Research You Can Use

Florida Golf Courses Help an Endangered Butterfly

Golf courses in the Florida Keys offer their help to save a colorful and rare butterfly.

BY JARET C. DANIELS AND THOMAS C. EMMEL

The plight of imperiled butterfly species around the world continues to generate increased public interest and funding support. Recent management plans created to conserve many critically endangered butterflies mirror the aggressive, creative, and cooperative nature of those types of plans historically implemented for traditional vertebrate conservation programs. Laboratory and field-based ecological research combined with captive propagation, organism reintroduction and translocation, habitat restoration or augmentation, and movement corridor development have helped unite university researchers, governmental agencies, non-governmental conservation organizations, and private landowners in a common goal of biodiversity conservation. Although not yet fully realized, the outcome of such ambitious recovery measures has helped bring invertebrate conservation to the forefront and led to cautious, but optimistic forecasts for the future of the species involved.

Native larval host plants and adult nectar sources were planted on golf courses to create natural habitat suitable to maintain transient adult butterflies, encourage adult movement and gene flow between existing colonies, and allow for the natural establishment of new breeding colonies within the Florida Keys.

THE CASE OF THE SCHAUS SWALLOWTAIL

By far one of the most successful and highly publicized projects has centered on the only endangered swallowtail butterfly in the United States. The Schaus swallowtail (*Papilio aristodemus ponceanus*) is a large, colorful butterfly endemic to southern Florida; additional subspecies occur in the West Indies.[12] It is considered one of the rarest resident butterflies in North America and is listed as an endangered species by both the state of Florida and the federal government. It is one of seven swallowtail butterflies out of about 573 known species that are listed by the International Union for Conservation of Nature and Natural Resources.[1]

Historically, the species was once widespread from the greater Miami area south to Lower Matecumbe Key in the Florida Keys. It was formally named as a species, *Papilio ponceanus*, in 1911 by William Schaus, a physician stationed in Miami during the Spanish-American War to help treat American soldiers evacuated from Cuba because of yellow fever. He was an amateur naturalist who in his spare time discovered and collected specimens of a new swallowtail.

When discovered, the Schaus swallowtail inhabited tropical hardwood hammocks on the south Florida mainland. This globally endangered habitat type, one of the most imperiled plant communities in Florida, also occurs throughout the Florida Keys and is composed of slightly elevated limestone areas that support broad-leaved tropical deciduous trees. Due to poor nutrient availability, sparse soils, lack of fresh water, and harsh growing conditions, the dense hammock canopy remains diminutive, rarely reaching over 40 feet high. High, stable ground in southern Florida was a highly sought-after commodity, and soon it was rapidly dwindling due to expanding urban development surrounding Miami.

Also during this period, a collector took a specimen of the swallowtail on Key West in 1885. It is not surprising that the Schaus swallowtail was first recorded in the Lower Keys, then some 200 miles from the south Florida mainland, as the only viable means of travel to the Keys was via boat, and Key West was a major port. In fact, Key West was the largest city in Florida in 1890, exceeding even Miami in population. It was not until some years later in 1912

that Henry Flagler built a new railroad through the Keys, linking the mainland to Key West and opening up the numerous small islands to tourism and colonization. By then the remaining tropical hardwood hammock habitat on Key West had already been cleared for housing and commercial development, and the butterfly was extirpated there while inhabiting the less-settled Keys to the north.

DEVELOPMENT AND ANDREW THREATEN SURVIVAL

In the ensuing decade, better roads, mosquito control, widespread electricity (making air conditioning possible), and fresh water piped in from the Florida mainland brought rapid development to much of the Keys. As a result, the overall trends in the Schaus swallowtail's range and numerical abundance continued to decline. It was last recorded on the Florida mainland on May 31, 1924,[11] and during the 1940s to 1970s was reduced in range to Key Largo and numerous small islands to the north within Biscayne National Park. Up to 1972, naturalists could come to Key Largo and regularly see several hundred swallowtails along the sun-dappled hammock trails on the island's northern end.

