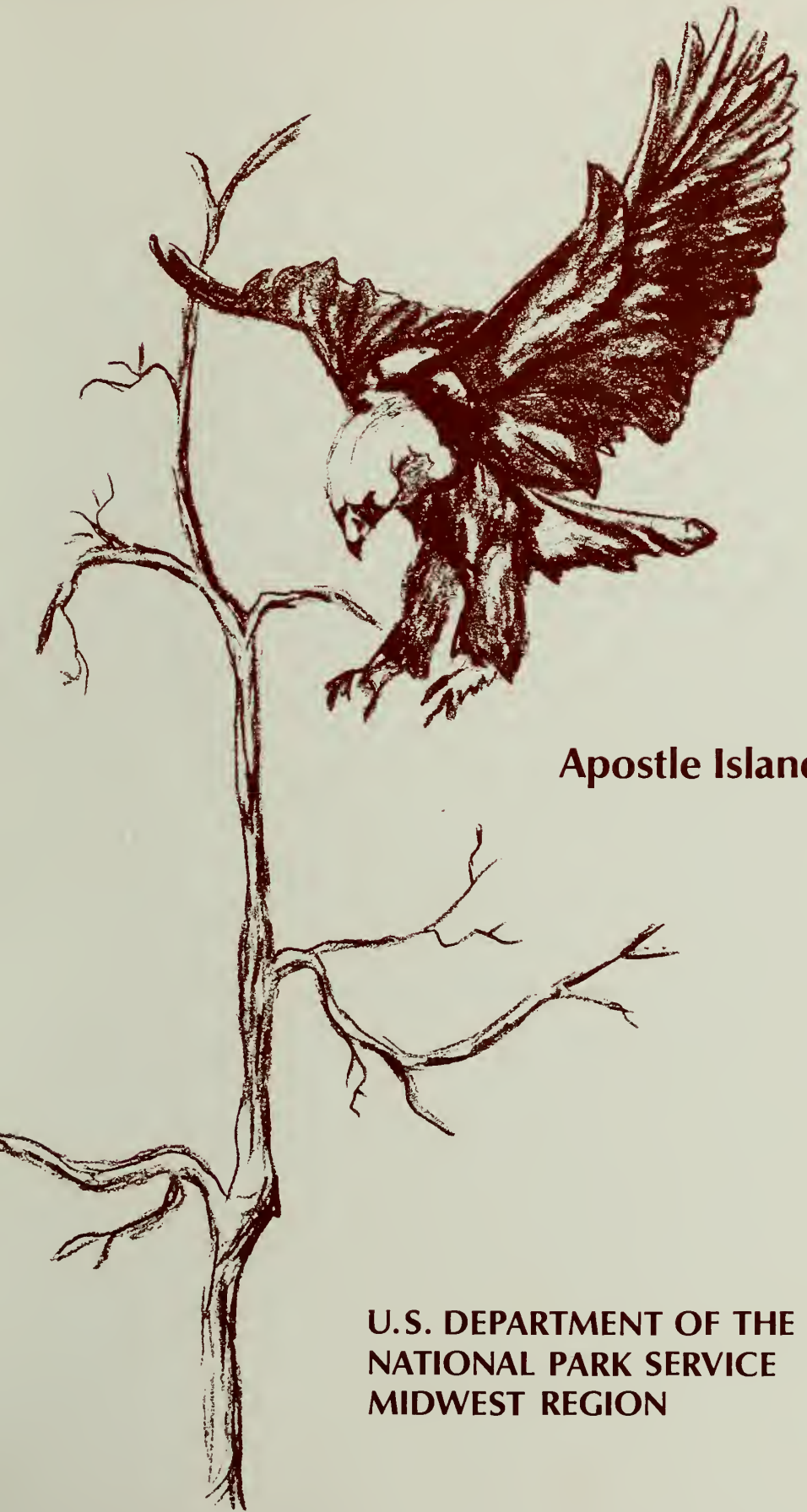
Proceedings of the

Fourth Annual Research Conference



Apostle Islands National Lakeshore

Bayfield, Wisconsin
October 29, 1982

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
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Proceedings of the

FOURTH ANNUAL RESEARCH CONFERENCE
APOSTLE ISLANDS NATIONAL LAKESHORE

October 29, 1982

Park Headquarters
Old Courthouse Building
Bayfield, Wisconsin

Compiled by Terry Daulton
Cover Design by Terry Daulton

U.S. Department of the Interior
National Park Service
Midwest Regional Office
Research and Science Division
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INTRODUCTION

Apostle Islands National Lakeshore hosted its 4th Annual Research Conference on October 19, 1982, in the Lakeshore's Headquarters/Visitor Center Auditorium, Bayfield, Wisconsin. Topics ranged from birds and bears to shipwrecks and logging camps. Researchers from nearly a dozen area agencies and universities gathered to report on their past year's work at the Lakeshore.

