other hammocks, may not be broad enough to support a viable population of Schaus Swallowtails by itself without association with hammocks east of Highway 905 (cf. recommendations in the Recovery Plan, criterion 1131 on page 23 and page 46, U.S. Fish & Wildlife Service, 1982, where Hammocks 6 and 9 were omitted on page 23 but included on page 46 in lists of essential habitat areas.)

It would also be feasible to reintroduce the Schaus Swallowtail into northern Key Largo hammocks from the larger populations in Biscayne National Park. In meeting this Recovery plan recommendation (step 13, p. 31, USF&WS, 1982) to reestablish ponceanus colonies in appropriate areas within its historic range, sites containing historically suitable habitat will have to be secured (steps 1311 and 1312, p. 31) and a decision will have to

be made regarding initiation of captive propagation versus transfers of wild adult individuals. From past experience with breeding rare butterflies, it would seem safer and more practical to remove a limited number (10-12) eggs or young larvae from the wild on Elliott or Old Rhodes Keys and use these as the basis for a breeding stock, than to remove an equivalent number of adults from the wild and transfer them between islands. A single female swallowtail is capable of laying over 100 eggs, and the close-to-95% loss in nature between egg and adult stages (USF&WS, 1982) is due to many selective factors such as parasitism and predation which can be excluded in the laboratory. Wild adult transfers have not been successful with other butterfly species as regards new colony establishment. However, transfers of eggs and larvae from montane Wyoming populations of the checkerspot nymphalid butterfly Euphydryas gellertii south to locations in the central Colorado mountains have resulted in the firm establishment of at least one Colorado population (Holdren and Ehrlich, 1981), and transfers of pupae have been used in south Florida to establish many new populations of the Florida Atala lycaenid butterfly, Eumaeus atala, in the past several years (R. Boender and P. Henry, unpublished). Adult transfers in the past have not successfully established the Atala butterfly in the same Everglades National Park areas (Rawson, 1961).

The problem with initiating reestablishment of the Schaus Swallowtail in the northern Key Largo area is that extensive aerial spraying of mosquito insecticides on the keys during the past decade may be responsible for the precipitous decline in numbers of the butterfly there. In this respect, then, it is

recommended that: (1) captive propagation of ponceanus be initiated with the aim of reintroduction into areas that are not being sprayed, or that spraying by the Monroe County Mosquito Control District be suspended in the areas where the butterfly is presently found or is to be released; (2) pesticide testing experiments be initiated with the parental subspecies of the Schaus Swallowtail, Papilio aristodemus aristodemus, collected and bred from material taken in the Dominican Republic on the island of Hispaniola, and assessment of the relative toxicity to the butterfly of each component of the complex spray mixture be undertaken.

Finally and most clearly, the tropical hardwood hammock in appropriate areas and quantities on Key Largo will need to be preserved in order to attain any of these objectives, and to insure the continued existence of the endangered Schaus Swallowtail outside its present reduced range (1984) in Biscayne National Park and one area on Key Largo. A substantial side benefit of this course would be to have this distinctive large butterfly in areas readily available to public observation during its flight season, an example of an endangered species brought back from the edge of extinction by sound environmental policies.

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MAP FIGURES

Figure 1. General map of south Florida mainland, principal keys in Biscayne National Park, and the Florida Keys, including the historic range of the Schaus Swallowtail (Papilio aristodemus ponceanus) from Miami to Lower Matecumbe Key and Key West.

Figure 2. Tropical hardwood hammocks (numbered after U.S. Fish and Wildlife Service, 1982, Figure 3 maps) and other habitat types on northern Key Largo, Monroe County, Florida. Specific locality records of museum and private-collection specimens of Schaus Swallowtails, where more detailed information than solely "Key Largo" labels was available, are shown by black stars. The 1984 record is shown by a white star.

Figure 3. Map of principal keys in Biscayne National Park, Dade County, Florida. Locations of 1984 populations of the Schaus Swallowtail on Elliot, Old Rhodes, and Totten Keys are shown by white stars.

