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FINAL REPORT

# Inventory and Establishment of Monitoring Programs For Special Floristic Elements at Isle Royale National Park, Michigan

Persuant to a Contract with the
National Park Service



American eyebright (*Euphrasia arctica*) on south shore of Isle Royale near Little Boat Harbor, 22 July 1998

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## INTRODUCTION

Isle Royale National Park (IRNP) is an archipelago of islands totalling 544 sq. km, located in the northwest corner of Lake Superior. The park lies some 110 km north of Houghton, Michigan, with the closest mainland point about 21 km away in Ontario, Canada. The Park's main island extends 72 km in length and 14 km at its widest point, and is surrounded by about 200 smaller islets. Due to its geologic history, insularity, and the strong climatological influence of Lake Superior, Isle Royale's flora is very distinctive. National Park Service (NPS) policy and the Endangered Species Act require preservation of this vegetation. A thorough, quantitative inventory, and a monitoring program were needed to complete my 1993-1994 survey effort.

Slavick & Janke (1987, 1993) reviewed the status of special vegetation elements of Isle Royale. Crispin et al. (1984) inventoried rare plants in high-use areas from Scoville Point to Daisy Farm, near Windigo, and on Mott, Davidson, and Raspberry Islands. The following year, Crispin et al. (1985) reported on the status of listed plant species on Passage Island, within the Park. However, most of the southwestern end of the Park has not been systematically surveyed, and little is known about the locations, abundance, and habitat status of these special plants.

Visitor use is often concentrated on or near these rock shore communities. Additional impacts are possible due to NPS management actions (e.g. fire management) or planned developments in this and other special habitats. The potential effects of these actions must be assessed in order to protect critical habitats. Without this knowledge, special vegetation elements could be diminished or destroyed.

## STATEMENT OF WORK

A. Purpose. The purpose of this project was to: 1) ascertain the status (location, abundance, and health) of plant species listed as endangered, threatened, or special concern by the State of Michigan, plus unlisted species that are rare on Isle Royale and grow on rock shores, forested areas at and near developed areas, and other vulnerable sites in the southwestern half of the Park, concentrating on those species specific to rock shoreline habitats and forest communities in developed zones; 2) re-survey a monitoring system for select species in rock shore habitats; 3) determine the effects of different management practices and Park uses on the special floristic elements of the rock shore community and other inventoried sites; and 4) make management recommendations for the maintenance of these species' populations.

B. Objectives. The objectives of the part of the survey covered by this funding were to:

1) Gather quantitative data on the distribution, vitality, and population size for Isle Royale sensitive (State-listed and those unlisted rare species known to occur in the Park) in the rocky shoreline area.

2) Identify any new species and revise the Park flora list to reflect new findings on species occurrence and abundance.

3) Re-survey permanent samplings.

D. Scope of Work:

1) Surveyed the inventory areas using MNFI or compatible methodology to locate all occurrences of listed and unlisted rare species, using both early and late season surveys to encompass the flowering and fruiting periods for most vascular species (based on knowledge of species to be studied. Comprehensive surveying was feasible in linear, open habitats such as rock shorelines and along trails.

2) Exact locations of all special status species populations was mapped on the most recent U.S.G.S. topographic quadrangles, enlarged to a scale of 2.5 inches per 0.25 miles. Descriptions of the most critical of these locations were detailed on standard MNFI forms (rare plant form, site summary form, and plant community form where appropriate) for incorporation into the MNFI statewide database.

3) Habitat data for each population location was collected for the most critical rare new plant populations, including community type, plant associates, overstory components (if any), slope, and aspect. It was not possible to specify the soil type to the soil series level. Any sign of disturbance within or near population areas, and any perceived potential threats to the population was addressed.

4) A hand-held Garmin 12 channel 12 XL GPS was used to record the positions of the most significant rare plant populations. Data was recorded in UTM coordinates (Continental North American 1927 Datum) to an accuracy of about 50-100 meters.

## RESULTS: SIGNIFICANT FINDINGS IN 1998

The general results of 1998 field work are that, as expected, the abundance and density of rare plant species along the coasts of the southwestern half of Isle Royale is considerably lower than the density near the northeastern tip of the island.

Two factors account for this relative poverty: First, the climate of the southwest is warmer with the absence of the upwelling zone of cold water that is found east of Blake Point. Second, the less rugged bedrock topography of the south coast. Wide splash zones with complex wave splash pools (outstanding habitats for rare species) are relatively uncommon in the southwest. Splash pools are found in only three areas: on the south coast in the Little Boat Harbor area (the best examples); on the west end of Washington Island, and at "Crowberry Point Bald" on the main island about a mile north of North Gap (both are relatively small sites).

Along the coast of Siskiwit Bay from Crow Point to Little Greenstone Beach there was increasing diversity of rare species. Even the shelving red sandstone from Malone Bay dock to Schooner Island had quite diverse rare plant communities. East of Schooner Island, massive pre-Cambrian igneous balds occur along the shore and these, too, are rich in rare plants. The most notable finds were more colonies of the encrusted saxifrage (Saxifraga paniculata); this disjunct arctic-boreal species occurs almost continuously for 12 miles along the south coast from just east of Malone Bay dock to Saginaw Point.

The long linear islands of Siskiwit Bay - Long and the Pauls - are composed of shelving red sandstone and have a moderate number of rare species - about ten - but no outstanding rarities. They seem free from recent human impacts, and have little or no moose visitation as evidenced by the abundance of Canada yew (only a few outlying islets of the Isle Royale archipelago have abundant yew - namely Passage, Net, Captain Kidd, South Government, Smithwick, and these islands).

The high diversity of rare plants along four miles of shelving red sandstone on the south coast from just west of Attwood Beach to Fishermens Home Cove was somewhat of a surprise. Diversity is highest in the area between the shore opposite McCormick Rocks and Little Boat Harbor, with well-developed splash pools present that harbor encrusted saxifrage, butterwort, pearlwort, eyebright and several other species.

Southwest of Attwood Beach, coastal rare plant diversity declines steeply - there are no splash pools, and the shoreline rock community is narrower. West and north of Long Point (and all the way to Washington Harbor), the only rare plants noted were spike trisetum (Trisetum spicatum), a ubiquitous coastal species.

I did identify a vulnerable habitat along the coast about one mile west of Attwood Beach (it is possible the dune is what was intended to be labelled as Attwood Beach, and that USGS cartographers mislabelled the map). In T63N-R37E, SW of Section 17 there is a unique (to Isle Royale) beach grass (Ammophila breviligulata) dune sward about 500 meters long and 10-20 meters wide. It is the only example of this community on Isle Royale. My concern is that this fragile dunescape is a desirable camping spot and indeed we found

kayakers camped there (they had been temporarily stopped by westerly winds in their attempt to paddle west to Windigo). Certainly as kayak traffic on this coast increases, this dune is likely to be relatively quickly degraded by illegal camping. Rangers patrolling out of Windigo should be made aware of the potential for this activity.

The far western coast of the main island was surveyed from the mouth of Washington Harbor to Huginnin Cove. There were two significant sites. "Crowberry Point Bald" is a small, juniper-clad coastal headland about a mile north of North Gap. It has splash-pool community with boreal species such as butterwort and crowberry (Empetrum nigrum), here at its only southwest Isle Royale occurrence. This site was also surveyed by Carol Reschke in 1998.

The other site is the McGinty Cove cliff, a sheer 60 meter tall palisade that is the highest coastal cliff on the island. Long known to harbor encrusted saxifrage, in 1997 Will MacKinnon found the first Michigan record for the western disjunct composite Arnica lonchophylla here, as well as the very rare crucifer Draba cana. I was able to relocate the arnica but not the draba (did not do a thorough survey of this cliff, though, as rapelling equipment would have been required). This is a site of exceptional significance in the Park.

The north coast of Isle Royale is difficult to access. I was able to survey the coast from Huginnin Cove northeast about four miles, and, after a gap of about seven miles, from opposite Lake Desor to the mouth of McCargoe Cove.

Northeast of Huginnin Cove the coast is abrupt and rugged with low brushy cliffs interspersed with tiny cobble beaches. There are tiny mossy shelves on some of these cliffs with a few rare species such as Carex atratiformis and C. media, as well as Polygonum viviparum and the ubiquitous Trisetum spicatum. Just inland are mossy fallen boulders in the shade of coastal cedar and balsam fir forests, and here fragrant fern (Dryopteris fragrans) and calypso orchid (Calypso bulbosa). Further northeast, from Little Todd Harbor on, there are fewer rare plants aside from spike trisetum and paintbrush (Castilleja septentrionalis).

## SUMMARY OF ISLE ROYALE NATIONAL PARK ISLANDS SURVEYED, 1998

About a dozen offshore islets were surveyed for the first time in 1998: the large islands at the mouth of Washington Harbor; the islands between Houghton Point and Menagerie Island in Siskiwit Bay; Net Island, the northernmost island in the Amygdaloid - Captain Kidd chain; and South Government, the northernmost islet in the Rock Harbor chain.

## WASHINGTON HARBOR ISLANDS

These islands are generally large by Isle Royale standards. They are generally heavily moose-browsed and are not outstanding centers for rare plants, perhaps because of the milder climate than at the northeast end of Isle Royale. The best shoreline boreal rare plant community on the islands and indeed in the entire southwest end of Isle Royale (along with "Crowberry Point Bald" north of North Gap) occurs around the small rock pools at the western end of Washington Island (see below), but even this site is far inferior in diversity to similar habitats along Rock Harbor, Blake Point, and Passage Island, all on the other end of Isle Royale.

ROCK-OF-AGES LIGHTHOUSE ISLET

Located at the opposite end of the Isle Royale archipelago about 90 km to the southwest, Rock of Ages is a nearly barren rock about 0.1 ha in area that protrudes at most five meters above Lake Superior. This was visited on 21 July 1994 and seven vascular plant species were noted: yarrow (dominant), lady fern (Athyrium filix-femina (L.) Roth; rare), fireweed, fowl meadow grass, common cinquefoil, dandelion (Taraxacum officinale Weber; common), and hawthorn-leaved gooseberry, the last forming a dense thicket at the southwestern tip and visible on the ledge on the left of the tower in the lighthouse photograph of Hyde (1986: 178).

BOTTLE ISLAND

This tiny (1 ha) island located a few hundred meters west of Washington Island appears (21 July 1998) to be forested with balsam fir, white cedar, and mountain-ash. It was not visited.

WASHINGTON ISLAND

This is the second largest offshore island (120 ha, a bit smaller than Amygdaloid) in the Park, and the highest, rising 50 meters above Lake Superior. A survey on 31 July 1998 recorded 196 plant species, but the survey was not complete and there are probably at least 100 more species present. The west end of the island consists of an old fishing settlement, now converted to summer cabins. The rare Aster modestus is present in the old field that formerly served as a baseball diamond early in the century; at least 20 exotic plant species occur here (Judziewicz 1995 campground report), with sweet vernal grass Anthoxanthum odoratum common here and on nearby Barnum Island. The majority of the island, however, is rugged and has seen little human impact, but has evidence of intense moose browsing activity. The balsam fir - white birch - white cedar forest varies from dense to open but has a brushy understory with much red raspberry (Rubus strigosus) present; the rare fern Dryopteris expansa is fairly common in the understory. The summit of Washington Island has a few brushy, grassy bedrock glades with no rare species detected. Wetlands occur near the east end across a small bay from the houses, and a conifer swamp in the interior which was not visited.

The far west end of the island has a small complex of rock pools of a type common at the northeast end of Isle Royale, but rare at the southwest end where they are restricted to this site and one on a coastal bald of the main island just north of North Gap. The Washington Island rock pool community has Pinguicula vulgaris, Castilleja septentrionalis, Scirpus cespitosus, Pinguicula vulgaris, Polygonum viviparum, Cornus stolonifera, Primula mistassinica, Trisetum spicatum, Prenanthes racemosa, Carex capillaris, C. buxbaumii, Platanthera hyperborea, Juncus brevicaudatus, and Halenia deflexa. There are smaller, more depauperate rock pools elsewhere along the north shore, and on the south shore, Trisetum spicatum and Ribes oxyacanthoides is scattered.

BARNUM ISLAND

This 1.5 ha island was not surveyed in 1998, but was examined in 1994 when 13 exotic plant species were recorded (Judziewicz 1995 campground report). Cabins dominate this small island, and the forest is balsam fir and white cedar. Many exotics are present, along with the rare Luzula parviflora along the eavesdrop of one of the cabins.

GRACE ISLAND

This 15 ha island was visited on 28 August 1998; 71 plant species were recorded including the rare taxa Pinguicula vulgaris (one plant), Potentilla pensylvanica (on the headland south of the campground), Trisetum spicatum, and Viburnum edule. 14 exotic species were recorded at the campground in 1994 (Judziewicz 1995 campground report). The forest on the north and east ends was dominated by heavily browsed balsam fir and white spruce; in the west was a savannalike open forest of mountain ash with a grassy, brushy understory.

BOOTH ISLAND

On 28 August 1998, this 2 ha island was connected by cobbles to Grace Island. It had been used a pasture early in the century, and so there are only scattered trees on the southern 2/3, with several escapes from cultivation (tiger lily, lilac, possibly garden currants) indicating past cultivation or settlement near the southern tip. The north coast is a narrow fringe of dense conifer forest below a high inland cliff. The only rare species noted was Viburnum edule. 56 plant species were recorded.

JOHNS ISLAND

A low 20 ha island, Johns Island is irregular in shape, with several deep bays. It was visited on 28 August 1998, when 95 plant species were recorded. The forest is rather open because of moose browse, and balsam fir, white spruce, and white birch are dominant. Nine exotic plant species occur around the cabin and dock at the northeast tip of the island (Judziewicz 1995 campground report). A few rare species occur on several shoreline headland areas, namely Carex media, Dryopteris expansa, Trisetum spicatum, and Viburnum edule.

THOMPSON ISLAND

45 ha Thompson Island is rather high (43 m above Lake Superior and is densely forested with moose-browsed fir, cedar, spruce, white birch, and mountain-ash; this is the largest islet lacking a building of any kind.. During a visit on 31 July 1998, 67 plant species were recorded including the rare ones Dryopteris expansa and Trisetum spicatum. Steep interior north-facing cliffs were not examined in detail and could harbor Dryopteris fragrans; an island conifer swamp was likewise not examined.