The meeting is held annually to enable people who share an interest in the Apostle Islands--both professional and non-professional--to exchange information. It provides the opportunity to learn about the diverse natural and cultural resources of the islands and surrounding area as well as some of the management approaches and projects currently being carried out within the Lakeshore.

This year's program included basic ecological inventories, electro-fishing surveys, floral and faunal habitat studies, water resources and wildlife management, and several historical research projects.

The Park Superintendent and representatives from the Midwest Regional Office in Omaha keynoted the program with a discussion on the role of research in National Park Service planning and programs.

The meeting was facilitated by Park Ecologist Merryll Bailey and Historian Kate Lidfors and was attended by over 35 researchers and interested area residents.

SCIENTIFIC RESEARCH FUNDED BY THE MIDWEST REGIONAL OFFICE OF THE NATIONAL PARK SERVICE, 1973-1982

- - Gary Willson, National Park Service, Midwest Regional Office, Omaha, Nebraska

During the 10-year period, 1973-1982, 97 contracts and purchase orders totaling $1,119,817 were let for park studies by the Midwest Regional Office, National Park Service, and 111 research papers, theses, and maps were received as final reports. An analysis of small and large acreage parks (18 and 19 in number respectively) showed that although the total acreage in small parks (12,015) was substantially smaller than that in large parks (1,176,086), visitation in each category was roughly equal (4,175,234 and 5,536,208 respectively). Furthermore, an accounting of the number of contracts or purchase orders let from 1973 to 1982 in small parks versus large parks showed large parks being favored by a 16:1 margin (83 to 5 in number). With the completion of resources management plans, five special funding categories were established to ensure a more equitable distribution of research funds from the Regional Office to the parks. Using this system, small parks received increased funding emphasis in FY 1982. This was accomplished without a significant decrease in funding commitments to large parks.

SOCIAL CARRYING CAPACITY FOR BOATING AT APOSTLE ISLANDS NATIONAL LAKESHORE

- - Thomas A. Heberlein, University of Wisconsin, Madison

During the summer of 1981, boater use patterns in the Apostle Islands National Lakeshore were examined. Boats were counted both from flyovers and by rangers at the more popular mooring sites. The number of empty slips at marinas were also counted every day as an index of boats entering the system. The goal of the research was to determine the effect of future marina development on boater experiences at mooring sites.

Boat use was highest on Fridays and Saturdays with 115 and 151 boats, respectively, estimated to be sailing from the Bayfield area marinas. Use level dropped off to about half of the Saturday total on weekdays. The maximum number of boats observed on any night was 40 at Anderson Bay, 28 at South Twin, and 19 at Raspberry. Mooring at the other sites was much lower. On over 50 percent of the Friday and Saturday nights there were more than 18 boats at Anderson Bay and more than 7 at Quarry Bay.

For each additional 100 new slips created in the Bayfield area, the number of additional boats mooring at Anderson Bay on a Saturday night would be 4, and the increase at Quarry Bay and Rocky Island would be 3 each, assuming current boater use patterns remain constant.

Boater surveys revealed that tolerable contacts at both Anderson and Quarry Bays ranged from 0 to 11. Visitors preferred to see fewer than 15 other boats moored in these sites.

WILDLIFE MANAGEMENT ACTION PLAN AND SOILS INVENTORY AND MAPPING OF THE MAINLAND UNIT AT APOSTLE ISLANDS NATIONAL LAKESHORE: A PROGRESS REPORT

- - Raymond K. Anderson, D. J. Milfred, L. Stowell, and J. Coert, University of Wisconsin, Stevens Point

Research for the 1982 field season was designed to accomplish the following objectives on the mainland unit: (1) inventory vegetation, (2) inventory and map soils, and (3) identify points of interest and possible trail routes. A fourth objective was to formulate a wildlife management action plan for Apostle Islands National Lakeshore.

Specific objectives of the wildlife management plan included: (1) management of larger mammals that are legally consumed, e.g., white-tailed deer, beaver, and black bear; (2) protection of colonial nesting birds; (3) incorporated management of both native and exotic species in the context of their roles in the natural ecosystem; (4) protection and enhancement of endangered, threatened, and sensitive species and their essential habitats; (5) identification and evaluation of extirpated species with emphasis on species amenable to reintroduction and management; (6) description of the interrelationships between wildlife and other management categories, e.g., clearings, sandspits, beaches, fire, and forest vegetation; and (7) recommendations for management compatible with the primary objectives of the Lakeshore, viz, preserving or restoring representative natural environments and native biota while providing for public use and enjoyment.

Vegetation on the mainland unit was identified and inventoried. Vegetation types on Devil's, North Twin, South Twin, Cat, Ironwood, and Otter Islands were inventoried and field mapped.

Soil units were identified and delineated on aerial photographs. Data obtained from aerial photo interpretation was combined with field and soil sample data, and a preliminary soil map was prepared. Glacial deposits were identified and effects of glacial materials on soils were recorded.