But following the 1972 flight season, the Schaus swallowtail population on Key Largo underwent a rapid and dramatic decline. In 1977, it was listed as a threatened species by the U.S. Fish and Wildlife Service (USFWS), and several quick studies were completed to determine the status of the butterfly, culminating in a recovery plan written by the Florida Game and Freshwater Fish Commission and published in 1982.

In May 1984, at the direct request of the USFWS office in Jacksonville, a University of Florida research team was assembled to carry out status surveys in south Florida and make recommendations for action on the existing recovery plan. The resulting data indicated that the observed decline in the swallowtail's historic range and numerical abundance from 1924 to 1981 had continued, with less than 70 adults recorded during the 1984 flight season. The only three colonies of any significant size were located, all within Biscayne National Park on Elliott Key, Old Rhodes Key, and Totten Key, with a fourth small colony in the remaining intact hammock on northern Key Largo being represented by only a single adult. Following this report in 1984, the Schaus swallowtail was upgraded in listing from threatened to endangered status.

Field and laboratory research indicated that the two principal factors contributing to the demise of the Schaus swallowtail throughout much of its former range were habitat loss and mosquito control adulticide spraying. The final blow, starting in 1973, had been the initiation that year of the use of two new organophosphate adulticides, Dibrom and Batex, in the Keys by the Monroe County Mosquito Control District. The resulting spraying had far-reaching effects on the butterfly and contributed to it being reduced to an extremely limited geographic range.

Despite these setbacks, ensuing restrictions on the use of these chemicals resulted in the slow increase in population, and the Schaus remained relatively secure from human-promoted influences in the small but protected hammocks of Biscayne National Park. The Nongame Wildlife Section of the Florida Game and Freshwater Fish Commission subsequently funded three successive two-year grants (1985-86, 1987-88, 1991-92), along with additional assistance from the dePont Fund during 1988-90, in order to continue the status surveys of this clearly endangered butterfly.

Researchers at the University of Florida initiated efforts to improve and expand suitable breeding habitat for the endangered Schaus swallowtail butterfly. Native larval host plants and adult nectar sources are being planted on golf courses in southern Florida to assist that effort.

The additional threat to the species resulting from the impact of a major natural disaster was realized on August 24, 1992, when hurricane Andrew slammed into southern Florida, destroying or heavily damaging all habitat areas fostering remaining butterfly populations. Field surveys conducted during the following flight season in 1993 revealed that Schaus swallowtail populations in Biscayne National Park and

northern Key Largo were extremely reduced (17 adults on Elliott Key, 33 on Adams Key, and 7 on Key Largo).

RESEARCHERS RESPOND

In a truly serendipitous occurrence, just two months prior to Hurricane Andrew, the U.S. Fish and Wildlife Service had given the University of Florida permission to remove 100 eggs in June 1992 as the starter nucleus of a large-scale captive propagation program. Following the destruction wrought by Hurricane Andrew, the USFWS committed major funding to continue the field surveys and captive propagation program, and implement experimental reintroduction of the species within protected habitat areas. The bulk of the captive propagation work was carried out at the University of Florida, where the Boender/USFWS Endangered Species Laboratory became available in June 1993, along with screened enclosures and greenhouse support facilities. As a result, the captive holding became the only readily available source for livestock reintroductions and prompted the rapid expansion of existing livestock breeding to become one of the largest endangered invertebrate captive propagation programs in the U.S.

This highly fortuitous timing allowed for the first successful mating of captive adults (via hand-pairing) in March 1993 and the successful captive production of 31 diapausing pupae by July 1993. Eggs produced from these captive females were increased by additional eggs brought from Adams Key in Biscayne National Park in June 1993 and produced 49 healthy pupae early that fall, the nucleus of the 1994, 1995, and 1996 captive propagation programs[2,5,6,9,10,11] for the 1995, 1996, and 1997 reintroduction releases.