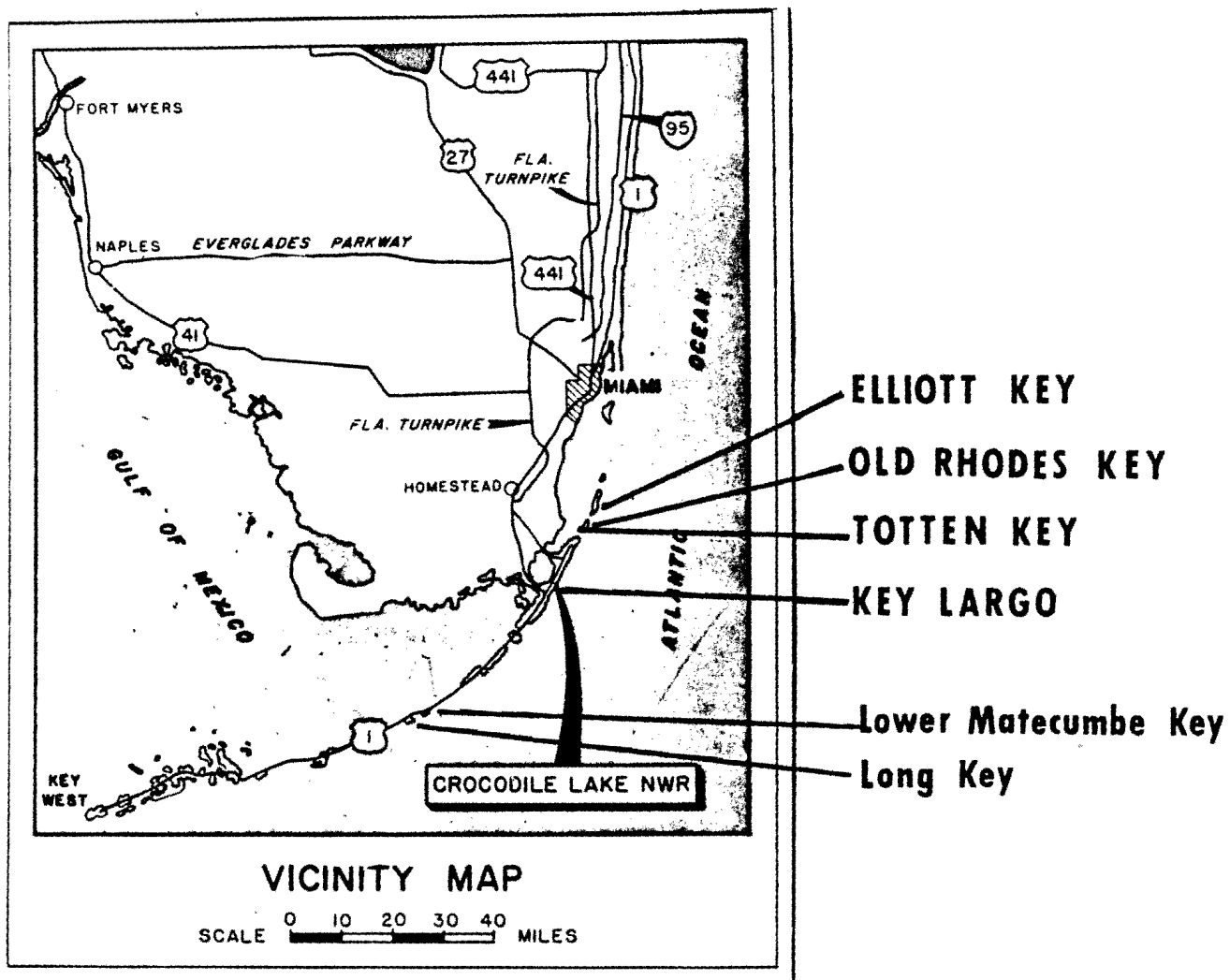


Figure 1

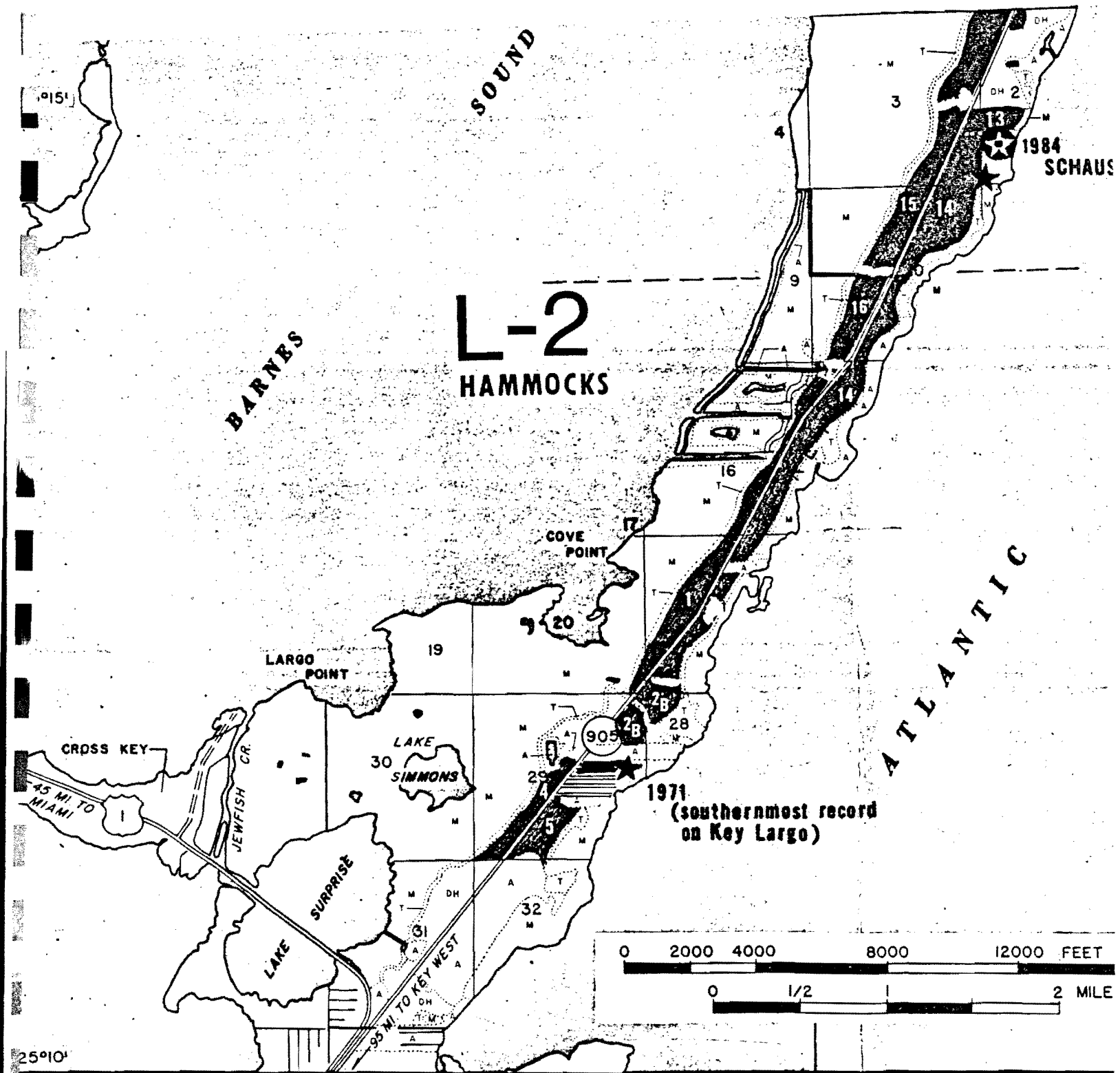


Figure 2a. NORTHERN KEY LARGO
MONROE COUNTY, FLORIDA

LEGEND

A	ALTERED LAND