Points of interest (scenic vistas, unique vegetation, and special landscape features) were identified through aerial photograph interpretation and field notation. Soil suitability relationships developed in previous years were combined with the soil map, and areas suitable for campsites and trail routes were designated.

An early settler's homestead was investigated. The surface soil horizon was inspected to determine which portions of the area had been cultivated. Soil samples were taken and analyzed for organic matter content and available phosphorous. Archeologists can use this information to help interpret activities of the early settlers. Preliminary analyses are complete and these data are presented.

The Sand Point deeryard, on the mainland unit, was inventoried to determine deer density, composition and structure of vegetation, and severity of browsing. Vegetation types found were white cedar, white cedar-red maple, and paper birch-balsam fir. Browsing severity on all three types was high. Carrying capacity of the yard is influenced by the presence of red and mountain maple, both products of relatively recent logging.

Browse stems have increased in abundance on all the islands since the surveys conducted by Beals et al. (1960). This is due to reduction or elimination of deer populations. Deer are still present on Basswood and Oak Islands. White cedar, considered fair winter cover, exists in numbers only on Hermit and Manitou Islands.

PROGRESS REPORT ON A WATER RESOURCES APPRAISAL OF THE APOSTLE ISLANDS NATIONAL LAKESHORE

- - Bill Rose, U.S. Geological Survey, Madison, Wisconsin

In 1982, the U.S. Geological Survey continued work on a water resources appraisal of the Apostle Islands National Lakeshore that began in 1979. Emphasis in 1982, as in previous years of the study, was on collecting baseline data that will be useful to the Park Service in developing and managing the Lakeshore.

In order to characterize and quantify water inputs to Lake Superior from tributaries draining the Bayfield peninsula, the Sand River was monitored for water, sediment, and phosphorous discharge. The Sand River drainage basin is mostly forested and is typical of stream basins draining into the Lakeshore region of Lake Superior. Water discharge ranged from 4.5 to 1,350 ft^3/s and averaged 34.1 ft^3/s during the 1982 water year. Preliminary analyses indicate that 20,300 tons of sediment were transported past the monitoring site. This translates into an annual yield of about 720 $tons/mi^2$. The sediment was comprised of about 25, 25, and 50 percent sand, silt, and clay, respectively. The method of transport was about 88 percent suspension and about 12 percent bedload based on an analysis using the modified Einstein procedure. The phosphorous load was 8,540 pounds during the 1982 water year, which translates into a yield of about 303 lb/mi^2. Loads and yields during the 1982 water year probably were greater than average because precipitation was 9.6 inches greater than average.

Four Lake Superior deepwater monitoring sites in the Lakeshore area that were established in 1981 were sampled in July 1982. The water column at each site was sampled at the surface, in the thermocline and just above the bottom. Bottom sediments and benthic macroinvertebrates were sampled. Mercury, phosphorous, and organic carbon concentrations in the water column were $<.1$ to 0.1 ug/l, $<.01$ to 0.01 mg/l and 1.1 to 2.9 mg/l, respectively. Fecal coliform bacteria counts from water surface samples were 1 col./100 ml at all sites. These values are all within the range of values reported by the International Joint Commission (IJC) (1977) for "nearshore" waters of Lake Superior.

Mercury, phosphorous, and organic carbon concentrations in the bottom sediments were 0.01 uG/G, 50-470 mg/Kg, and 1.8-14 G/Kg respectively. These values and benthic invertebrate types and counts were all within the range reported by the IJC (1977).

Relatively heavy use of Presque Isle Bay by sail boats and heavy visitor use of the adjacent shoreline of Stockton Island by campers raised concern about possible degradation of the water quality and nutrient enrichment of bottom sediments. In order to evaluate conditions in the bay, nine sites were established and sampled in July 1982. Water from the surface, bottom sediments, and benthic macroinvertebrates were sampled at each site. Concentration of mercury, phosphorous, and organic carbon in the water and concentrations of mercury and organic carbon were similar to those reported for the deepwater sites and those reported by the IJC (1977) for nearshore waters.

Phosphorous concentrations of Presque Isle Bay sediments ranged from 40 to 86 mg/Kg and averaged 22 mg/Kg. In contrast, samples from the deepwater sites averaged 179 mg/Kg and the IJC (1977) reported an average of 524 mg/Kg for nondepositional zones. The percentage of fine-grain (finer than 0.0625 mm) particles in the sediments provides an explanation for the occurrence of relatively little phosphorous in Presque Isle Bay sediments. The percentages of fine-grain particles are 3, 23, and 44 for sediments from Presque Isle Bay, the Apostle Island area deepwater sites, and the IJC nondepositional zones (1977), respectively. Phosphorous typically is associated with fine-grain or silt and clay size sediments. The availability of greater hydraulic energy in the relatively shallow water of Presque Isle Bay than in deepwater areas inhibits the deposition of fine-grain sediments and the accompanying phosphorous.