BEAVER ISLAND

Beaver Island is a high (50 m above the harbor), conical, 21 ha island that lies wholly within Washington Harbor only a short distance from Windigo dock. There is a campground at the southwest end with 11 exotic species (Judziewicz 1995 campground report). 122 plant species were noted during a visit on 22 July 1994. The forest is dominated by heavily moose-browsed fir, white spruce, and cedar. The rare species Carex media and Polygonum viviparum occur along the north shore, while Clematis occidentalis is scattered throughout the interior.

## OUTER SISKIWIT BAY ISLANDS

These islands were surveyed on 21 August 1998, except for Menagerie which was surveyed in 1994 (see Judziewicz 1995 report appendix). They are low (less than 6 m above the lake), linear islands consisting of reddish sandstone that slopes gradually to the Lake Superior on the southeast side, and a bit more steeply on the northwest (Siskiwit Bay) side. Because they are so remote from the mainland, moose apparently visit rarely or not at all; as a consequence some of their favored browse plants such as Canada yew (Taxus canadensis) and white mandarin (Streptopus amplexifolius) are present and locally common. Rare species are present, but no outstanding ones not better represented by populations near the northeast tip of Isle Royale.

### LONG ISLAND

The largest island (20 ha) in this chain is Long Island, which is about 3 km long but a maximum width of only about 200 meters. The sandstone bedrock is a reddish. The forest is dominated by mountain-ash (Sorbus decora) and balsam fir (Abies balsamea), with a dense understory of red raspberry (Rubus strigosus); 94 species were recorded during the visit, including nine rare species: Carex media, Castilleja septentrionalis, Draba arabisans, Dryopteris expansa, Euphrasia hudsoniana, Polygonum viviparum, Ribes oxyacanthoides, Trisetum spicatum, and Viburnum edule.

### CASTLE ISLAND

We were not able to land on this tiny island (about 400 x 50 meters, 1 ha). Mountain-ash appeared to be the dominant tree, although a few trees of balsam fir and white cedar are also present. Other species seen during our cruise by were Urtica dioica, Calamagrostis canadensis, Phalaris arundinacea, Rubus strigosus, and Alnus viridis.

### (NORTHWEST) PAUL ISLAND

This island is 500 x 100 meters in size (2 ha) and is dominated by mountain-ash, with a very dense shrubby understory of red-osier dogwood (Cornus stolonifera) and mountain maple (Acer spicatum). There are a few coniferous trees such as balsam fir and white spruce. A total of 44 species were recorded, including the rare species Castilleja septentrionalis, Draba arabisans, Ribes oxyacanthoides, and Viburnum edule.

### (SOUTHEAST) PAUL ISLAND

Located only 150 meters southeast of the previous island, Southeast Paul Island is 350 x 80 m in size (1 ha) and is dominated by mountain-ash, mountain maple, and abundant Canada yew, but no conifers. 35 species were recorded, including the rare ones Dryopteris expansa, Ribes oxyacanthoides, and Viburnum edule.

### REDFIN ISLAND

We were not able to land on this 400 x 40 m (1 ha) islet. Again, mountain-ash appeared to be the dominant tree, with a few large white birches, and one or two firs and cedars. Of plants seen were fireweed, red-osier dogwood, and alders.

NET ISLAND

Net Island is the small (700 x 150 meters, 2 ha) at the northeastern end of the Amydaloid - Captain Kidd line of islands on the north coast of Isle Royale. It is significant in that it is being invaded by cormorants; these nest at its northeast end and have destroyed about 15% of the island's forest so far. The dominant forest trees are balsam fir, white cedar, and mountain-ash. On 12 August 1998, 72 plant species were recorded including the following rare species: Castilleja septentrionalis, Draba arabisans, Polygonum viviparum, Potentilla pensylvanica, Saxifraga tricuspidata (in its only occurrence on the north shore of Isle Royale), Trisetum spicatum, and Viburnum edule.

AMYGDALOID ISLAND

The extreme northeast prong of the island just north of Crystal Cove dock was visited for the first time. Here a juniper bald occurs with cinquefoil (Potentilla pensylvanica) and wild chives (Allium schoenosprasum); the latter is uncommon on Isle Royale and occurs elsewhere only on neighboring Captain Kidd Island in on the north shore. I also surveyed the north coast of Amygdaloid Island and found few rare species since cliffs are low and densely forested right to the edge. The tiny islet at the southwest end of Amygdaloid Island does have a number of rare species such as Draba arabisans.

PEARLWORT ROCK

This tiny rock off the Davidson Island dock measures 15 x 3-5 meters in size with a maximum elevation of 50 cm above Lake Superior in 1998. The dominant plants were Euthamia graminifolia, Deschampsia cespitosa, Achillea millefolium, Poa compressa, and rare Sagina nodosa, with 30-35 clumps in full flower in 18 August 1998. Other species present were Poa nemoralis, Epilobium coloratum, Potentilla norvegica, Primula mistassinica, Rubus strigosus, Veronica peregrina, Cardamine penylvanica, and an indeterminate grass.

SOUTH GOVERNMENT ISLAND

This 800 x 150 meter islet (4 ha) is the northeasternmost in the Rock Harbor chain, and suffers from some of the worst lake waves of any of the "Outer Island" at the northeast tip of Isle Royale proper. There is extensive bare sloping basaltic rock exposed on the southeastern (lake-facing) side , and low but steep cliffs on the northwest-facing harbor side. The forest is dominated by balsam fir, with Canada yew and devil's-club (Oplopanax horridus) dominant in the understory; moose apparently seldom visit the island. The devil's club area was about 100 x 20 meters in size in the island's interior, with 200-250 stems including 100 with mature infructescences. 71 species were recorded during a visit on 26 August 1998, including the rare taxa Castilleja septentrionalis, Draba arabisans, Dryopteris expansa, Empetrum nigrum, Oplopanax horridus, Pinguicula vulgaris, Poa alpina, Sagina nodos, Saxifraga tricuspidata, Trisetum spicatum, and Viburnum edule.

INVENTORY: STATUS OF SPECIAL FLORISTIC ELEMENTS

The following is the template used for the rare species accounts, Isle Royale National Park (IRNP). Abbreviations are used wherever possible in order to save space. It is the same as used in my 1995 report.

Name. Scientific (Latin) name as used by Michigan Natural Features Inventory (MNFI) of Michigan Department of Natural Resources) in their 1998 list of Michigan's Special Plants; author(s) of scientific name; [in brackets: other scientific names used in current literature such as Flora of Michigan (Voss 1972, 1985, 1996), Flora of Isle Royale (Slavick & Janke 1993), and Flora North America (Flora of North America Editorial Committee 1993)]; (in parentheses: common name used by MNFI, 1998). Three letter acronym (based if possible on the first three letters of the genus name) used to identify locations of the species on master set of 1:24,000 U.S. Geological Survey topographic maps.

Family. Latin name of plant family (common name in parentheses).

Distribution and Conservation Status:

Global: General global distribution given by Gleason & Cronquist (1991).

U.S.: United States distribution; if the species is restricted in the lower 48 contiguous states only or principally to IRNP, this is so noted. Note: There are no federally listed vascular plant species in IRNP. However, there are two species that are candidates (C3) for federal listing (as of 1998): ram's-head lady's-slipper (Cypripedium arietinum) and auricled twayblade (Listera auriculata).

Michigan: State ranking as given by MNFI (1998) [see attached photocopy of global and state ranking symbols]; Michigan conservation status as of 1998 (endangered, threatened, or special concern); general Michigan distribution, with a note (if applicable) on whether the species is wholly or mostly restricted to IRNP in Michigan.

IRNP: Distribution and an estimate of relative abundance within the park.

Habitat and associates in IRNP: Based on personal observations, published data, and collection label notes for localities within the Park. If there is sketchy information on within-Park habitat, habitat preferences of the species on the adjacent mainland (Michigan, Minnesota, and Ontario) is given. If within-Park habitat differs significantly from mainland habitat preferences, this is also noted.

Appearance and similar species: A brief description giving prominent identification characters and comparisons with similar species is given. To aid in identification, each species account also includes a photocopy of a well-preserved herbarium specimen and (if possible) a color print or slide of the species taken in the Park.

Reproductive biology: A brief description of the species' autecology including flowering and fruiting times, pollinators, dispersers, and herbivores is given; if possible, a reference to recent published ecological work is given.

Historically known populations in IRNP: These include records of the species (either an herbarium voucher or a sight record) in IRNP prior to this study. This includes the very useful Crispin et al. (1984, 1985) rare plants studies of the Rock Harbor Peninsula, Windigo area,

and Mott, Davidson, Raspberry, and Passage Islands. For both this category and the next ("Populations newly discovered in IRNP"), the following format was used (it is easier to give an example and interpret it):

AME-1. 2 mi N of Lk. Desor [LT; probably T65N-R37W, Sec. 25, just N of center and SE of Minong Ridge Trail]; 17 June 1942, Bailey & Bailey 4218 (IRNP, MICH, MSC).

AME = Three letter acronym for the species used in this report;
-1. = Arbitrary number of site (used for identification purposes) given on annotated set of master 1:24,000 U.S. Geological Survey topographic maps;
"swamp 2 mi N of Lk. Desor" = Brief description of location; directions are abbreviated by N, NE, E, SE, S, SW, W, and NW; distances are given in kilometers (km) or meters (m) unless collector has specified miles (mi).
LT = Little Todd Harbor 1:24,000 U.S.G.S. topo map on which the site is located; 14 of these maps cover IRNP, and they are abbreviated as follows in this report:

| | |
|---|---|
| BH = Belle Harbor | MI = Mott Island |
| FL = Feldtmann Lake | PH = Point Houghton |
| FR = Feldtmann Ridge | PI = Passage Island |
| LR = Lake Richie | RH = Rock Harbor Lodge |
| LT = Little Todd Harbor | SM = Sugar Mountain |
| MB = Malone Bay | TH = Todd Harbor |
| MC = McCargoe Cove | WI = Windigo |

T65N-R37W, Sec. 25 = Legal description of site in terms of town, range, section, and parts of section; for offshore islets, which are easily and unambiguously located, legal descriptions are usually omitted, although topo sheets on which they are located are always given (e.g., "Davidson Island (BH)"-- that part of the island on the Belle Harbor topo sheet).
17 June 1942 = Date of original collection or observation; if relocated in the present survey, this date is also given.
Bailey & Bailey 4218 (IRNP, MICH, MSC) = Names of collectors and their collection number (in italics) and place of deposition of the specimen (in parentheses); herbaria are abbreviated as follows:

BLH = Cranbrook Institute of Science, Bloomfield Hills, Michigan.
GH = Gray Herbarium, Cambridge, Mass.
IRP = Isle Royale National Park, Mott Island.
LKHD = Lakehead University, Thunder Bay, Ontario.
MICH = University of Michigan, Ann Arbor.
MCT-F = Michigan Technological University, Houghton.
MSC = Michigan State University, East Lansing.
ND = Notre Dame University, South Bend, Ind.
WIS = University of Wisconsin, Madison.

If the species was observed and not collected, the name of the observer and date of observation is given.

Populations newly discovered in IRNP. The format is identical to that of the previous category. Unless noted, all observations were made by Judziewicz. For several ubiquitous "rare" species (eastern paintbrush, Castilleja septentrionalis; downy oat-grass, Trisetum spicatum; and squashberry, Viburnum edule) the great number of new sight records prevented their consistent, complete inclusion on the master set of topo maps. However, all new locations are mapped on the individual species maps given with each species account. Also omitted

were about ten common "rare" species from the master topo map of Passage Island. It was felt that these taxa were sufficiently well-mapped for this island in the study of Crispin et al. (1985).

Potential threats. A brief comment (sometimes merely speculative), is given on potential threats to the species in IRNP. Potential human impacts in all cases appear to be very slight at this time, and certain species such as Poa alpina and perhaps others appear to benefit from the disturbance entailed in trail maintenance. The main (speculative!) agents of potential change might be global warming and moose herbivory. Anton A. Reznicek (in a March 1995 review of a draft of this report) points out that global warming, if it occurs, may at first affect arctic-alpine species indirectly, in that they may suffer increased competition from more southerly species already on the islands.

Monitored populations and monitoring recommendations. If applicable (i.e., rocky shoreline species). The "JEJ-0xx" numbers refer to monitoring plots established during the course of this survey and are dealt with in detail in the "monitoring" section of this report. Note that most all inland species and some shoreline species are not monitored due to constraints in time and logistics. Monitoring recommendations -- i.e., the time periods between plot re-samplings -- are given in the "monitoring" sections of this report. In general, it is recommended that plots be re-censused every three to five years; if extra personel and resources are available, this could be shortened for some plots to biennially (once every two years), especially those plots that are easily accessible (as noted in the "monitoring" section) such as the ones from Mott to Davidson Islands, on the adjacent main island, and on Scoville Point.

Name. Allium schoenoprasum L. var. sibiricum (L.) Hartman, Wild chives. Acronym used in this report: ALL.

Family. Liliaceae (Lily).

Distribution and Conservation Status:

Global: G5; circumboreal.

U.S.: Alaska; south to Oregon, Utah, Colorado, Minnesota, Pennsylvania, New York, and northern New England.

Michigan: S2; Threatened; rare in the U.P. (locally common along the Escanaba River?), and not present as a native plant in the L.P. The Passage Island and (perhaps) the Escanaba River populations are the most significant in Michigan.

Adjacent Canadian mainland: Fairly common in suitable habitat.

IRNP: Rare at NE end of main island (Blake Point, Captain Kidd Island, Amydaloid Island, Cork Island); locally common on Passage Island. There are also several locations for cultivated (i.e., exotic) garden chives (A. schoenoprasum var. schoenoprasum) next to cabins and fisheries (see below).

Habitat and associates in IRNP: Wild chives grows in moist, wave-washed, probably humus-filled crevices in shoreline basaltic bedrock. Associates are typically few but may include shrubby and three-toothed cinquefoils (Potentilla fruticosa and P. tridentata), tufted hairgrass (Deschampsia cespitosa), harebell (Campanula rotundifolia), and Scirpus cespitosus.

Appearance and similar species: Wild chives (along with its cultivated relative, garden chives) is the only IRNP representative of the familiar genus that includes onion and garlic. It is a perennial, bulb-based herb about 20-40 cm tall. The numerous leaves, clustered towards the plant base, are tubular, hollow, and have an oniony odor when crushed. The flowers are borne in purple to pink globular heads.