In spring 1995, the first reintroduction efforts were initiated. A total of 764 pupae were released at 7 sites, from the Deering Estate in south Miami on the mainland to Key Largo. Despite heavy predation by migrating warblers, successful adult emergence and subsequent reproduction were identified at all sites, representing the first time since 1924 that the Schaus swallowtail was found on the south Florida mainland. The subsequent 1996 and 1997 releases of 500 and 209 adult butterflies enhanced the previous year's offspring in the existing population and established, directly or indirectly (via local movements), 6 additional colonies in the Upper to Middle Keys.

Following these three years of introductions, as of June 1997, the butterfly occupied sites stretching from the south Miami area in Dade County to Lower Matecumbe Key in the Middle Keys of Monroe County, across a graphic range of 57 miles. Thus the reintroductions have resulted in the quadrupling of the species' geographic range from what it was in the 20 years prior to the destruction by Hurricane Andrew. Additionally, the total annual wild adult Schaus swallowtail population rose to more than 1,200 butterflies as of the 1997 flight season. Still, the celebration of the project's success was tempered by lingering concerns regarding existing habitat quality and long-term management as well as efficient gene flow between populations.

In early 1998, under direct funding support from the National Fish and Wildlife Foundation (NFWF), habitat improvement was initiated by the planting of hundreds of wild lime trees (*Zanthoxylum fagara*), one of two native larval host plants, within several selected Key Largo colonies. The ultimate goal was to improve and expand the suitable breeding habitat available to the butterfly within already existing protected colony sites and allow for the natural increase of the wild population to sufficient and stable levels. While habitat improvement was currently being addressed, efficient gene flow between the numerous existing and newly established colonies remained a critical concern.

Historically, the Schaus swallowtail enjoyed an intact range of pristine tropical hardwood hammock habitat throughout much of the Florida Keys, broken only by periodic but negotiable water barriers. Individuals from neighboring colonies regularly infiltrated each other, allowing for more or less constant gene flow between populations. Additionally, wild population numbers annually waxed and waned, creating periodic localized extinctions that could be overcome by founder individuals wandering in from nearby colonies.

Today, the remaining Schaus swallowtail populations no longer have that simple luxury. Adult butterflies now have to deal with urban development that has left the Florida Keys with a patchwork of isolated and often distant pockets of suitable habitat, making contact between colonies an ever increasingly difficult task. Since all newly established colonies were derived from a relatively small initial nucleus of material obtained from a single colony, all clearly face the continued threat of a narrowing genetic base, as well as unforeseen future natural disasters.

USGA AND FLORIDA GOLF COURSES GET INVOLVED

The opportunity to develop a viable corridor system to encourage adult butterfly movement and regular gene flow between colonies presented itself in the spring of 1999 through grant funding from the USGA's Wildlife Links Program and the NFWF, and with the direct cooperation of the U.S. Fish and Wildlife Service, the University of Florida, and two private golf clubs. The project, funded for three years, involved improving and restoring remaining tropical hardwood hammock habitat on the golf course property of Sombrero Country Club in Marathon and Cheeca Lodge on Islamorada.

Native larval host plants and adult nectar sources are being planted to create sufficient natural habitat suitable to maintain transient adult butterflies, encourage adult movement and gene flow between existing colonies, and

allow for the natural establishment of new breeding colonies within the Keys. Central to the project's success is the cooperation achieved between the government agencies, private organizations, and private landowners involved, including the current development of two Safe Harbor agreements.

If the current project proceeds as expected and additional funding becomes available for additional years of captive propagation, reintroduction, and monitoring, the Schaus swallowtail will occur over a broad enough geographic range in protected habitat areas and in sufficient areas and in sufficient numbers outside of the Biscayne National Park population that a major catastrophic event such as a hurricane, fire, or other focused environmental event no longer threatens extinction or major depletion of the species. At such a point, it seems evident that reclassification of the butterfly's status from endangered to threatened can occur, making it the first invertebrate successfully removed from the U.S. endangered species list.

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The Schaus swallowtail is considered one of the rarest resident butterflies in North America and is listed as an endangered species by both the state of Florida and the federal government. Wild lime plants serve as host sites for swallowtail eggs.