International Joint Commission, Upper Lakes Reference Group, 1977, The Waters of Lake Huron and Lake Superior--Lake Superior, Volume III, 575 p.

ELECTRO-FISHING SURVEY RESULTS OF THE APOSTLE ISLANDS INSHORE WATERS

- - Merryll Bailey, Apostle Islands National Lakeshore, Bayfield, Wisconsin

The National Park Service, in cooperation with the U.S. Fish and Wildlife Service, conducted an electro-fishing survey along the shorelines of several Apostle Islands in 1981-82. The objective of the survey was to determine the species composition and relative abundance of fish within the littoral zone during months of relative high visitor use (June-September).

The sampling gear used was a 16-foot flat-bottom boat equipped with two fiberglass booms and three weighted conduit electrodes suspended from each boom. Electrical power was supplied by two 120 volt AC generators. Fish stunned in the electrical field were dipped into freshwater tanks aboard the boat and processed.

For the purpose of this study, catches at the different Island stations were considered similar enough to combine the monthly data. Fish captured were categorized into commercial, game, non-game, and forage species.

On June 3-4, 1982, the dominant species captured was the commercial menominee whitefish, followed by the non-game longnose sucker. Although nine-spine sticklebacks were captured in abundance, literally thousands were observed spawning in large schools off sand bottom in Presque Isle Bay, Stockton Island.

Catches on July 13-15 were dominated by longnose suckers with the forage species--lake northern chubs--ranking second. The commmerical menominee whitefish was taken in very small numbers and no game species were captured.

On the nights of August 11-12, 1982, few fish were taken in over seven hours of electro-fishing. Of special note, however, was three adult carp taken at Stockton and Basswood Islands. Also taken off the south tip of Basswood Island were three species categorized as game fish, one each of splake trout, rock bass, and yellow perch.

In late September and early October of 1982, catches at Basswood Island and along the mainland unit out of Little Sand Bay were considered similar enough to combine. Surface waters had cooled to 55°C. Changes in species composition and diversity were demonstrated by the sampling of several game species, including three salmonids (splake, brown, and rainbow trout) plus rock and smallmouth bass. The dominant inshore species was menominee whitefish (as it was in June) which could be explained by the approaching spawning season.

In conclusion, the data suggest a general lack of game fish species inhabiting inshore waters during periods of high visitor use (June through August). The summer visitor to the Lakeshore, therefore, should not expect to be overly successful at catching game fish species by hook and line from shoreline or docks. Many of the Lakeshore's outlying waters, including the shorelines of several islands, are within the state refuge system and permanently closed to all fishing.

Future fishery survey work will include intensive sampling around underwater structures plus additional inshore electro-fishing to better assess spring fish populations.

EMERGENCE OF THE APOSTLE ISLANDS FROM THE GLACIAL LAKES

- - Terry Daulton, Apostle Islands National Lakeshore, Bayfield, Wisconsin

The emergence of the Apostle Islands as the last glacier receded has been a dynamic process. Lakes formed by glacial runoff have varied drastically in elevation and longevity. These fluctuations have direct impacts on cultural resources and on future research. Settlement patterns of prehistoric peoples are greatly influenced by lake levels. Understanding the geology of Superior's shorelines is essential in determining what areas were available or accessible and what time periods each lake stage encompassed.

The most recent glaciation of the Apostle Islands by the Valders Ice Lobe occurred approximately 12,000 B.P. Its retreat began at that time, and in its wake, melt waters formed lake stages whose levels were controlled by drainage patterns and glacial rebound. Rebound was most rapid and drastic on the northern and eastern shore of Lake Superior and was minimal in the Apostle Islands area. The zero isobase, or area of zero rebound, was found in the Duluth-Bayfield-Ashland area.

The first glacial lake formed was composed of four smaller, basically unconnected lakes titled: Nemadji, Brule, Ashland, and Ontonogan. As the glacier retreated, these four lakes joined, about 11,700 B.P., and formed Glacial Lake Duluth at approximately 1,085 feet above sea level. This level is significantly higher than the present lake level of 602 feet. The Apostle Islands and most of the Bayfield Peninsula were submerged. Lake Duluth was originally drained through two outlets, one at Moose Lake and another at the Brule River, but continued glacial retreat opened a third outlet just west of Marquette, Michigan. Drainage eventually shifted from the Mississippi basin to this eastern outlet, ending Glacial Lake Duluth and initiating the Post-Duluth stages.

The Post-Duluth stages began about 11,000 B.P. and are characterized by rapidly falling lake levels. Over a period of 600 years, the lake fell from 1,005 feet to 645 feet, exposing most of the Apostle Islands. These stages are named for proximity to the zero isobase or for prominent features such as beach lines or wave cut bluffs. In order from oldest to most recent they are: Sub-Duluth, Highbridge, Moquah, Washburn, Manitou, and Beaver Bay.