Cultivated plants of what are presumed to be the exotic European garden chives (Allium schoenoprasum var. schoenoprasum) were found in 1994 near dwellings at the following locations in IRNP: Amygdaloid Island Ranger Station, Barnum Island, Belle Isle Campground, Davidson Island, Edisen Fishery, Johnson Island, and Mott Island. Garden chives is supposedly a shorter, more slender plant with the narrower leaves all clustered at the plant base but overtopping the inflorescence.

Reproductive biology: The purple inflorescences become evident in late June, and blooming occurs in July and August. Reproduction often occurs vegetatively through bulbs.

Populations newly discovered in IRNP. A population was found on Amygdaloid Island, T67N-R34W, Sec. 35, NW of NW, on 11 August 1998. It grew In bare, juniper-dominated heathland on a prong just north of Crystal Cove dock, with Rosa acicularis, Ribes oxyacanthoides, Campanula rotundifolia, Achillea, Deschampsia cespitosa, Potentilla fruticosa, P. tridentata, Diervilla, Amelanchier, Calamagrostis canadensis, Vaccinium angustifolium, and Allium schoenoprasum. UTM = 16U0381937, 5335155.

Potential threats; management. It is difficult to distinguish between the two varieties of chives and there are two confusing possibilities concerning the nativity of IRNP plants. Either the cultivated populations such as the ones on Davidson Island could have been introduced from supposedly native IRNP stands (such as on a visit to Passage Island Lighthouse sometime earlier in the century?). Or,

populations supposed to be native (such as those on Passage Island) may represent introductions and escapes from garden populations. Probably molecular biological techniques such as analysis of cp-DNA from individual populations from throughout the Lake Superior region would be needed to resolve this question, but to date no such studies have been done. Another possibility (the assumption adopted here) is that both native and exotic populations are present. If this is so, there could be the danger (unlikely, however) of out-crossing and the transfer of deletorious genes from garden to native populations. If this proved to be true (again, a difficult undertaking), then all populations of garden chives near buildings on IRNP should be eradicated.

Monitored populations and monitoring recommendations. JEJ-034 on Passage Island (Overlook Point). The populations on that island are extensive and stable at this time. The Captain Kidd Island populations are surprisingly extensive and it seems possible that the NW-facing coast of Amygdaloid Island (not surveyed) has similar habitat and may harbor the species. The Blake Point and Cork Island populations are small and probably vulnerable to stochastic effects.

Best reference: Coffin & Pfannmuller 1988: 162.

Name. Arabis holboellii Hornem. var. retrofacta (Graham) Rydberg, Holboell's rock-cress. Acronym used in this report: ARA.

Family. Brassicaceae (Mustard).

Distribution and Conservation Status:

Global: Northwestern North America, disjunct in northern Great Lakes region to St. Lawrence Valley.

U.S.: Alaska; south to California, Colorado, the Dakotas, and Michigan; disjunct in the Great Lakes region (Marquis & Voss 1981).

Michigan: No status; scattered in IRNP, U.P., and northernmost L.P.

Adjacent Canadian mainland: Rare on sandy roadsides.

IRNP: Occasional on rocky ridgetops near NE end, especially Stanley Ridge near Lane Cove.

Habitat and associates in IRNP: Arabis holboelli is a plant of dry basaltic ridgetops on Isle Royale, usually growing in crevices on slight southeast-facing slopes. Associates include jack pine (Pinus banksiana), common and creeping junipers (Juniperus communis and J. horizontalis), bearberry (Arctostaphylos uva-ursi), small blue-eyed mary (Collinsia parviflora), early saxifrage (Saxifraga virginiensis), staghorn sumac (Rhus hirta), snowberry (Symphoricarpos albus), hook-spur violet (Viola adunca), rock spikemoss (Selaginella rupestris), buffaloberry (Shepherdia canadensis), prairie cinquefoil (Potentilla arguta), rusty woodsia (Woodsia ilvensis) and prairie buttercup (Ranunculus rhomboideus).

Appearance and similar species: This is a fairly distinctive perennial herb about 20-60 cm tall. The leaves tend to be clustered in thick basal rosettes, often with a basal branch that leads to yet another rosette and so on, giving the plant the look of a succulent rock garden cultivar. This latter vegetative aspect alone separates it from all other members of the Brassicaceae on Isle Royale. The narrow stem leaves are slightly clasping at the base and the inflorescence is a raceme of small white, 4-parted mustard-like flowers that mature into slender, pendant pods 3-6 cm long.

Reproductive biology: Flowering occurs in late May and early June, fruiting shortly thereafter.

Historically known populations in IRNP: There are several collections by Robert Janke from the Minong or Stanley Ridge in 1978, probably at or near one of the localities listed below. There is also a 1949 collection (Richards 2181, MICH) from somewhere on Porter Island.

Populations newly discovered in IRNP.

ARA-6. McGinty Cove cliffs, T64N-R39W, Sec. 25; noted here by Will McKinnon in 1997.

Potential threats; management. The populations seem stable at this time. Like other ridgetop species, periodic natural fires may aid in reducing competition with other species.

Monitored populations and monitoring recommendations. None.

Best references: Coffin & Pfannmuller 1988: 51; Marquis & Voss 1981. Also:

Hopkins, M. 1937. Arabis in eastern and central North America. Rhodora 39: 63-98, 106-148, 155-186.

Name. Arnica cordifolia Hooker, Heart-leaved arnica.
Acronym used in this report: ARNC.

Family. Asteraceae (Sunflower).

Distribution and Conservation Status:
Global: G5; northwestern North America.
U.S.: Alaska; south to New Mexico, South Dakota (Black Hills), and Michigan.
Michigan: S1; Threatened; rare in IRNP and uncommon in the U.P., where known from many sites along north shore of the Keweenaw Peninsula from Eagle Harbor to Copper Harbor.

Habitat and associates in IRNP: In IRNP the species is known only from a shoreline boreal forest at Checker Point on Siskiwit Bay (MacKinnon, 1997).

Appearance and similar species: This is an easily distinguished composite. It looks like a small (15-45 cm tall) sunflower with a single radiate head with yellow rays, reduced stem leaves, and several large heart-shaped basal leaves up to 10 cm long and nearly as wide. Its close relative A. lonchophylla has narrow, linear leaves less than 2 cm wide.

Reproductive biology: Flowering occurs in late June and July.

Recent site (not relocated):
ARNC-1. Checker Point [PH; T64N-R37W, Sec. 35, SE of SW], shoreline balsam fir forest; discovered by Will MacKinnon here in 1997, not relocated during a search on 22 July 1998. Reported to be 3-6 meters inland from low (ca. 1 meter) sandstone bluffs.

Monitored populations and monitoring recommendations. None.

Best reference: Gleason & Cronquist 1991.

Name. Arnica lonchophylla Greene, Lance-leaved arnica. Acronym used in this report: ARNL.

Family. Asteraceae (Sunflower).

Distribution and Conservation Status:

Global: G5; northwestern North America.

U.S.: Alaska; south throughout the Rocky Mountains of Canada and the U.S. to the Black Hills of South Dakota, with disjunct populations near Lake Superior (including eastern Minnesota).

Michigan: No status yet; known in Michigan and Isle Royale only from McGinty Cove cliffs.

Adjacent Canadian mainland: Common, with many records from near Thunder Bay.

Habitat and associates in IRNP: In IRNP the species grows only on very high northwest-facing basaltic cliffs at McGinty Cove (MacKinnon 1997).

Appearance and similar species: See description under A. cordifolia. Arnica lonchophylla has much narrower (maximum 2 cm wide) leaves than that species.

Reproductive biology: Flowering occurs in July.

Recent site relocated in IRNP:

ARNL-1. McGinty Cove cliffs [WI; T64N-R39W, Sec. 25, NE], several dozen plants on sheer 60 meter high cliff and on lip on top of cliff in boreal forest; discovered here in 1997 by Will MacKinnon, relocated on 26 July 1998 by Judziewicz and Jaunzems. 1998 UTM: 16T0335628, 5309338.

Potential threats; management. Uncertain; little is known of the biology of this species

Monitored populations and monitoring recommendations. None.

Best reference: Coffin & Pfannmuller (1988: 53).

Name. Aster modestus Lindley, Great northern aster. Acronym used in this report: AST.

Family. Asteraceae (Sunflower).

Distribution and Conservation Status:
Global: G5; northwestern North America.
U.S.: Alaska; south to Idaho, Minnesota (only in a tight cluster of sites in inland St. Louis Co.), and Michigan.
Michigan: S1; Threatened; rare in IRNP and in U.P. (a recent collection from Cat Harbor in the Keweenaw Peninsula).
Adjacent Canadian mainland: Common, with many records from near Thunder Bay.
IRNP: Rare in central and southwestern parts.

Habitat and associates in IRNP: In IRNP the species grows on sheltered grassy shorelines (Wright Island), an old woods' clearing (Windigo), a rocky shoreline (Lake Siskiwit), at the edge of a streamside alder thicket (Little Todd Harbor), and in an old overgrown field (Washington Island).

Appearance and similar species: Great northern aster is a distinctive species that is related to and somewhat resembles the common New England aster (Aster novae-angliae) of the eastern U.S.; A. modestus is smaller, more slender, and has fewer, smaller, lighter blue flowers than A. novae-angliae. Great northern aster is a rhizomatous, often colonial perennial 50-100 cm tall with hairy stems and numerous sessile, lanceolate, entire (in IRNP material) leaves 5-9 cm long and 1-2 cm wide. The inflorescence is a group of heads about 2-3 cm in diameter bearing numerous light blue ray flowers (fading to dark blue upon pressing) and glandular involucres. The only other IRNP aster with which A. modestus could be confused is the common purple-stemmed aster (A. puniceus), which is a taller plant with larger flowers, eglandular involucres, and conspicuously clasping-auriculate leaves.

Reproductive biology: Flowering occurs in August and early September.

Historical site not relocated.
AST-2. Minong Ridge Trail ca. 1 km S of Little Todd Campground (ca. 50-100 m S of junction of spur trail to campground), large colony on NE side of trail as it enters a wet alder thicket [LT, T65N-R36W, Sec. 19, 400 m S of center], ca. 150 plants, associated with thimbleberry and Aralia nudicaulis, 29 August 1994, Judziewicz 11182 (MICH).

Populations newly discovered in IRNP.
AST-6. Old field (formerly the baseball diamond illustrated in Sievertson's paintings!) just west of cabins on eastern end of Washington Island [WI; T63N-R39W, Sec. 11, SW of NW], ca. 100 flowering plants with Phleum, Poa pratensis, Physocarpus, Ranunculus acris, Rosa acicularis, Anemone canadensis, Vicia angustifolia, Rubus strigosus, 31 July 1998. 1998 UTM: 16T0332951, 5304703.
AST-7. Minong Ridge Trail 1.5 km S of Little Todd Campground (ca. 400 m S of junction of spur trail to campground), large colony on NE side of trail as it enters a wet alder thicket [LT, T65N-R36W, Sec. 19, NW of SE of SE, several old fruiting plants, associated with thimbleberry, 31 August 1998. 1998 UTM: 16U0356664, 5319242.

Potential threats; management. Uncertain; little is known of the biology of this species. It appears to favor old anthropogenic clearings (Wright and Washingtin Island, Windigo Harbor campground).

Monitored populations and monitoring recommendations. None.

Best reference: Gleason & Cronquist 1991.

Name. Calypso bulbosa (L.) Oakes, Calypso. Acronym used in this report: CBU.

Family. Orchidaceae (Orchid).

Distribution and Conservation Status:
Global: G5; northern North America and Eurasia.
U.S.: Alaska; south to Arizona, New Mexico, Minnesota, Wisconsin, New York, and northern New England.
Michigan: S2; Threatened; scattered in U.P. and northern L.P.
Adjacent Canadian mainland: Common.
IRNP: Occasional, especially in the NE 1/3 of the island; near Windigo it is restricted to N-facing slopes under white cedar.

Habitat and associates in IRNP: This is a plant of moist, shady boreal forest on Isle Royale, where it often grows on north-facing mossy banks under balsam-fir and white cedar. It will also grow under white birch or aspen towards the NE end of the island. Common associates are the mosses Hylocomium splendens and Ptilium crista-castrense, and typical boreal forest herbs such as Moneses uniflora, Pyrola secunda, and Linnaea borealis. It often grows in dense clumps of up to 100 flowering stems.

Appearance and similar species: This is an easily identified orchid. It is a perennial 7-20 cm tall arising from an underground bulb, and bearing a single 3-5 cm long furrowed ovate leaf at the base. The single 2-4 cm long flower is terminal to the stem and bears 3 linear-lanceolate sepals and 2 petals as "crown" above the lower lip petal which is modified into a saccate purple pouch, flushed with yellow. Calypso differs from the lady's-slippers by, among other characters, the presence of only a single (versus 2-many) leaf.

Reproductive biology: The leaf is produced in late autumn, overwinters, then senesces by mid-summer of the following year; the flower is produced from late May through the end of June. It is the one and only "spring ephemeral" herb in the boreal forest. In July and August the only evidence of this plant may be the dried erect capsules. Bumblebees are the pollinators (Mosquin 1970).

Populations newly discovered in IRNP.
CBU-55. Boreal forest ca. 3 km NE of Huginnin Cove [WI; T64N-R38W, Sec. 16, NE of NW], several old fruiting plants noted, 30 July 1998.
CBU-56. Boreal forest ca. 4 km NE of Huginnin Cove [WI; T64N-R38W, Sec. 9, SE of SE], ca. 10 old fruiting plants noted, 30 July 1998.
CBU-57. Boreal forest at Todd Harbor eagle/Prosartes site, T65N-R36W, Sec. 1, sight record by Will MacKinnon in 1997.

Potential threats; management. Global warming might be the only potential threat in IRNP. The plants are so scattered that random picking by hikers is probably not a great threat, but locations of this species should not be freely given out.

Monitored populations and monitoring recommendations. JEJ-011 (Davidson Island).

Best references: Case 1987; Smith 1993: 44-45. Also:
Mosquin, T. 1970. Reproductive biology of Calypso bulbosa (Orchidaceae). Canad. Field-Nat. 84: 291-296.

Name. Carex atratiformis Britton, A sedge. Acronym used in this report: CXA.

Family. Cyperaceae (Sedge).