DH	DISTURBED HAMMOCK

H	HAMMOCK
M	MANGROVE
T	TRANSITION ZONE

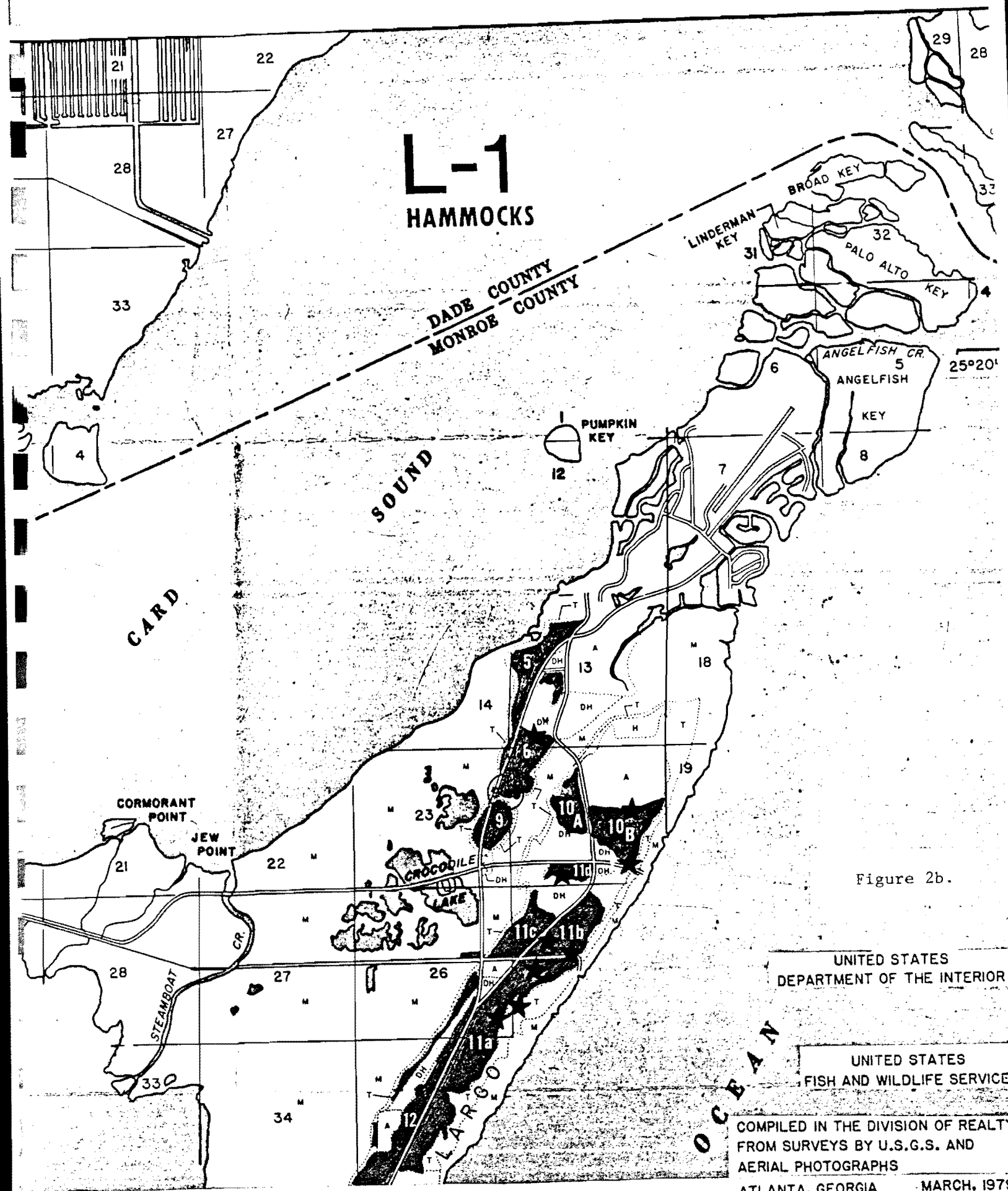


Figure 2b.

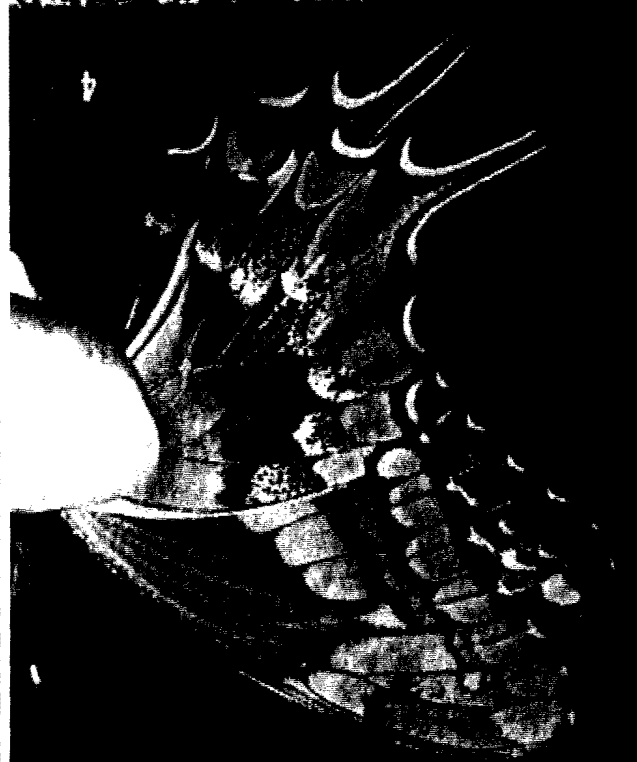
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COMPILED IN THE DIVISION OF REALTY
FROM SURVEYS BY U.S.G.S. AND
AERIAL PHOTOGRAPHS
ATLANTA, GEORGIA MARCH, 1979