As glacial retreat continued the lake was opened to its present dimensions and drainage again shifted, this time to Sault St. Marie. This shift brought Glacial Lake Minong into being at 10,200 years B.P. and 450 feet above sea level. Continued deglaciation opened yet another outlet at North Bay, Ontario and brought the lake to its lowest level at 375 feet. This extreme low is termed the Houghton stage of Glacial Lake Minong and occurred about 9,600 B.P. At that time, the islands were totally exposed and were contained within a massive peninsula reaching far beyond their present extremities.

Following these periods of rapid retreat were 5,000 to 6,000 years of gradually rising lake levels controlled by rebound. As the land at North Bay

continued to rise, drainage shifted to Sault St. Marie and the Nipissing Great Lakes formed at 608 feet. This lake was characterized by stable levels and existed from 5,000 to 4,000 B.P. Two sub-stages occured, the Algoma and Sault, initiated by rebound variations and erosion at Port Huron and Sault St. Marie. During these sub-stages, levels fell from 608 feet to today's level, at 602 feet above sea level.

FLORISTICS OF THE APOSTLE ISLANDS NATIONAL LAKESHORE: CURRENT STATUS

- - Rudy G. Koch, University of Wisconsin, LaCrosse

Currently 566 species of vascular plants have been collected from the Apostle Islands. The largest family is the Compositae (66 species), followed by Cyperaceae (62 species, 44 of which are from the genus Carex, the largest single genus), Gramineae (45 species) and Rosaceae, Orchidaceae, and Ericaceae. Interestingly, a number of large Wisconsin families are not well represented. For instance, there are only 10 taxa from the Cruciferae and 7 from the Scrophulariaceae. Eight taxa are on the Wisconsin (1981) endangered and threatened plant list. No plants on the federal list are reported from the park. The total flora enumerated is similar to that reported for the Pictured Rocks National Lakeshore in Michigan by Read (572 taxa).

THE ROLE OF BEACH VEGETATION IN SANDSPIT MORPHOLOGY

- - Beth Middleton and David Schimpf, University of Minnesota

Beach vegetation is related to long-term changes in sandspit morphology. In this study (1982) aerial photos from 1938 and 1978 were used to compare geological formations in the Apostle Islands. Present day sand particle size distribution and vegetative cover and type were examined in ground surveys on the islands.

Two pairs of sandspits were selected based on their morphology, vegetation, and past land usage. As cuspate shaped sandspits, Raspberry and Ironwood Sandspits were paired. Ironwood, unlike Raspberry, has an exotic vegetation component, possibly as a result of its past use as a logging camp.

As linear sandspits, Rocky and Michigan were paired on the basis of vegetative differences. Rocky has a stable interdunal zone comprised of a reindeer lichen association while Michigan has a windswept juniper association.

HABITAT EFFECTS ON BIRD POPULATIONS AT APOSTLE ISLANDS NATIONAL LAKESHORE

- - Robin Maercklein, Apostle Islands National Lakeshore, Bayfield, Wisconsin

The summers of 1980 and 1981 were spent on Stockton Island collecting data on bird populations. Sitings were listed each day, and in 1981 weekly bird counts were conducted. During the winter of 1981-1982, the data was compiled and combined with data from Apostle Islands National Lakeshore files. This resulted in the production of The Birds of Apostle Islands, a checklist and guide by habitat.

The most noteworthy effect of the islands on birds occurs during spring migration, as noted by researcher James Harris. In spring, birds are funneled onto the islands by the Bayfield Peninsula. Here, they concentrate while waiting for favorable weather. When strong northerly winds prevail, they are unable to cross the great expanse of open water between the islands and the north shore of Lake Superior. Eventually, many birds head south and then west, passing through Duluth and Superior. Their flight path after leaving the islands has not been documented. Hawks are particularly weak fliers and concentrate in unusual numbers. Night flying migrants and day migrants other than hawks are less hesitant to cross the lake, but usually wait for southerly winds.

The past summer was spent comparing the avifauna of Raspberry Island and Stockton Island. Stockton Island is a highly variable island, with components of every habitat found in the Apostle Islands. It is, therefore, very diverse in bird populations. Raspberry Island is a small homogenous island dominated by yew, yellow birch, maple, and fir. This allows the study of one habitat type with negligible influence from other habitat types. Raspberry Island has a higher density of birds by at least 50 percent. Migrating shorebirds seem to prefer its small beach to those on Stockton.

THE 1982 STATUS OF COMMON TERNS, HERRING GULLS, AND DOUBLE-CRESTED CORMORANTS IN THE APOSTLE ISLANDS AND CHEQUAMEGON BAY AREA

- - Frederick C. Strand, Wisconsin Department of Natural Resources, Brule, Wisconsin

Common terns currently nest only in one location in the Chequamegon Bay Area, an old ore dock ruins near Ashland. The numbers of nesting common terns at this location has increased steadily since the site was first surveyed in 1974 when 20 pairs were present. In 1981, 58 pairs nested and in 1982, 103 pairs nested. This increase in breeding pairs can be attributed to : 1) vegetation clearing of the nesting area to provide a more suitable breeding habitat, 2) posting of information signs to alert and advise humans against disturbance, and 3) immigration of adult common terns into the area.