Distribution and Conservation Status:
Global: G5; northern North America.
U.S.: Only in Michigan, northern New York, and northern New England.
Michigan: S2; Threatened; rare in the Keweenaw Peninsula and near Marquette in the U.P.
Adjacent Canadian mainland: Common.
IRNP: Fairly common in suitable habitat in NE one-third of IRNP.

Habitat and associates in IRNP: Carex atratiformis is most common in sheltered gravelly or cobbly shorelines of Lake Superior, in deep protected coves or on the harbor sides of island chains. It frequently grows in moss in the shade or semi-shade of waterside white cedar or balsam-fir. Common associates include Carex norvegica, Primula mistassinica, Selaginella selaginoides, Pinguicula vulgaris, Euphrasia arctica, Halenia deflexa, Polygonum viviparum, and Castilleja septentrionalis. It is also found on the margins of rock pools in more exposed sites, but always well inland from the worst storm waves and usually at the margins of the forest. Occasionally C. atratiformis is found along inland paths, but usually less than 100 m from the Lake; such is the case on the trail near the Passage Island Boat House; on the Lake Richie trail from Moskey Basin; and along the trail boardwalk (CXA-22) at the Barge Cove on Mott Island, where one of the largest, most accessible, and robust populations grows.

Appearance and similar species: This is a member of the Atratae group of Carex, three species of which are found in Michigan. This is an elegant, easily recognized group of rhizomatous perennial sedges, with a terminal male spikelet and, below it, several pretty, thimble-shaped female (pistillate) spikelets with boldy contrasting purple-black and green scales and

Reproductive biology: Flowering occurs in June, fruiting and the spikelets distintegrating in July; few plants retain any perigynia by the middle of August. Populations typically consist of a few to a few dozen plants.

Populations newly discovered in IRNP.
CXA-60. Moist shoreline rock ledges of Lake Superior ca. 2 km NE of Huginnin Cove [WI; T64N-R38W, Sec. 17, NW of SE}, with Polygonum viviparum, Carex atratiformis, C. norvegica, Primula mistassinica, Trisetum spicatum), 10 plants, 30 July 1998.

Potential threats; management. This sedge is so common that it seems unlikely that human activities impact it at all. Probably the only threat would be climatic warming.

Monitored populations and monitoring recommendations. JEJ-008 (Rock Harbor 1 km NE of Lodge), 013 (West Caribou Island South Tip Cleft), 032 (Passage Island Boathouse Forest).

Best references: Gleason (1952: I: 354); Voss (1972: 313-114).

Name. Carex norvegica L. [C. media R. Br.], A sedge. Acronym used in this report: CXM.

Family. Cyperaceae (Sedge).

Distribution and Conservation Status:

Global: G5; northern Eurasia; northern and western North America.
U.S.: Alaska; south to New Mexico, Iowa, Wisconsin, and Michigan.

Michigan: S2S3; Threatened; rare in Keweenaw Peninsula of the U.P.
Adjacent Canadian mainland: Fairly common.
IRNP: Fairly common in suitable habitat in NE one-third of island; rare elsewhere.

Habitat and associates in IRNP: Carex norvegica is most common in sheltered gravelly or cobbly shorelines of Lake Superior, in deep protected coves or on the harborside of island chains. It frequently grows in moss in the shade or semi-shade of waterside white cedar or balsam-fir. Common associates include Carex atratiformis, Primula mistassinica, Selaginella selaginoides, Pinguicula vulgaris, Euphrasia arctica, Halenia deflexa, Polygonum viviparum, and Castilleja septentrionalis. It is also found on the margins of rock pools in more exposed sites, but always well inland from the worst storm waves and usually at the margins of the forest.

Appearance and similar species: This is a member of the Atratae group of Carex, three species of which are found in Michigan. This is an elegant, easily recognized group of sedges, with a terminal male spikelets and below its several pretty, thimble-shaped female (pistillate) spikelets with boldy contrasting purple-black versus green scales and perigynia.

Reproductive biology: Flowering occurs in June, fruiting and the spikelets distintegrating in July; few plants retain any perigynia by the middle of August. Populations typically consist of only a few scattered plants.

Populations newly discovered in IRNP.

CXM-62. 2nd cove NE of Fisherman's Home Cove [PH; T64N-R36W, Sec. 32, SW of SW], 15 plants in mossy waved splashed shoreline rocks in sheltered cove, 22 July 1998.

CXM-63. Shoreline rock pools on north coast of Washington Island [WI; T63N-R39W, Sec. 10, NE of NW], 5 plants in fruit, 31 July 1998.

CXM-64. Rock ledges on south tip of Johns Island [WI; T63N-R39W, Sec.3], about 10 plants in old fruit, 26 August 1998.

CXM-65. Long Island in Siskiwit Bay [MB; T64N-R35W, Sec. 19], scattered in moist mossy shoreline crevices, mostly along north coast, 21 August 1998.

CXM-66. Islet at far SW tip of Amygdaloid Island [MC; T66N-R34W, Sec. 7, NE of NW], wave-splashed shoreline crevices, several plants, 21 August 1998.

CXM-67. Moist shoreline rock ledges of Lake Superior ca. 2 km NE of Huginnin Cove [WI; T64N-R38W, Sec. 17, NW of SE}, with Polygonum viviparum, Carex atratiformis, C. norvegica, Primula mistassinica, Trisetum spicatum), 25 plants, 30 July 1998.

CXM-68. East coasts of Herring Bay [MC; T66N-R34W, Sec. 7 NE of SE And Sec. 8 NW of SW], several dozen old fruiting plants in on two sheltered mossy shoreline ledges shaded by boreal forest, 20 August 1998.

CXM-69. South shore (Malone Bay) opposite Hat Island, T65N-R35W,

Sec. 32, NW of SE, several old fruiting plants, 15 August 1998.

Name. Castilleja septentrionalis Lindley, Eastern paintbrush. Acronym used in this report: CAS.

Family. Scrophulariaceae (Figwort).

Distribution and Conservation Status:

Global: G5; northeastern and western North America.

U.S.: In the West south to Utah, Colorado, and South Dakota; in the East, to extreme NE Minnesota, Michigan, and northern New England.

Michigan: S2S3; Threatened; common on Isle Royale and in the U.P. all along the north side of the Keweenaw Peninsula.

Adjacent Canadian mainland: Common (Soper & Maycock 1963).

IRNP: Common on shorelines; occasional to locally common inland in rocky and burnt clearings, along trails, and in open aspen and white borch stands.

Habitat and associates in IRNP: Eastern paintbrush is the only "bimodal" cordilleran/alpine species in IRNP: it occurs both along the rocky shorelines (along with many rare species) and sheltered shoreline and on inland upland ridgetops and burned areas, where it is often found in glades with common juniper, buffaloberry, and bearberry in sunny areas with a southeast aspect. In both habitats it seems to favor areas with rich, moist soil pockets.

Appearance and similar species: Eastern paintbrush is an easily recognized species. It is a 20-50 cm tall clump-forming perennial herb; the single hairy stem bears alternate, linear, tri-nerved leaves 3-10 cm long and ca. 0.5 cm wide. The inflorescence is a compact spike 3-5 cm long with prominent white, often three-lobed bracteal leaves subtending inconspicuous greenish flowers 1.5-2 cm long. The common Indian paintbrush (C. coccinea) has bright orange inflorescence-bracts and does not occur in IRNP.

Reproductive biology: Flowering occurs in June and July, and by mid-August all that remains of the inflorescence are the brown, many-seeded capsules. Paintbrushes are parasitic on the roots of other plants.

Populations newly discovered in IRNP.

Checker Point [PH; T64N-R37W, Sec. 35, S of SW], 22 July 1998.

2nd cove NE of Fishermen's Home [PH; T64N-R36W, Sec. 32, SW of SW], 22 July 1998.

South shore: more or less continuous from Fisherman's Home cove west to shoreline opposite McCormick Rocks [PH; T63N-R36-37W, Sec. 5, 6, 1, 12 and 14], hundreds of plants, 21-22 July 1998.

Attwood Beach area of south shore [FR; T63N-R37W, Sec. 16], common, 21 July 1998.

Glades on south shore and on S-facing glade slopes south of Feldtmann Ridge [FR; T63N-R37-38W, Sec. 18 and 24], dozens of plants, 21 and 23 July 1998.

Rock shoreline on east end of Grace Harbor [WI; T63N-R39W, Sec. 1, NW of SE], a few plants, 1 August 1998.

Rock pools at west end of Wshington Islands [WI; T63N-R39W, Sec. 9, NE of SE], 31 July 1998.

"Crowberry Point", a small juniper (both species)-dominated coastal bald on the shore of the main island between North Gap and McGinty Cove [WI; T64N-R39W, Sec. 35, NW of NE], with Potentilla fruticosa, Deschampsia cespitosa, Primula, Physocarpus, Danthonia, Trisetum, Pinguicula, Chamaedaphne, Andromeda, Ledum, Arctostaphylos, Carex lenticularis, Tofieldia glutinosa, Prenanthes recemosa, Scirpus cespitosus, Calamagrostis canadensis, Castilleja septentrionalis,

Empetrum nigrum, 26 July 1998,

Long Island in Siskiwit Bay [MB; T64N-R35W, Sec. 19], scattered, 21 August 1998.

NW Paul Island in Siskiwit Bay [MB; T64N-R36W, Sec. 26], rare on shoreline rocks, 21 August 1998.

Net Island, dryish rocks on NW-facing coast [BH; T67N-R34W, Sec. 25, NE of NE, 12 August 1998.

Twelve O'Clock Point [TH; T66N-R35W, Sec. 29 and 32], common, 8 August 1998.

Twelve O'Clock Point to mouth of McCargoe Cove [TH, MC; T66N-R35W, Sec. 13 and 22], scattered in rocky glades along shoreline, a few dozen plants noted, 10 August 1998.

Malone Bay shoreline opposite Hat Island [MB; T65N-R35W, Sec. 32], common, 15 August 1998.

Potential threats; management. This is one of the commonest "rare" plants in the Park and probably could not be threatened by anything but global warming. It often appears to spread along trails and in clearings following disturbance.

Monitored populations and monitoring recommendations. JEJ-001 (Mott Island Central SE Coast), 008 (Rock Harbor 1 km NE of Lodge), 009 (Inner Hill Island), 032 (Passage Island Boat House Forest).

Best reference:

Pennell, F.W. 1935. Scrophulariaceae of eastern temperate North America. Acad. Nat. Sci. Philadelphia Monogr. 1.

Name. Crataegus douglasii Lindley, Black Hawthorn.
Acronym used in this report: CRD.

Family. Rosaceae (Rose).

Distribution and Conservation Status:
Global: G5; western North America, disjunct in the northern Great Lakes region.
U.S.: Alaska; south to California, New Mexico, Minnesota, and Michigan.
Michigan: S3S4; Special Concern; uncommon in U.P., rare in L.P.
Adjacent Canadian mainland: Occasional, mostly along rocky streams; also grown as an ornamental in the vicinity of Thunder Bay.
IRNP: Occasional.

Habitat and associates in IRNP: Black hawthorn has several habitat preferences in IRNP: 1) Open, rocky, often weedy and previously-burned ridgetops such as the Greenstone and Feldtmann Ridges, where the native (pre-disturbance) forest consisted mainly of deciduous trees (white and yellow birch, quaking aspen); 2) Weedy, open habitats on sandy or gravelly post-glacial beach ridges such as the complex on the SW side of Feldtmann Lake and along the brushy Feldtmann Lake Trail 1-3.5 km SW of Siskiwit Bay Campground; 3) Present beaches (such as at Long Point).

Appearance and similar species: Crataegus douglasii is a tall shrub or small tree that can hardly be confused with any other in the Park: it has stout branch thorns or spines 2-4 cm long, much longer than those of any other woody plant on the island. The alternate, simple, rhombic leaves are about 4-7 cm long. The white flowers are borne in clusters (corymbs), and they mature into plump, juicy, blue-black fruits about 1 cm in diameter. There are no other hawthorns in IRNP, and all other regional species have red fruits.

Reproductive biology: Flowering occurs in June, fruiting in August.

Populations newly discovered in IRNP.
CRD-22. 2 km NE of Long Point on south shore [FR; T63N-R38W, Sec. 23, S half], uncommon small tree in shoreline glades with common juniper, white birch, and white spruce; only place seen along the south shore, 23 July 1998.

Potential threats; management. Despite its thorns, black hawthorn appears to be heavily browsed by moose in some places (Greenstone and Stanley Ridges). Fire may be beneficial to this species; it is particularly common on burned, weedy ridgetops.

Monitored populations and monitoring recommendations. None.

Best references: Marquis & Voss 1981; Voss 1985.

Name. Cryptogramma acrostichoides R. Br. [C. crispa var. acrostichoides], American rock-brake; American parsley fern. Acronym used in this report: CRA.

Family. Adiantaceae (Maidenhair fern).

Distribution and Conservation Status:

Global: G5; northwestern North America.

U.S.: Alaska; south to California, Arizona, New Mexico; mapped in extreme northeastern Minnesota by Marquis & Voss (1981) based on a specimen not seen by either Coffin & Pfannmuller (1988) or Ownbey & Morley (1991); Michigan.

Michigan: S2; Threatened; only from IRNP.

Adjacent Canadian mainland: Absent (Crowe 1993, Soper et al. 1989), or one specimen from the north shore near Schreiber, Ontario (Marquis & Voss 1981).

IRNP: Locally common in the NE 1/3 of IRNP, typically on steep SE slopes overlooking a sheltered harbor or inland lake (Tobin, Rock, and Chippewa Harbors; Lake Whittlesey). It is rare both inland on the Greenstone and Stanley Ridges, and on rocky shores (such as Scoville Point) exposed to the full force of Lake Superior. The southern range limit on Isle Royale is uncertain; it has been found as far as Lake Whittlesey and may extend to Schooner Point on basaltic rocks.

Habitat and associates in IRNP: American parsley fern is restricted to dry, sunny crevices in SE-facing basalt glades; along with rusty woodia it is the most sun-loving IRNP fern. Typically a colony will consist of a few to several dozen large, widely-spaced (at least 1 m apart) clumps.