COLOR PLATES:
FIGURES 1 - 6

- Figure 1. Schaus Swallowtail (Papilio aristodemus ponceanus), adult male, in the wild on Petrel Point trail, Elliott Key, Biscayne National Park, Florida, on May 10, 1984, showing typical basking and resting posture.
- Figure 2. Schaus Swallowtail male resting momentarily on torchwood branch within a hardwood hammock on Elliott Key.
- Figure 3. Torchwood (Amyris elemifera) on northern Key Largo in May, 1984. This is the preferred larval hostplant for the Schaus Swallowtail.
- Figure 4. The distinctive underside pattern of Schaus Swallowtail (an adult male). This also illustrates how the adults may be lightly held without damage for a short time, in order to record wing condition, sex, and distinguishing marks.
- Figure 5. In the same tropical hardwood hammocks where Schaus Swallowtails fly in May and June, this second distinctive tropical species, the Florida Purple Wing (Eunica tatila tatislista) flies in August and September in fair numbers. It is the only member of its group that is resident in the United States, and its habitat on the Florida Keys is seriously threatened by development along with the same factors affecting Schaus Swallowtail. Its life history is unknown.
- Figure 6. Interior of a tropical hardwood hammock on Tottem Key in Biscayne National Park, where both Schaus Swallowtail and the Florida Purple Wing are found. The adult Schaus Swallowtails normally stay within five feet of the ground during their slow, deliberately cautious flight; they avoid obstacles such as fine branches and spider webs by flying slowly, backing off, maneuvering up or sideways slowly, and then proceeding.



COLOR PLATES:
FIGURES 7 - 11

- Figure 7. Adult male (left) and female specimens of Schaus Swallowtail, Papilio (Heraclides) aristodemus ponceanus Schaus: dorsal surface. (Mounted specimens from the Allyn Museum of Entomology, Sarasota, Florida.)
- Figure 8. Ventral surface of male (left) and female Schaus Swallowtail specimens shown in Figure 7.
- Figure 9. View of mature hardwood hammock on Old Rhodes Key on June 4, 1984, when the Schaus Swallowtail adult population was at maximum flight here.
- Figure 10. The second recorded larval hostplant for Schaus Swallowtail: Wild Lime (Xanthoxylum fagara), photographed on Elliott Key on May 10, 1984.
- Figure 11. The primary larval hostplant for Schaus Swallowtail: Torchwood (Amyris elemifera) showing the lighter new growth at the top of a shoot. The new growth each spring (and later times following rains) is the preferred oviposition site of the females.



COLOR PLATES:
FIGURES 12 - 17

- Figure 12. Adult female of the Giant Swallowtail, Papilio cresphontes Cramer: dorsal surface. (Mounted specimen from Gainesville, Alachua County, Florida; same phenotype as in south Florida.)
- Figure 13. Adult male of Giant Swallowtail: dorsal surface.
- Figure 14. Ventral surface of Giant Swallowtail, adult female.
- Figure 15. Ventral surface of Giant Swallowtail, adult male. The adults of the Giant Swallowtail fly in overlapping broods throughout the year in the same hammocks where the single annual brood of Schaus Swallowtail flies.
- Figure 16. The primary larval hostplant of the Giant Swallowtail, Papilio cresphontes, in the hammocks where it flies with Schaus Swallowtail, Papilio aristodemus ponceanus, is true wild Key Lime, Citrus aurantifolia, which has naturalized in the hammocks of south Florida and the Florida Keys. Other naturalized species of Citrus are also used by the Giant Swallowtail. Apparently, the two swallowtails do not compete for larval foodplants extensively, although Giant Swallowtail eggs and larvae may be found frequently on the Wild Lime (Xanthoxylum) used secondarily by the Schaus Swallowtail. The extent of this foodplant overlap, as well as competition for adult nectar sources, will be analyzed in the proposed research.
- Figure 17. The Florida Atala, Eumaeus atala florida Rober, is a very rare lycaenid butterfly endemic to south Florida and the Keys. It was believed to have become extinct by the early 1960's, but several colonies were rediscovered in the late 1970's and during 1983 and 1984, the butterfly reappeared in the Miami urban area, using cycads (its larval host) in nurseries and home gardens as hosts! It occurs in shady tropical hardwood hammocks in its Florida distribution, including (1984) the Schaus Swallowtail habitat on Elliott Key and on northern Key Largo. The preservation of tropical hardwood hammocks for Schaus Swallowtail populations should also aid Florida's other unique tropical butterfly species such as the Florida Atala and the Florida Purple Wing (Figure 5).

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