Efforts were made again in 1982 to encourage common terns to nest at a historical breeding location, the old dock ruins in Thompson Park in Washburn. Vegetation was manipulated to provide a more suitable nesting habitat and adult size common tern decoys were placed on the island in an attempt to attract terns to the island. No common terns nested on this island, but some behavioral responses to the decoys by common terns were observed.

Only three herring gull nests were counted along the rock ledges of Otter Island in 1982. This compares with 46 nests in 1981. The reason for this lack of nesting in 1982 on Otter Island is unknown.

The number of herring gull nests on Gull Island were not surveyed in the spring of 1982, but numbers of young gulls and used nests appeared normal when the island was visited on June 18.

The double-crested cormorant is a species whose numbers and distribution is undergoing radical changes in the Great Lakes and adjacent States and Provinces. In 1966, the estimated Wisconsin population was 30 breeding pairs and by 1981 this had increased to 1,300 pairs. A similar trend has occurred on the Great Lakes. In 1973, an estimated 40 breeding pairs were on the Great Lakes and this increased to 2,000 breeding pairs in 1982.

This increase in numbers of double-crested cormorants can be attributed to: 1) a decline in pesticides and pesticide residuals in the environment, especially the polychlorinated hydrocarbons; 2) less human persecution; 3) a decline in some commercial fishing activities and/or an increase in some fisheries resources, i.e., alewives, smelt, trout; 4) improved breeding habitat conditions; 5) reproductive success greatly in excess of that needed to maintain a stable population; and 6) immigration of double-crested cormorants into the Great Lakes region.

In 1979, 41 pairs of double-crested cormorants nested on Gull Island. This was the first nesting record of double-crested cormorants in the Apostle Islands since the mid-1950's. In 1981, 128 pairs nested on Gull Island and this increased to 214 pairs in 1982.

The increase in the double-crested cormorant population is causing problems to commercial whitefish pound net fishing. Pound nets consist of a stationary pot with long leads which funnel fish into the pot. Double-crested cormorants reduce the commercial harvest of whitefish by: 1) feeding on fish in the pots and near the leads, 2) scaring fish away from the pots, 3) scaring fish into the netting of the pot and subsequently the fish gill themselves in the netting and die, and 4) injuring or wounding fish with their bills.

During 1982, the five commercial fishermen who used pound nets estimated that their whitefish harvest was reduced by 30 to 40 percent. Commercial fishermen tried several techniques to alleviate the problem in 1982, but none were successful. In the near future, representatives of several government agencies, including the Wisconsin Department of Natural Resources, Apostle Islands National Lakeshore, and the U.S. Fish and Wildlife Service, will meet with commercial fishermen to explore potential solutions to this problem.

ARCHEOLOGY AT THE TROUT POINT LOGGING CAMP, STOCKTON ISLAND

- - Jeff Richner, National Park Service, Midwest Archeology Center, Lincoln, Nebraska

Field work was completed at the Trout Point Logging Camp, Stockton Island, in May 1982. As a result of this work, the former locations of eight structures and a variety of pits, drainage ditches, and other features were mapped. Limited test excavations were initiated at each structure and at several of the features. A variety of cultural materials, including architectural, personal, domestic, subsistence, and work-related classes, are represented in the artifact assemblage. Preliminary study of the structural information and artifact assemblage has allowed for interpretation of the function of several of the former structures and features at the site. Bunkhouses, kitchen and dining area, equipment sheds, drainage ditches, privies, and other features have been tentatively identified. Preliminary attempts to refine the chronological placement of the site have been only partially successful, but it now appears that the site was used prior to 1912.

Laboratory processing of the recovered artifacts was begun in November, with cleaning and initial sorting completed by November 24. The difficult and time-consuming metal stabilization and preservation processing was also begun in November and will continue through early December. A combination of techniques, including mechanical, air abrasion, acid baths and electrolysis, are being utilized to stabilize the corroded metal materials. Report preparation will begin in December, and a draft report will be completed by January 1.

PRELIMINARY HISTORICAL SURVEY OF "GREATER APOSTLE ISLANDS" SHIPWRECKS

- - Thom Holden, Canal Park Visitor Center and Marine Museum, Army Corps of Engineers, Duluth, Minnesota

The Apostle Islands National Lakeshore region of Lake Superior is an historically rich area with written records easily spanning more than 250 years. This area reflects both growth and development and decline of local industries in commercial fishing, ship building and repair, sandstone quarrying, tourism, logging, lumbering, and log rafting. Some historical studies have been compiled, yet little has been done to identify and evaluate the area's history of shipwrecks and marine casualties.