Common associates are lichens (Cladonia sp.), rock spikemoss (Selaginella rupestris), rusty woodsia (Woodsia ilvensis), pale corydalis (Corydalis sempervirens), Bicknell's cranesbill (Geranium bicknellii), three-toothed and common cinquefoils (Potentilla tridentata and P. norvegica), poverty oatgrass (Danthonia spicata), and early saxifrage (Saxifraga virginiensis). In places it also grows with characteristic basalt glade species such as Collinsia parviflora, Ranunculus fascicularis, and R. rhomboideus, but in drier microhabitats not associated with vernally moist crevices.

Reproductive biology: This is an evergreen fern with two types of fronds, fertile and sterile; new growth is produced in the spring, the sterile fronds overwinter, and senesce in the second spring. Spores are produced most of the summer.

Appearance and similar species: This is a distinctive, densely clump-forming sedge resembling, as one of the names imply, garden parsley. The sterile leaves are 5-15 cm long and spreading, the fertile (spore-bearing) ones 5-25 cm tall and erect; the blades are triangular or ovate-triangular, twice- to three-times compound and somewhat leathery; the ultimate segments of the sterile blades are ovate-lanceolate and wedge-shaped at the base, while those of the fertile segments are linear. Its relative C. stelleri (rare in IRNP) is a smaller, shade-loving species that is not densely clumped and has narrower fronds.

Populations newly discovered in IRNP. Many.

CRA-82. Rocky glades ca. 300 m inland from Malone Bay shoreline opposite Hat Island [MB; T65N-R35W, Sec. 32, center], about 30 clumps noted in open glade with Dathonia, Ranunculus rhomboideus, 15 August 1998.

CRA-83. Rocky glades ca. 200 m inland from Datolite Mine on south shore [LR; T65N-R35W, Sec. 33, NE of NE], about 10 clumps noted in open

glade with Danthonia, 15 August 1998.

Potential threats; management. Widespread and apparently secure in suitable habitat; perhaps the only threat might be global warming.

Monitored populations and monitoring recommendations. JEJ-010 (Threemile Parsley Fern Glades), 022 (Porter Island).

Best references: Flora of North America 1993.

Name. Cypripedium arietinum R.Br., Ram's-head lady's-slipper. Acronym used in this report: CYP.

Family. Orchidaceae (Orchid).

Distribution and Conservation Status:
Global: G3; China; northeastern North America.
U.S.: C3; Minnesota, Wisconsin, Michigan, and northern New England.
Michigan: S3; Special concern; occasional throughout the U.P. and northern L.P., mostly in moist calcareous habitats near the Great Lakes.
Adjacent Canadian mainland: Present (Crowe 1993).
IRNP: Uncommon in the NE 1/3.

Habitat and associates in IRNP: The most common habitat in IRNP is at the ecotone between boreal forest and a bedrock glade. In such habitats, common associates are Cladonia lichens, common juniper (Juniperus communis), bearberry (Arctostaphylos uva-ursi), eastern paintbrush (Castilleja septentrionalis), strawberry (Fragaria virginiana), and wood lily (Lilium philadelphicum). It also occurs along trails through boreal forest, such as in a white birch grove near Lane Cove Campground.

Appearance and similar species: This is an easily distinguished orchid when in flower. It is an unbranched, herbaceous perennial 20-35 cm tall with 3-4 alternate elliptical leaves 4-9 cm long and 1.5-2.5 cm wide. The single flower is borne at the stem apex. The sepals are narrow and greenish to purplish, while the lower petal is developed into a downward-pointing, pouchlike lip 1-2 cm long, which is whitish or pinkish streaked with vertical purple veins.

Reproductive biology: The flowering season of this orchid is short, from late May to mid-June. Small bees are the pollinators, and individual plants appear to be short-lived. In IRNP, the plants often grow in very dense clumps of up to 50 individuals; on the mainland, more loosely-spaced colonies are the rule.

Populations newly discovered in IRNP.
CYP-13. Along Minong Ridge trail ca. 2 km E of Todd Harbor campground [TH; T65N-R35W, Sec. 6, NE of SW], 7 fruiting plants noted in rockt glade with common juniper, 8 August 1998.
CYP-14. On W (upslope) side of Indian Portage trail ca. 1 km SW of McCargoe Cove campground, T66N-R35W, Sec. 26, SW of SW], 25 fruiting plants noted on trailside rocky glade near arm of Chickenbone Lake, 9 August 1998. This may be the population reported to me in 1994 by a hiker from along the Indian Portage Trail between McCargoe Cove and West Chickenbone Lake Campground.

Potential threats; management. On the mainland this scarce orchid is vulnerable to digging by collectors; this is probably less of a threat in IRNP, and there are probably more undiscovered populations in rocky glades, especially in the Chippewa Harbor area. Its short period of bloom protects it to some extent; it is easy to overlook in sterile condition. Locations of this orchid should not be given out casually to visitors.

Monitored populations and monitoring recommendations. Plot JEJ-018 (Ransom Hill) is easily accessible by 10 minute walk from Daisy Farm Campground on the Mt. Ojibway Trail and should be re-censused every 2-5 years.

Name. Draba arabisans Michaux, Rock whitlow-grass. Acronym used in this report: DRA.

Family. Brassicaceae (Mustard).

Distribution and Conservation Status:
Global: G4; northeastern North America.
U.S.: Minnesota, Wisconsin, Michigan, New York, and Maine.
Michigan: S2S3; Threatened; rare in the Keweenaw Peninsula, the Garden Peninsula, and in extreme eastern U.P.
Adjacent Canadian mainland: Apparently absent.
IRNP: Occasional, especially at NE end.

Habitat and associates in IRNP: This is most typically a species of rock crevices just above the wave-splash zone. It is often found with Achillea millefolium, Campanula rotundifolia, Danthonia spicata, Juniperus horizontalis, and Artemisia campestris. It is sometimes abundant around old buildings such as at the Menagerie Island and Passage Island Lighthouses, and at the old Belle Isle lodge site. Several inland sites are known such as at Wood Lake, Mt. Franklin, and Monument Rock.

Reproductive biology: Flowering in June and fruiting in July and August.

Populations newly discovered in IRNP:
DRA-46. Long Island in Siskiwit Bay [MB; T64N-R35W, Sec. 19], scattered in dry low rock faces along both coasts, 21 August 1998.
DRA-47. NW Paul Island in Siskiwit Bay [MB; T64N-R36W, Sec. 26], rare on shoreline rocks, 21 August 1998.
DRA-48. Net Island, dryish rocks on NW-facing coast [BH; T67N-R34W, Sec. 25, NE of NE], 15 fruiting plants, 12 August 1998.
DRA-49. Islet at far SW tip of Amygdaloid Island [MC; T66N-R34W, Sec. 7, NE of NW], wave-splashed shoreline crevices, ca. 25 plants in old fruit, 21 August 1998.

Potential threats; management: As proven by its healthy state on Belle Isle and at the Menagerie and Passage Island Lighthouses, this species tolerates and may even thrive on a certain amount of human disturbance. It does not appear to be threatened in IRNP.

Monitored populations and monitoring recommendations. JEJ-024 (North Government Island), 033 (Passage Island NW Coast Cliffs), 037 (Passage Island Lighthouse).

Name: Draba cana Rydb., Hoary whitlow-grass. Synonym: Draba lanceolata Royle. Acronym used in this report: DRC.

Family: Brassicaceae (Mustard).

Distribution:
Global: Northern North America and Eurasia.
U.S.: Alaska; south to Colorado, Wisconsin (several places on the Niagara escarpment in Door County), Michigan and northern New England. Not known from Minnesota.
Michigan: Threatened; scattered in central Upper Peninsula, most frequently on dolomite bluffs.
IRNP: Known only at the southwest end of the island at McGinty Cove.

Habitat and associates in IRNP: High basaltic cliffs

Appearance and similar species: Draba cana is most similar to D. arabisans among the four IRNP species of Draba. Like D. arabisans, the stems have few cauline but many basal leaves, and the fruits are twisted when mature. Unlike D. arabisans, however, the pedicels of the lower flowers are subtended by leaves or bracts, and the mature fruiting pods (siliques) are hairy with fine stellate hairs, not glabrous.

Historically known populations in IRNP: None.

Population newly discovered in 1997:
DRC-1 McGinty Cove cliffs [WI; T64N-R39W, Sec. 25, NE], sheer 60 meter high cliff and on lip on top of cliff in boreal forest; discovered here on 25 July 1997 by Will MacKinnon, not relocated on 26 July 1998 by Judziewicz and Jaunzems. 1998 UTM: 16T0335628, 5309338.

Potential threats; management. Due to its remote location, no threats to this species are anticipated.

Best reference: Voss 1985: 299-300.

Name. Draba glabella Pursh, Smooth whitlow-grass. Acronym used in this report: DRG.

Family. Brassicaceae (Mustard).

Distribution and Conservation Status:

Global: G4G5; northern Eurasia and North America; mostly a coastal species.

U.S.: Alaska; rare on Wyoming-Montana border, Michigan, amd northern New York (Gleason 1952).

Michigan: S1; Threatened; only in IRNP.

Adjacent Canadian mainland: Occasional; Sibley, Mt. McKay, Puff Island, Pigeon River.

IRNP: Rare, only at south tip of Passage Island.

Habitat and associates in IRNP: The single collection was made from upper bedrock beach, in rock crevices and at the edge of Abies-Sorbus decora forest, with Maianthemum, Lycoopodium obscurum, and Cornus canadensis.

Appearance and similar species: See "Notes on Isle Royale National Park whitlow-grasses (Draba species)" above.

Reproductive biology: This is a perennial species that flowers in June.

Historically known populations in IRNP:

DRG-1. Passage Island, 100-150 m NE of the lighthouse, ca. 20 plants, 29 June 1985, Freudenstein 1682 (MSC). This population was not relocated during several searches from 20-24 June 1994.

On 4 June 1997 I found 300 flowering plants in 25 loosely defined colonies at the summit and in crevices in the upper sides of NW-facing cliffs extending from ca. 25 m NW of the tramway turntable, for a distance of 50 meters north. The plants were in loose colonies of 5-50 individuals in the open or in partial shade of shrubby mountain-ash and white birch. The commonest associates were Potentilla tridentata and Polypodium vulgare. Others were Saxifraga tricuspidata, Trientalis, Festuca saximontana, Empetrum, Amelanchier bartramiana, Cornus canadensis and Maianthemum. With its short (1 cm long), toothed, smooth and shiny leaf top surfaces, it was easily distinguished from the longer (2+ cm) untoothed stellate-hairy leaves of the as-yet unflowering D. arabisans common around the base of the lighthouse. Draba glabella colonies grew from (5-) 10-20 meters above the lake, and on lake cliffs or up to 5 (-10) meters inland from the cliff edges. There were also "weedy" colonies of 10 plants at the base of the old north radio tower pylon, and even in the grooves of the metal tramway turntable (15 flowering plus 15 sterile).

Populations newly discovered in IRNP. None.

Potential threats; management. Hikers from the weekly tour boat to Passage Island could conceivably pose a problem if the colony is on the trail, but this seems like a small threat.

Monitored populations and monitoring recommendations. None.

Name. Dryopteris expansa (Presl) Fraser-Jenkins & Jermy [D. assimilis], Expanded or spreading woodfern. Acronym used in this report: DRE or DRY.

Family. Aspleniaceae (Spleenwort).

Distribution and Conservation Status:
Global: G5; Europe; western and northeastern North America.
U.S.: Alaska; south to Califronia, Montana, Minnesota, Wisconsin, and Michigan.
Michigan: S2S3; Special Concern; occasional in the U.P.
Adjacent Canadian mainland: Common.
IRNP: Fairly common near northeast tip and on Passage Island; occasional elsewhere.

Habitat and associates in IRNP: Most typically a species of open to closed-canopy white birch-balsam fir forests, in rich soil with Clintonia, Maianthemum, Cornus canadensis, Linnaea, Coptis, and Lycopodium species. It is commonest near the NE tip of IR; farther SW it is restricted to rich soil pockets on the lee side of cliffs.

Appearance and similar species: This is a large (blades up to 75 cm long and 25 cm wide) and distinctive wood fern. The blades (fronds) are deltate-ovate, much "fatter" in outline than the ovate-lanceolate blades of the common species D. carthusiana and D. intermedia. Similarly, the basal pinnae of D. expansa are very much stouter and more triangular in outline than those of the two common species.

Reproductive biology: Spores produced in the summer; the leaves die back late in the fall.

Populations newly discovered in IRNP.
DRY-20. Cumberland Point [FL; T63N-R39W, Sec. 14, SE of SW], fairly common in shoreline balsam fir - white cedar forest, 1 August 1998.
DRY-21. Washington Island [WI; T63N-R39W, Sec. 9 and 10], ubiquitous in boreal forests on the island, with probably tens of thousands of plants, 31 July 1998.
DRY-22. Johns Island [WI; T63N-R39W, Sec. 3], scattered throughout boreal forest, 28 August 1998.
DRY-23. Thompson Island [WI; T63N-R39W, Sec. 2], scattered throughout boreal forest, 28 August 1998.
DRY-24. Long Island in Siskiwit Bay [MB; T64N-R35W, Sec. 19], occasional in interior fir - white birch - mountain-ash forest, 21 August 1998.
DRY-25. SE Paul Island in Siskiwit [MB; T64N-R36W, Sec. 26], fairly common in mountain-ash / mountain maple forest, 21 August 1998.

DRY-26. South Government Island [RH; T67N-R33W, Sec. 25, SE], common (with Oplopanax) in boreal forest understory, 26 August 1998.
DRY-27. Amygdaloid Island [BH; T67N-R34W, Sec. 34, NW of SW], locally common in boreal forest in interior of island, 20 August 1998.

Potential threats; management. No threats except possibly global warming; moose may also browse, but apparently not heavily.

Monitored populations and monitoring recommendations. JEJ-026 (Boys Island Devils Club), 028 (Blake Point Devils Club), 031 (Passage Island Trail Boardwalk), 032 (Passage Island Boat House Forest).

Best references: Flora North America (1993).

Name. Dryopteris fragrans (L.) Schott, Fragrant woodfern.
Acronym used in this report: DRF.

Family. Aspleniaceae (Spleenwort).

Distribution and Conservation Status:
Global: Eurasia; northern North America.
U.S.: Alaska; Minnesota, Wisconsin, Michigan, and northern New York, Vermont, New Hampshire, and Maine.
Michigan: Occasional in suitable habitats in the U.P.
Adjacent Canadian mainland: Common.
IRNP: Occasional.