This study is only in its earliest stages. Yet to be developed is a formal study proposal with adequate funding not only to complete the study but to prepare a suitable publication for public use. The formal study would progress through several steps: development of preliminary notes on casualties, preparation of a preliminary wreck list, biographical information on pre- and post-casualty histories, development of details on each of the incidents, preparation of individual narrative histories, an interpretive summary of the study, and preparation of an interpretive product for the general public.

The preliminary historical study was completed in April 1982 and revised in July 1982. This survey shows at least 89 vessels known to have been involved in shipwreck or other marine casualties in the general region of the Apostle Islands. The geographic boundary of the study area is somewhat larger than the Apostle Islands, alone encompassing Port Wing, Cornucopia, Ashland, Chequamegon Bay, Saxon Harbor, and north into Lake Superior 10 miles above the established Lake Carriers' Association vessel travel lanes. The total of 89 vessels involved does not include several dozen abandoned vessels that are ashore, partially submerged, or totally submerged. These too should be accounted for in the final study.

Significant archeological remains will probably be limited to the more than two dozen abandoned vessels which are largely wooden commercial fishing vessels and tugboats and to those casualties which became total losses and were not salvaged. Identifying historical sites of casualties may clarify voids in the historical record concerning cargo, salvage techniques, extent of salvage, equipment specifications and manufactures, exact nature of casualty, and final disposition of the vessel. Also, knowledge may be gained relating to natural disposition of shipwreck remains and state of preservation in freshwater.

At this time, about two-thirds of the 89 known casualties have been identified as to the specific vessels involved, physical description, and final disposition. Virtually all types of casualties are represented by those now under study. Types of wooden craft represented: passenger and package freight propellers, steam barges, bulk carriers, tugboats, fish tugs, schooners, schooner-barges, and a barge or scow. The steel-hulled vessels include: bulk freighters, general freighters, package freighters, and a lake tug. Not yet represented is the wooden sidewheel steamer common on Lake Superior until about 1885.

GARDENS IN THE WILDERNESS: RESTORATION OF AN HISTORIC LANDSCAPE AT RASPBERRY ISLAND LIGHT STATION

- - Kate Lidfors, Apostle Islands National Lakeshore, Bayfield, Wisconsin

In accord with the Apostle Islands National Lakeshore General Management Plan and Interpretive Prospectus, in August of 1981, the Lakeshore staff initiated actions to restore to a predetermined period (ca. 1920) the historic gardens at the Raspberry Island Light Station. Historically, the U.S. Lighthouse Service had encouraged the maintenance of showcase yards and gardens at the stations.

The landscape created by the Lightkeeper (Lee Benton) and his wife from the mid-teens to the mid-twenties was found to combine "naturalistic" trends introduced to this country by A. J. Downing in the 1840's and the Victorian penchant for "cut-out" geometric garden beds. Foundation plantings and the extensive use of shrubbery which had come into style elsewhere in the United States were not in evidence here. It is suggested that the gardens at Raspberry Island reflect a degree of cultural lag.

Research was carried out during the winter of 1981 to determine the extent and positions of garden beds when Lee Benton was keeper. Interviews were conducted with people who had visited the Raspberry Light Station ca. 1920. Historic photographs were collected, dated, and enlarged to serve as the basis for a scaled reconstruction plan. Specialists from the University of Wisconsin Extension Service submitted the photographs under magnification to identify plant species. Period garden manuals and catalogs were studied to aid in the selection of appropriate plant materials. Horticulturists were consulted to determine contemporary equivalents to older varieties. A first-year planting plan was formulated and plant materials ordered.

The execution of the project involved Lakeshore personnel from all Divisions. After the flower and vegetable beds were laid out and prepared, a voluntary work day was held on Raspberry Island to plant the beds. Lakeshore naturalists, stationed at the Raspberry Island Light, tended the gardens throughout the summer and interpreted their significance to visitors.

A comprehensive management plan for the development and continued maintenance of the gardens is in preparation.

THE REHABILITATION OF LAKE TROUT SPAWNING STOCKS ON THE DEVIL'S ISLAND SHOAL

- - Bruce Swanson, Wisconsin Department of Natural Resources, Bayfield, Wisconsin

On June 2-3, 1982, the Lake Superior Work Unit, with the assistance of divers from UW-Sea Grant (Madison) and the U.S. Coast Guard (Bayfield), retrieved 16 of the 21 astro-turf egg frames placed on Devils Island Shoals in October of 1981.

When placed there, each sandwich contained approximately 13,000 Gull Island Shoal fertilized eggs which is equivalent to the spawning capacity of 2-3 mature females.

The frames were located in 40-45 feet of water and survived an extremely windy and cold winter. The survival of the frames through the winter of 1982 substantiates their durability.

Upon retrieval, data on the existing contents of the egg frames were calculated. The 1982 hatching success of 88 percent compares to the 1981 success rate of 78 percent. The favorable increase in hatching success rate is likely due to an improvement of the technique of distributing the eggs more evenly over the mats.