Habitat and associates in IRNP: This is strictly a fern of moist vertical crevices on shaded rock faces in IRNP. It is never very common where found, populations seldom exceeding a few plants. Doubtless there are many more populations not discovered on the island. One unusual habitat was old mine tailings at the Haytown Mine at Todd Harbor.

Appearance and similar species: This is a small, densely clump-forming, evergreen wood fern. The narrowly lanceolate fronds tapering to both ends and are 8-25 cm long and 2-5 cm wide. They and the stipes are densely scaly and papery in texture. When crushed, the glandular fronds emit an indescribably pleasant fresh aroma.

Reproductive biology: Spores appear in the summer.

Populations newly discovered in IRNP.
DRF-15. Cliffs in boreal forest ca. 2 km NE of Huginnin Cove [WI; T64N-R38W, Sec. 17, NW of SE], a few plants among giant jumbled boulders, 30 July 1998.
DRF-16. Cliffs in boreal forest ca. 3 km NE of Huginnin Cove [WI; T64N-R38W, Sec. 16, NW of NE], 10 clumps among giant jumbled boulders, 30 July 1998.
DRF-17. Shoreline ridge between Little Todd and Todd Harbors [TH; T65N-R36W, Sec. 9, NE of SE], a few plants in shade of inland cliff, 31 August 1998.
DRF-18. Boreal forest on West Huginnin Cove bald at PRO-2 site, note by Will MacKinnon in 1997; T64N-R38W, Sec. 19, SE of SW.
DRF-19. Boreal forest at McGinty Cove, noted by Will MacKinnon in 1997, T64N-R39W, Sec. 25, NE.

Potential threats; management. The habitats are generally remote and the plants inconspcuous, so there is little human threat.

Monitored populations and monitoring recommendations. None.

Best reference: Flora North America (1993).

Name. Empetrum nigrum L., Black crowberry (including E. rubrum var. atropurpureum, and E. atropurpureum). Acronym used in this report: EMP.

Family. Empetraceae (Crowberry).

Distribution and Conservation Status:
Global: G5; northern Eurasia; northern North America; southern South America and Antarctic islands.
U.S.: Alaska; south to California, Minnesota, Michigan, and northern Vermont, New Hampshire, and Maine.
Michigan: S2; Threatened; rare in the U.P.
Adjacent Canadian mainland: Fairly common on offshore islands.
IRNP: Uncommon near northeast tip and on Passage Island.

Habitat and associates in IRNP: This is a species restricted to bare rocky shorelines above the splash zone at the edge of spruce-fir forests. Common associates are bog bilberry (Vaccinium uliginosum), junipers (Juniperus horizontalis, and J. communis), and bearberry (Arctostaphylos).

Appearance and similar species: Crowberry is a low creeping shrub that resembles a conifer. The leaves are small and needle-like, only ca. 5 mm long and 1 mm wide. The flowers are borne in the leaf axils and are small and inconspicuous; these mature into conspicuous blue-black, blueberry-like fruits about 5 mm in diameter. They are edible but not as sweet as blueberries.

Reproductive biology: Flowering occurs in June, fruiting in August.

Populations newly discovered in IRNP.
EMP-32. "Crowberry Point", a small juniper (both species)-dominated coastal bald on the shore of the main island between North Gap and McGinty Cove [WI; T64N-R39W, Sec. 35, NW of NE], with Potentilla fruticosa, Deschampsia cespitosa, Primula, Physocarpus, Danthonia, Trisetum, Pinguicula, Chamaedaphne, Andromeda, Ledum, Arctostaphylos, Carex lenticularis, Tofieldia glutinosa, Prenanthes recemosa, Scirpus cespitosus, Calamagrostis canadensis, Castilleja septentrionalis, Empetrum nigrum, a 2 sq. meter patch, 26 July 1998, UTm = 16T0333989, 5308267. This is the only occurrence of this species on the SW end of Isle Royale.

Potential threats; management. Trampling by hikers may be a potential threat to the large colony at the tip of Scoville Point past the Stoll Memorial Plaque, but no significant damage by trampling was seen. Most other sites are too remote to be menaced by hikers.
There are likely additional populations of crowberry on the very small rocky islets near the NE tip such as the Split Islands, and the unnamed islets NE of Heron Island and NE of Bat Island, and on Flag Island.

Monitored populations and monitoring recommendations. JEJ-007 (Scoville Point), 019 (Mad Island), 021 (Shaw Island), 023 (Edwards Island), 024 (North Government Island), 033 (Passage Island NW Coast Cliffs), 034 (Passage Island Overlook Point), 035 (Passage Island Anglica Pool).

Best references: Voss 1985; Coffin & Pfannmuller 1988.

EUP-29. Shoreline of Malone Bay ca. 1.5 km W of Malone Bay dock [MB; T65N-R36W, Sec. 36, SW of SW], abundant, hundreds of flowering plants, with Euthamia graminifolia, Deschampsia cespitosa, Campanula rotundifolia, Potentilla norvegica, 16 August 1998. UTM = 16T0364076, 5315465.

Potential threats; management. This species appears to be secure from human threats. Climate change may be the only threat to this species in IRNP.

Monitored populations and monitoring recommendations. JEJ-008 (Rock Harbor 1 km NE of Lodge), 009 (Inner Hill Island).

Best reference: Sell, P.D. & P.F. Yao. 1970. A revision of the North American species of Euphrasia L. (Scrophulariaceae). J. Linnaean Soc. (Botany) 63: 189-234.

Name. Galium boreale L., Northern bedstraw. Acronym used in this report: GAL.

Family. Rubiaceae (Madder).

Distribution and Conservation Status:
Global: Throughout much of North America.
U.S.: Abundant throughout much of the U.S.
Michigan: Common.
Adjacent Canadian mainland: Present (Crowe 1993).
IRNP: Rare; in disturbed ground at Windigo, Crystal Cove, and Passage Island Lighthouse.

Habitat and associates in IRNP: This is a plant of trailsides, roadsides, docksides, and grassy meadows in IRNP; its presence seems correlated with human disturbance and because of its sweet scent it could possibly have been intentionally introduced by fisherman or their wives. It is noteworthy that northern bedstraw shows a similar distribution in the Apostle Islands, where it is known only from old farmsteads on Basswood Island and fishing and logging camp clearings on Stockton Island. On the mainland it is often found in forest edges and in open woodland.

Appearance and similar species: There are several bedstraws on IRNP but this is the only with a cross-shaped pattern of four linear-lanceolate leaves at each node. The inflorescence is also much showier than the other island bedstraws. It is a large, much-branched panicle with numerous tiny white flowers.

Reproductive biology: Flowering occurs in June and July, fruiting in August. The fruits are bristly and are dispersed by animals.

Populations newly discovered in IRNP.
GAL-4. Old field (formerly the baseball diamond illustrated in Sievertson's paintings!) just west of cabins on eastern end of Washington Island [WI; T63N-R39W, Sec. 11, SW of NW], scattered throughout clearing, 31 July 1998.

Potential threats; management. There are no threats. The species, although native to the Great Lakes region, is suspected (by me) as being introduced to IRNP.

Monitored populations and monitoring recommendations. None.
Best references: Gleason 1952.

Name. Hierochloe odorata (L.) P. Beauv., Sweet or holy or vanilla grass. Acronym used in this report: HIE.

Family. Poaceae (Grass).

Distribution and Conservation Status:
Global: Northern Eurasia and northern North America.
U.S.: Alaska; south to Arizona, Iowa, Ohio, and New Jersey.
Michigan: Occasional throughout the state.
Adjacent Canadian mainland: Present (Crowe 1993).
IRNP: Rare, Windigo and Passage Island.

Habitat and associates in IRNP: See below. Elsewhere, the species is most frequent on moist, sandy shores, ditches, roadsides, and meadows, often in open sun.

Appearance and similar species: This is a distinctive perennial clump-forming grass about 30-40 cm tall, with open, elegant pyramidal panicles 5-10 cm long. The spikelets are 4-6 mm long and more or less oval in outline. The long glumes enclose three florets, the lower two male and the upper perfect. The most distinctive character of this plant is its pleasant vanilla- or coumarin-like aroma. It is often gathered by the Ojibwe and other native peoples for ceremonial purposes and for making baskets.

Reproductive biology: Flowering occurs in June.

Populations newly discovered in IRNP:
HIE-3. Old field (formerly the baseball diamond illustrated in Sievertson's paintings!) just west of cabins on eastern end of Washington Island [WI; T63N-R39W, Sec. 11, SW of NW], only a few old fruiting plants, 31 July 1998.

Potential threats; management. Unknown; there is a possibility that the species, although regionally native, was introduced to the island; many tribes of Native Americans use it medicinally and spiritually.

Monitored populations and monitoring recommendations. None.

Best reference: Voss (1972: 209).

Name. Lonicera involucrata (Richardson) Banks, Black twinberry or Involucred honeysuckle. Acronym used in this report: LON.

Family. Caprifoliaceae (Honeysuckle).

Distribution and Conservation Status:
Global: G4G5; Northern North America.
U.S.: Alaska; south to California, New Mexico, Wisconsin (extipated), and Michigan.
Michigan: S2; Threatened; one collection from the Keweenaw Peninsula.
Adjacent Canadian mainland: Common.
IRNP: Fairly common in the northeastern part, but curiously absent NE of Rock Harbor Lodge and from Passage Island.

Habitat and associates in IRNP: The favored habitat in IRNP is in rich soil at the margins of alder thickets and open cedar swamps, in partial shade. It is also frequently found near human habitation (such as on Mott Island, Davidson Island, and Caribou Island Campground), sometimes in disturbed soil (such as at around a new outhouse on Caribou Island), especially on trailsides. Whether this predilection for anthropogenic sites is the result of more efficient bird dispersal to these sites or a more diverse matrix of habitat types is difficult to say. Certainly it appears to be commoner near the Mott Island headquarters complex than anywhere else in the park.

Appearance and similar species: This is a distinctive shrub that is easily recognized and is unlike any other island honeysuckle. It is from 1-2 m tall and bears large, opposite, somewhat obovate entire leaves 6-12 cm long. The most distinctive character of this species are the twinned, stalked flowers borne in the leaf axils, subtended by several large, leaf-like, bright red-purple bracts that set off the small trumpet-shaped yellow flowers that later develop into black berries. The contrast between the small black fruits and large red-purple enveloping bracts is quite distinctive.
Reproductive biology: Flowering occurs in June and early July, and fruit ripens in late July and early August. The trumpet-shaped flowers are pollinated by hawkmouths and hummingbirds.

Populations newly discovered in IRNP.
LON-33. Checker Point [PH; T64N-R37W, Sec. 35, SE of SW], shoreline boreal forest with white spruce, balsam fir, alder, Aster macrophyllus, Aralia nudicaulis, a few plants, 22 July 1998.
LON-34. Minong Ridge Trail 0.5-1 km W of McCargoe Cove Campground [MC; T66N-R35W, Sec. 26, w half], a few plants in relatively dry trailside habitat in open white birch - quaking aspen stand with abundant Aster macrophyllus, 9 August 1998.

Potential threats; management. Moose-browsing was evident on some plants; how great a threat it is is undetermined. Climate change may be the only threat to this species in IRNP.

Monitored populations and monitoring recommendations. JEJ-017 at the small boat cove on Mott Island.

Best reference: Gleason 1952.

Name. Pinguicula vulgaris L., Butterwort. Acronym used in this report: PIN.

Family. Lentibulariaceae (Bladderwort).

Distribution and Conservation Status:

Global: G5; northern Eurasia; northern North America.

U.S.: Alaska; south to Oregon, Idaho, Montana, Minnesota, Wisconsin (4 Apostle Islands), Michigan, New York, and northern New England.

Michigan: S3; Special Concern; rare in U.P. and northern L.P.

Adjacent Canadian mainland: Common.

IRNP: Fairly common in suitable habitat in NE part, especially on the offshore Rock Harbor Islands; extending SW as far as Little Greenstone Beach on the S coast, and at least as far as the SW tip of Amygdaloid Island on the N coast.

Habitat and associates in IRNP: This is a shoreline species in INRP; the only inland record is from a shoreline white cedar swamp at the head of Tonkin Bay. Butterwort's preferred habitat is the margins of sheltered wave-splashed rock pools, often with Scirpus cespitosus, Primula, Potentilla fruticosa, Selaginella selaginoides, and Tofieldia species. Butterwort also occurs on shaded, moist, mossy shoreside banks under white cedar, as at the outlet of Wallace Lake at the head of Moskey Basin. In the latter habitat, associates might be Carex capillaris, C. norvegica, C. atratiformis, Polygonum viviparum, and Selaginella selaginoides. Plants grow in small groups or in colonies of up to hundreds of individuals.

Appearance and similar species: With its bright lime-green rosette of oval basal leaves and single terminal, blue, violet-like flower, butterwort is unmistakable.

Reproductive biology: Flowering occurs in June and early July, fruiting in late July and August. The sticky leaves trap insects, helping the species to survive in its nutrient-poor environment.

Populations newly discovered in IRNP:

PIN-69. Shoreline ca. 1 km SW of Little Boat Harbor [PH; T63N-R37W, Sec. 1], about 50 plants scattered along shore, 2 July 1998. UTM = 16T0354411, 5304695.

PIN-70. West end of Washington Island [WI; T63N-R39W, Sec. 9, NE of SE], rock splash pool complex with Pinguicula, Polygonum viviparum, Scirpus cespitosus, Primula, Potentilla fruticosa, Carex buxbaumii, 500 plants, 31 July 1998. UTM = 16T0330867, 5304041.

PIN-71. North shore of Grace Island [WI; T63N-R39W, Sec. 2, SW of SE], only 1 plant seen, 28 August 1998.

PIN-72. "Crowberry Point", a small juniper (both species)-dominated coastal bald on the shore of the main island between North Gap and McGinty Cove [WI; T64N-R39W, Sec. 35, NW of NE], with Potentilla fruticosa, Deschampsia cespitosa, Primula, Physocarpus, Danthonia, Trisetum, Pinguicula, Chamaedaphne, Andromeda, Ledum, Arctostaphylos, Carex lenticularis, Tofieldia glutinosa, Prenanthes recemosa, Scirpus cespitosus, Calamagrostis canadensis, Empetrum nigrum, 200-300 plants, 26 July 1998,

PIN-73. Islet at far SW tip of Amygdaloid Island [MC; T66N-R34W, Sec. 7, NE of NW], wave-splashed shoreline crevices, about 10 plants, 21 August 1998.