As was the case last year, very few dead fry were found in the frames, meaning that the fry had little difficulty in leaving the frame after hatching. Frames placed on Devils Island Shoal in the fall of 1982 will be cabled to each other so retrieval should be 100 percent. Some of the mats and frames had been reused from 1980, so costs were kept down by recycling the material. Material cost of one egg frame is approximately $42.

The egg frames will play a two-fold role in the rehabilitation of lake trout. First, mature survivors will home directly back to the target reef. Secondly, recent evidence has indicated that a reef with some native spawners will draw mature hatchery origin lake trout there to spawn. These two features will hopefully accelerate lake trout rehabilitation.

SEA LAMPREY CONTROL AND ASSESSMENT IN THE APOSTLE ISLANDS NATIONAL LAKESHORE

- - Dale Ollila, U.S. Fish and Wildlife Service, Marquette, Michigan

Research by our office in the Apostle Islands National Lakeshore in 1982 consisted of the examination of 20 island drainages to determine their potential for sea lamprey production and the survey and subsequent chemical treatment of the Sand River on the mainland.

Among the streams checked on the islands, only four on Oak Island seemed suitable for sea lampreys, and even in these, the potential appeared to be very small. Spawning adults were seen in one of these streams, in the NW 1/4 of Sec. 2, by campers and a biologist of the Wisconsin Department of Natural Resources in 1972, but subsequent larval surveys found no evidence of successful reproduction. No sea lamprey ammocoetes were found in any of the streams in 1982, either. Four additional streams on Oak Island, eight on Stockton, three on Outer, and one on Michigan were also checked and judged to have little, if any, potential as sea lamprey producers. The limiting factors in the streams are their small size and apparent seasonal intermittency.

Pretreatment investigations and biological collections made during chemical treatment of the Sand River in early September indicated a small reestablished population of larval sea lampreys, extending for approximately 3 miles above the mouth on the mainstream and for about 1/4 mile upstream on a small tributary. Several year classes of ammocoetes were present and a few individuals were undergoing transformation to the parasitic form.

Our plans for work in the Apostle Islands National Lakeshore in the next few years are very tentative. The Sand River will probably be checked in 1983 to evaluate the effectiveness of this year's treatment and monitored annually thereafter to determine if and when another treatment is needed. Other streams will be examined much less frequently, depending on their individual sea lamprey potential and the funding available.

THE THREE BEARS OF STOCKTON ISLAND

- - Raymond Anderson, University of Wisconsin, Stevens Point

A sow black bear and two cubs were regularly visiting Quarry Bay and Presque Isle campsites on Stockton Island during July 1982. The bears would appear at one of the campsites in the evening when campers were preparing meals; they were also seen on several occasions during the day in the same general area. They were not aggressive and ignored the efforts of campers to frighten them away.

The sow was trapped at the Presque Isle campsite on July 21 with a standard culvert trap and held overnight for disposition on July 22. There was one cub with her at this time; the second cub had not been seen for some time prior to capture. Personnel from the Wisconsin Department of Natural Resources, The University of Wisconsin-Steven Point, and the National Park Service-Apostle Islands National Lakeshore radio tagged the sow and ear tagged the cub. The bears were then released near the site of capture. Both were back at the campsites that same evening and again on July 25. The sow was subsequently drugged with a dart gun and moved to Manitou Island on July 26. At least two other bears were known to be present there. Attempts to catch the cub were unsuccessful. The sow was seen on Oak Island on August 1, along with two other bears, as they disturbed the equipment of a backcountry camper. The cub was caught on August 3, radio tagged on August 4, and held on site pending location of the sow. The sow was located by airplane on August 5 near the Red Cliff Dump. She was monitored for a period of 24 hours August 11 and 12, and traveled in a 20-mile circle that began and ended near the Red Cliff Dump. Monitoring continued periodically until August 19, and her movements were relatively predictable and local. The last contact was August 19. The present status of the sow is unknown, but searches will be conducted for her during the 1982-1983 search for den sites of other radio tagged bears.

The cub was released on Stockton Island because of the questionable future of the sow. It was radio tracked and was seen several times by Park Service personnel between August 7 and 22. It stayed in the vicinity of Quarry Bay and Presque Isle campsites. Radio transmission ceased on August 22, probably due to transmitter power failure. The cub was seen several times after that in the same areas, occasionally with another adult bear. Further attempts to trap the cub were unsuccessful. Remains of what is assumed to be the second cub were found on Stockton Island; cause of death is unknown. The other cub will probably resume its pattern of visiting campsites next summer and should be vulnerable to trapping for replacement of the radio collar.

Once a bear has been successful at securing food with little effort, it often continues to exploit the source. At this time, there is no certain method of changing a bear's behavior pattern based on human food sources. Electricity and aversive materials do not deter bear visitations with any degree of reliability. Bear-human confrontations, like the one on Stockton Island, present a challenge for solution to a complex problem that is going to be ominipresent.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environment and cultural value of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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