PIN-74. Wave-spashed crevices just W of Little Greenstone Harbor [LR: T65N-R35W, Sec. 34, NE of NW], 15 August 1998.

PIN-75. Splash pools on north shore of Lake Superior at Twelve O'Clock Point, T66N-R35W, Sec. 29/32 border, 120 old plants, 8 August 1998.

PIN-76. North coast of Washington Island, a few plants in splash pool, T63N-R39W, Sec. 10, 31 July 1998.

PIN-77. Shore of Malone Bay opposite Hat Island, a few plants, T65N-R35W, Sec. 32, 15 August 1998.

Name. Polygonum viviparum L., Alpine bistort. Acronym used in this report: POL.

Family. Polygonaceae (Buckwheat).

Distribution and Conservation Status:
Global: G5; northern Eurasia; northern North America.
U.S.: Alaska; south to Nevada, New Mexico, South Dakota, Minnesota, Michigan, and northern New England.
Michigan: S1S2; Threatened; rare on Keweenaw Peninsula in U.P.
Adjacent Canadian mainland: Occasional (Soper & Maycock 1963: 193, map).
IRNP: Occasional.

Habitat and associates in IRNP: Alpine bistort is characteristic of shaded, sheltered mossy shorelines and moist, shaded lakeside crevices. The only inland site noted was along the trail 100 m inland from the boathouse on Passage Island. Typical associates include Selaginella selaginoides, Thuja occidentalis, Carex atratiformis, C. capillaris, C. norvegica, Halenia deflexa, Pinguicula vulgaris, and Primula mistassinica.

Appearance and similar species: Alpine bistort is a distinctive species not liable to be confused with other polygonums in the park. It is a perennial species 10-25 cm tall with linear-lancoelate leaves and a terminal spike of small, whitish to pinkish flowers.

Reproductive biology: Flowering occurs in June and July, fruiting in July and August. The species also produces vegetative bulbils produced in the inflorescence.

Populations newly discovered in IRNP.
POL-49. 2nd cove NE of Fisherman's Home Cove [PH; T64N-R36W, Sec. 32, SW of SW], 35 plants in mossy waved splashed shoreline rocks in sheltered cove, 22 July 1998.
POL-50. First small cove N of Fisherman's Home [PH; T63N-R36W, Sec. 5, NW of NW], 30 plants on shoreline with Primula, Carex capillaris, 22 July 1998.
POL-51. Shoreline rocks between Fisherman's Home and Little Boat Harbor [PH; T63N-R36W, Sec. 6], red sandstone coast with Primula, 100 fruiting plants, 22 July 1998.
POL-52. West end of Washington Island [WI; T63N-R39W, Sec. 9, NE of SE], rock splash pool complex with Pinguicula, Polygonum viviparum, Scirpus cespitosus, Primula, Potentilla fruticosa, Carex buxbaumii, 50 plants, 31 July 1998.
POL-53. Rock pool on N coast of Washington Island [WI; T63N-R39W, Sec. 10, NW of NW], 25 plants in fruit, 31 July 1998.
POL-54. Long Island in Siskiwit Bay [MB; T64N-R35W, Sec. 19], rare in moist mossy shoreline crevices, mostly along north coast, 50 plants, 21 August 1998.
POL-55. Net Island, dryish rocks on NW-facing coast [BH; T67N-R34W, Sec. 25, NE of NE], 5 fruiting plants, 12 August 1998.
POL-56. Moist shoreline rock ledges of Lake Superior ca. 2 km NE of Huginnin Cove [WI; T64N-R38W, Sec. 17, NW of SE}, with Polygonum viviparum, Carex atratiformis, C. norvegica, Primula mistassinica, Trisetum spicatum), 50 fruiting plants, 30 July 1998.
POL-57. Shore of Malone Bay opposite Hat Island, a few plants, T65N-R35W, Sec. 32, 15 August 1998.

Potential threats; management. Given the many new stations for this species and the large amount of suitable habitat that was not explored, it is likely that there are more undiscovered sites in the park. It is not under any threat from human activities. Climate change may be the only threat to this species in IRNP.

Monitored populations and monitoring recommendations. JEJ-013 (West Caribou Island SE Tip Cleft), 014 (West Caribou Island Gilberts Hole), 023 (Edwards Island), 032 (Passage Island Boat House Forest).

Best reference: Coffin & Pfannmuller (1988: 200).

Name. Potentilla pensylvanica L., Prairie cinquefoil (P. bipinnatifida). Acronym used in this report: POT.

Family. Rosaceae (Rose).

Distribution and Conservation Status:
Global: G5; northern and western North America.
U.S.: In the east, south to Minnesota, Iowa, Michigan, and New Hampshire.
Michigan: S1; Threatened; rare on Keweenaw Peninsula.
Adjacent Canadian mainland: Occasional, shaley gravel and dry esposed basaltic crests.
IRNP: Uncommon, mostly near NE end.

Habitat and associates in IRNP: This is typically a species of basaltic rocky headlands, frequently where gulls congregate. Common associates are Campanula rotundifolia, Achillea millefolium, Potentilla norvegica, and Deschampsia cespitosa. It also occurs on headlands where there is a denser development of vegetation, namely in bearberry-juniper heaths. On Menagerie Island it is weedy in crevices and steps of the lighthouse.

Appearance and similar species: This is a distinctive cespitose perennial cinquefoil. It grows 15-50 cm tall and bears an open inflorescence of a few yellow, 5-petaled flowers about 1 cm across; the calyx is densely glandular. The leaves are alternate and pinnately compound, with the leaflets strongly dissected and with densely white-hairy undersides. The only similar species in IRNP is P. arguta, which may occasionally grow in bearberry heaths. It has oval leaflets that are not densely whitened beneath.

Reproductive biology: Flowering occurs in July, fruiting in August.

Historic site relocated in 1998:
POL-6. Crystal Cove, T67N-R34W, Sec. 35, NW of NW. Relocated on far northeastern prong of island across from Crystal Cove dock on 11 August 1998. A dozen plants 20-30 m from tip of prong in juniper-dominated shrubland with Rosa acicularis, Ribes oxyacanthoides, Campanula rotundifolia, Achillea, Deschampsia cespitosa, Potentilla fruticosa, P. tridentata, Diervilla, Amelanchier, Calamagrostis canadensis, Vaccinium angustifolium, and Allium schoenoprasum. UTM = 16U0381937, 5335155.

Populations newly discovered in IRNP.
POT-11. Shoreline headland at E end of Grace Island, just S of campground [WI; T63N-R39W, Sec. 2, SE of SE], about 20 fruiting plants in dry rocky ground with Achillea, Campanula rotundifolia, Danthonia, 28 August 1998.
POT-12. Open shoreline headland on S side of Herring Bay [MC; T66N-R34W, Sec. 18, NW of NW], about 5 plants with Achillea, Potentilla fruticosa, Danthonia, Trisetum, Juniperus communis, 20 August 1998.

Potential threats; management. It is difficult to assess population trends of this species in the Park; it may be declining. Brown (1937) calls it "frequent in rock crevices and rock openings...", which it is certainly not today. Perhaps, like Phacelia franklinii, this species might have been more common during the fishing era when more exposed gravelly ground and gulls were present. The Amygdaloid and Mott Islands and Tobin Harbor populations were not relocated, but this was balanced out by the discovery of four new sites in 1993-1994 (Belle Isle, Center

Island, Middle Islands, and Menagerie Islands).

Monitored populations and monitoring recommendations: None.
Best references: Voss (1985); also:

Kohli, B. & J.G. Packer. 1976. A contribution to the taxonomy of the Potentilla pensylvanica complex in North America. Canad. J. Bot. 54: 706-719.

Name. Prosartes trachycarpa S. Watson [Disporum trachycarpum], wartyfruit fairybells. Acronym used in this report: DIS.

Family. Liliaceae (Lily).

Distribution and Conservation Status:
Global: Western and north-central North America.
U.S.: Washington and North Dakota (NW half of state) south to Arizona and New Mexico; Michigan.
Michigan: Known only from IRNP.
Adjacent Canadian mainland: Absent, although present in the James Bay drainage basin.
IRNP: Rare.

Habitat and associates in IRNP: Mladenoff (1990) has pointed out that in the Porucpine Mountains of Michigan P. hookeri, an even more striking disjunct Western disjunct closely related to P. trachycarpa, may be limited to areas with deep, prolonged snow cover that protects the below-ground parts from winters that are longer and colder than in the maritime-influenced Pacific Northwest. It seems plausible that potential Isle Royale habitat for P. trachycarpa is limited to at least some extent by such microclimatic requirements. Blooming occurs very early in the season (mid-May) on steep ridgetops whose microclimate remains unstudied. Such parameters as length of frost-free season, amount of snow cover in winter, average date of snow melt, and springtime maximum daily temperatures have never been studied here but could be useful in understanding the peculiar distribution of fairy bells on Isle Royale.

Appearance and similar species:
Although a large herb, Prosartes trachycarpa is inconspicuous in the brushy ecotone vegetation of rosy twisted-stalk (Streptopus roseus Michaux), wild sarsaparilla (Aralia nudicaulis L.), bunchberry (Cornus canadensis L.), and bush-honeysuckle (Diervilla lonicera Miller) in which it grows. Among these species it is difficult to maintain a "search image" for fairy bells. In particular, vegetative plants of fairy bells could easily be mistaken as extreme variants of the ubiquitous and highly variable rosy twisted-stalk. Prosartes trachycarpa differs most obviously from Streptopus roseus in its eciliate, broader, slightly cordate, and more palmately-veined leaf blades with a more shiny yellowish-green rather than dull bluish-green cast. The purplish stem is densely short-pubescent, and the few flowers are produced only from the branch tips, not in the leaf axils as in rosy twisted-stalk. The fruits are finely roughened reddish-orange berries about 1 cm in diameter, compared with smaller, smooth, shiny, purplish-red berries in S. roseus.

Potential threats; management. These are the first Michigan and eastern United States records for wartyfruit fairy bells (Prosartes trachycarpa (S. Wats.) Benth. & Hook.). Previously known to occur from northern British Columbia eastward through Alberta, Saskatchewan, and Manitoba to the James Bay region of northern Ontario, then southward to Oregon, southern Arizona, New Mexico, and the western Dakotas and Nebraska (Hitchcock & Cronquist; Scoggan; Rare Plants of Ontario), the species is new to the Gray's Manual and Britton and Brown Manual range (Fernald 1950, Gleason & Cronquist 1991). It seems likely that other populations of Prosartes trachycarpa may occur on Isle Royale. After its discovery, fairy bells was carefully searched for in other seemingly suitable localities such as the Feldtmann Ridge cliffs on the south side of Feldtmann Lake, and the Greenstone and Minong/Stanley Ridges. Optimal

habitat appears to be near the crests of steep, locally high "hogsback" ridges with at least a scattering of white spruce and neither too much (as in areas dominated by thimbleberry and bracken fern, Pteridium aquilinium), too little (the prairie-like scree slope glades of the Stanley Ridge), or too weedy (Greenstone Ridge) vegetation. Such suitable ridgetop localities appear to be concentrated all along the northwest-facing shore, inland to about the Minong Ridge. Figure 1 shows areas that, based on U.S.G.S. topographic maps, appear most likely to harbor undiscovered populations of fairy bells. The species may also be expected in suitable habitats in the Thunder Bay District of Ontario and extreme northeastern Minnesota.

It is not certain what impact the high current densities of moose (Alces alces) on Isle Royale have on fairy bells. Certainly, it appeared as if the large Grace Hill population was thriving in an area that was at least partially protected from moose browse by a dense stand of unpalatable white spruce. The effects of fire on fairy bells is similarly problematical. The species does not occur in any areas that have been burned in the recent past, including the 1936 fire area that consumed 20% of the island, but the possibility is not excluded that it might benefit from fires on a long-term basis-- say, every century or so, as the Minong Canyon Rim site, with its scattered, magnificent super-canopy white pines may indicate. Prosartes hookeri is currently listed as endangered by the Michigan D.N.R. [1993], and P. trachycarpa, which appears to be locally commoner, should be listed as at least threatened.

New sites discovered in 1995, 1997, and 1998:

PRO-6. McGinty Cove Point, Will MacKinnon in 1997; see Judziewicz et al. 1999 publication. 15 plants, most fertile. UTM = 335615, 5309866.

PRO-7. McGinty Cove Bluff Top, Will MacKinnon in 1997; see Judziewicz et al. 1999 publication. UTM = 335798, 5310041.

PRO-8. Cliffs above Huginnin Cove Campground, Judziewicz in 1995; see Judziewicz et al. 1999 publication.

PRO-9. "Atypical" cedar - yellow birch forest Minong Ridge Trail population, Will MacKinnon in 1997; see Judziewicz et al. 1999 publication. 2 fetile plants; UTM = 339719, 5310179.

PRO-10. New Minong Ridge population about 2.5 miles by Minong Ridge Trail northeast of Todd Harbor Campground, T66N-R35W, Sec. 32, SE of SW (UTM = 16U0367775, 5324997), 4 robust fruiting plants in very open SE-facing white spruce glade with Hieracium piloselloides, Diervilla lonicera, Anaphalis margaritacea, Danthonia spicata, Aster macrophyllus, Aralia nudicauliis, and Maianthemum canadense.

Best reference:

Judziewicz et al. 1999.

Name. Ranunculus rhomboideus Goldie, Prairie buttercup. Acronym used in this report: RAR.

Family. Ranunculaceae (Buttercup).

Distribution and Conservation Status:
Global: G4; central North America.
U.S.: South to South Dakota, Iowa, Illinois, and Michigan.
Michigan: S2; Threatened; rare in L.P., absent from U.P.
Adjacent Canadian mainland: Absent (Crowe 1993).
IRNP: Common on ridges, mostly in the northeastern half.

Habitat and associates in IRNP: Prairie buttercup is one of the characteristic species of the thin soil of steep, SE-facing, open, fire-maintained basalt glades of the NE end of the island. Specifically, it grows in crevices and moss mats that are wet in the spring immediately after snow melt. Common associates are blue-eyed Mary (Collinsia parviflora), early buttercup (R. fascicularis), American parsley fern (Cryptogramma acrostichoides), field chickweed (Cerastium arvense), rock cresses (Arabis spp.), hook-spur violet (Viola adunca), early saxifrage (Saxifraga virginiensis), rock spikemoss (Selaginella rupestris), Danthonia spicata, rusty woodsia (Woodsia ilvensis), Polygonum douglasii, as well as weedy invaders such as Veronica verna, Canada bluegrass (Poa compressa), wild basil (Satureja vulgaris), clovers (Trifolium pratense and T. repens), and dandelions (Taraxacum officinale).

Appearance and similar species: This is an easily identified perennial buttercup 10-30 cm tall. The leaves are mostly basal and have prominently diamond-shaped (or with the base truncate) blades which are often villous-hairy beneath and on the petioles. The prominent yellow flowers are 1-2 cm in diameter. The only other buttercups to grow in dry habitats are the common (R. acris) and early (R. fascicularis). Both have deeply lobed or dissected rather than entire leaves.

Reproductive biology: Flowering occurs in earliest spring after the snow melts, and is finished by early June. Fruiting occurs in the summer.

Populations newly discovered in IRNP.

RAR-85. Steep coastline glade about 1 km SW of Little Boat Harbor on Houghton Ppoint [PH; T63N-R37W, Sec. 1, SE], at least a dozen plants in rocky SE-facing glade with cedar, juniper, and Potentilla arguta, 22 July 1998.

There are probably more populations in the glades on the SE slopes of Houghton Point.

RAR-86. Rocky glades ca. 300 m inland from Malone Bay shoreline opposite Hat Island [MB; T65N-R35W, Sec. 32, center], about 10 clumps noted in open glade with Dathonia, Potentilla arguta, and Cryptogramma acrostichoides, 15 August 1998.

Name. Ribes oxyacanthoides L., Northern or hawthorn-leaved gooseberry. Acronym used in this report: RIB.

Family. Grossulariaceae (Gooseberry).

Distribution and Conservation Status:
Global: G5; northern North America.
U.S.: Alaska; northern Minnesota, Wisconsin (rare), and Michigan.
Michigan: S3; Special Concern; uncommon in western U.P., absent from L.P.
Adjacent Canadian mainland: Common.
IRNP: Occasional to fairly common. This species has the widest range of any IRNP plant, growing from the Rock-of-Ages Lighthouse islet in the far SW to the Gull Islands in the far NE.

Habitat and associates in IRNP: The most characteristic habitat in the park is bare, open rocky headlands, often where gulls congregate, with such species as harebell (Campanula rotundifolia) and yarrow (Achillea millefolium). It grows in cracks in masonry or rocks near dwellings on Belle Isle, and near the Rock-of-Ages, Menagerie Island, and Passage Island Lighthouses (again, probably correlated with dispersal by gulls); Brown (1937) noted its occurrence on gravel beaches, now less extensive on the island after cessation of commercial fishing operations. Inland, R. oxyacanthoides is occasionally found on bare ridgetops, sometimes associated with basaltic glade communities or burned areas, as near the Minong Mine, at the far SW terminus of the Greenstone Ridge, on Coyote Hill on the Feldtmann Ridge, and one ridges on both sides of Lake Desor. Most populations consist of only a few bushes. An exception is that it is particularly common on the summit of the extension of the Stanley Ridge that terminates in Hill Point, where common associates are common juniper (Juniperus communis) and buffaloberry (Sheperdia canadensis).

Appearance and similar species: There are five species of the genus Ribes that occur in the Park, and R. oxyacanthoides is easily distinguished from the other four by its flowers borne in small clusters of 2-4 rather than in elongate, many-flowered racemes. The stems are very spiny unlike in all other island species except R. lacustre, which has prickly rather than usually smooth berries. Another good character is leaf size: The leaves of R. oxyacanthoides are small, only 2-4 cm long, smaller than any other IRNP species. The only species with which it could be confused is R. hirtellum, which has never been recorded from the island. The latter species has glandless leaves, stamens equalling or exceeding the calyx lobes, and exceeding the petals.

Reproductive biology: This 0.5-1 m tall sprawling shrub flowers in June and fruits in July and August.

Populations newly discovered in IRNP.
RIB-59. West end of Washington Island [WI; T63N-R39W, Sec. 9, NE of SE], rock splash pool complex with Pinguicula, Polygonum viviparum, Scirpus cespitosus, Primula, Potentilla fruticosa, Carex buxbaumii, a few plants on higher, drier headland nearby, 31 July 1998. UTM = 16T0330126, 5303870.
RIB-60. E half of N coast of Washington Island [WI; T63N-R39W, Sec. 10, NE of NE], a few plants on rocky headlands, 31 July 1998.
RIB-61. NW Paul Island in Siskiwit Bay [MB; T64N-R36W, Sec. 26], rare on shoreline rocks, 21 August 1998.
RIB-62. Long Island in Siskiwit Bay [MB; T64N-R35W, Sec. 19], a few plants scattered on dry headlands on shoreline, 21 August 1998.
RIB-63. SE Paul Island in Siskiwit [MB; T64N-R36W, Sec. 26], a

few plants on shoreline, 21 August 1998.

RIB-64. Islet at far SW tip of Amygdaloid Island [MC; T66N-R34W, Sec. 7, NE of NW], wave-splashed shoreline crevices, several plants, 21 August 1998.

RIB-65. Shoreline of Malone Bay opposite Malone Island [MB; T65N-R35W, Sec. 31, SE of SE], a few plants on shoreline conglomerate, 15 August 1998.

RIB-no number. Also a few plants at the extreme NE prong of Amydaloid Island north of Crystal Cove dock, 11 August 1998. See Allium schoenoprasum (ALL-6) for details.

Potential threats; management. This species is commoner than was thought and does not appear to be endangered in IRNP. Climate change may be the only threat to this species in IRNP.

Monitored populations and monitoring recommendations. Smithwick Island (JEJ-006), Scoville Point (JEJ-007), Blake Point (JEJ-027), North Government Island (JEJ-024).

Best reference: Voss (1985: 331).

Name. Sagina nodosa (L.) Fenzl, pearlwort. Acronym used in this report: SAG.

Family. Caryophyllaceae (Pink).

Distribution and Conservation Status:
Global: G5; northern Eurasia; northern North America.
U.S.: Alaska; south to Minnesota, Michigan, and Maine.
Michigan: S2; Threatened; rare in U.P., absent from L.P.
Adjacent Canadian mainland: Common (Soper & Maycock 1963: 194, map).
IRNP: Occasional on the SE-facing shore of the NE half, from Malone Bay to the northeast.

Habitat and associates in IRNP: This is a shoreline species of wave-splashed crevices and sheltered bedrock shores that grows nearer to lake level than perhaps any other IRNP plant. Preferred habitat appears to be horizontal slabs of rocks nearly at lake level with some protection from the open lake: the Caribou Island end of the Mott-Caribou footbridge and the tiny islet between Davidson and Star Islands are typical sites. Associates may include Primula mistassinica, Euthamia graminifolia, Deschampsia cespitosa, and Campanula rotundifolia.

Appearance and similar species: Pearlwort is a tiny mat-forming perennial herb that is apt to be overlooked when not in flower. The decumbent stems are 5-15 cm long and bear opposite pairs of needle-like leaves about 1 cm long. In the upper part of the stem these grade into bracts and finally the flowers are borne near the apex and are 5-merous, with showy white petals 3-4 mm long. Tiny short shoots sometimes proliferate from the axils of the tiny paired bracts in the inflorescence. From the common stitchwort Stellaria, pearlwort differs in its entire rather than notched petals; from the rare exotic weed Sagina procumbens (found once at a tent site at Daisy Farm in 1994), pearlwort differs in its more copiously-flowered inflorescence and petals longer than the sepals.

Reproductive biology: Flowering occurs in late July and early August during a relatively short period.

Populations newly discovered in IRNP.
SAG-35. Shoreline ca. 1 km SW of Little Boat Harbor [PH; T63N-R37W, Sec. 1], 10 plants scattered along shore, 22 July 1998.
SAG-36. Shoreline about midway from Little Boat Harbor to Attwood Beach [PH; T63N-R37W, Sec. 11], 10 flowering plants scattered along shore, 21 July 1998.
SAG-37. Shoreline of Malone Bay opposite Ross Island [MB; T65N-R35W, Sec. 32, NW of SW], about 25 flowering plants on shoreline conglomerate, 15 August 1998.
SAG-38. Tiny rock about 100 m north of north tip of Davidson Island. This rock emerges only about 1.5 meters above the water, and there were dozens of flowering plants here in August 1998. This is interesting in that in 1994 this rock had no plants on it. The water is lower this year than in 1994.

Potential threats: Due to its short flowering season and inconspicuousness, pearlwort was probably overlooked at many localities, particularly on islands in the Tobin Harbor and Merritt Lane areas. It appears to be secure in the park, with the proviso that, since it occurs so close to lake level, any manipulation (or maintenance) of lake levels at the Soo may have unknown impacts (either positive or negative) on the

species. Climate change may be another threat to this species in IRNP.

Monitored populations and monitoring recommendations. JEJ-008 (Rock Harbor 1 km NE of Lodge), 013 (West Caribou Island South Tip Cleft), 019 (Mad Island).

Best references: Coffin & Pfannmuller (1988: 140).
Crow, G.E. 1978. A taxonomic revision of Sagina (Caryophyllaceae) in North America. Rhodora 80: 1-91.

Name. Saxifraga paniculata Miller [S. aizoon], Encrusted saxifrage. Acronym used in this report: SXP.

Family. Saxifragaceae (Saxifrage).

Distribution and Conservation Status:
Global: G5; central Europe; northeastern North America.
U.S.: Minnesota, Michigan, northern New York, and northern New England.
Michigan: S1; Threatened; only in IRNP.
Adjacent Canadian mainland: Occasional; mostly coastal sites but also inland on Mt. McKay and in Ouimet Canyon (Soper & Maycock 1963: 195, map).
IRNP: Occasional on South Shore from Malone Bay to Saginaw Point, and on Mott and the Caribou Islands; fairly common, Passage Island; rare elsewhere. Its near-absence from seemingly suitable habitat NE of Mott Island (except for Passage Island) is puzzling.

Habitat and associates in IRNP: This species is typical of the most exposed headlands and rocky shores in the Park, where the microclimates are most rigorous. Associates include Vaccinium uliginosum, Arabis lyrata, Campanula rotundifolia, Empetrum nigrum, and Lycopodium selago. It does not grow on the most exposed lakeward side of such sites, but rather a few meters inland in crevices and on shelves that face NW. On Passage Island, this is one of the few rare species that grow on steep vertical NW-facing cliffs on the north side of the island. The only inland site known for encrusted saxifrage is on N-facing conglomerate cliffs at the W end of the Feldtmann Ridge escarpment.

Appearance and similar species: This is an easily distinguished perennial herb. The leaves occur in dense basal rosettes. They are oblanceolate, 1-3 cm long. The most distinctive character are the margins: they are finely toothed with each tooth becoming encrusted with a whitish powder from a pore near the tip. The bracted flowering shoot is 10-30 tall and bears white, 5-petaled flowers about 1 cm across. The fruit is a two-beaked capsule.

Reproductive biology: Flowering occurs at the end of May through most of June, fruiting in July. The plants also reproduce by long stolons.

Populations newly discovered in IRNP.
SXP-46. Shoreline ca. 1 km SW of Little Boat Harbor [PH; T63N-R37W, Sec. 1], reported by Will MacKinnon from here in 1997, not seen on 22 July 1998.
SXP-47. Shoreline of Malone Bay opposite Malone Island [MB; T65N-R35W, Sec. 31, SE of SE], at least 100 plants on shoreline conglomerate, widely distributed and locally common, 15 August 1998. UTM = 16T0366388, 5315857.
SXP-48. Shoreline of Malone Bay opposite Schooner Island [MB; T65N-R35W, Sec. 33], at least 75 plants on shoreline conglomerate, widely distributed and locally common, 15 August 1998.
SXP-49. Shoreline of in the vicinity of the Datolite Mine [LR; T65N-R35W, Sec. 33, NE], hundreds or perhaps over 1000 plants on massive shoreline basaltic balds, widely distributed and common, 15 August 1998.
SXP-50. Shoreline of in the vicinity of Little Greenstone Beach [LR; T65N-R35W, Sec. 34, NE of NW], several hundred plants in various crevices, 15 August 1998.

Potential threats; management. It was encouraging to find this species locally common along the South Shore from Chippewa Harbor to Saginaw

Point. No direct human influences threaten this species, but this is a potentially sensitive species to climatic warming.

Monitored populations and monitoring recommendations. JEJ-001 (Mott Island Central SE Coast), 004 (Bat Island), 015 (West Caribou Island SE Coast), 016 (East Caribou Island NE Peninsula), 024 (North Government Island), 027 (Blake Point Signal Light), 033 (Passage Island NW Coast Cliffs), 034 (Passage Island Overlook Point).

Best references: Coffin & Pfannmuller (1988: 142); Voss (1985: 325-326).

Name. Saxifraga tricuspidata Rottb., Prickly saxifrage. Acronym used in this report: SXT.

Family. Saxifragaceae (Saxifrage).

Distribution and Conservation Status:
Global: G4G5; northern North America.
U.S.: Alaska; Michigan.
Michigan: S2; Threatened; only on Isle Royale.
Adjacent Canadian mainland: Occasional on offshore islands from Tunnel Island to Hawk Island (Given & Soper 1981: 36, map).
IRNP: Uncommon, rocky shorelines near NE tip and Passage Island. It is definitely not now "frequent in rock shore crevices and rock ridges in the interior" (Brown 1937).

Habitat and associates in IRNP: This species grows on shoreline rocks, but usually higher up in the juniper-bearberry-blueberry heath zone than its relative S. paniculata. Frequent associates include Festuca saximontana, Woodsia ilvensis, Potentilla tridentata, Selaginella rupestris, and Danthonia spicata.

Appearance and similar species: This is a distinctive small (10-20 cm tall) perennial herb easily distinguished even in vegetative condition. The stiff, shiny, 1-2 cm long leaves are crowded along the basal part of the stem (a few reduced ones occur farther up the stem). The leaves are obovate-oblong and at the apex are divided into three large sharp teeth. The inflorescence is a terminal cyme of 5-merous flowers that are 1-1.5 cm in diameter. The petals are white to more frequently cream-colored and are often dotted with tiny flecks of red or purple. A common associate, three-toothed cinquefoil (Potentilla tridentata), might be confused with S. tricuspidata when in sterile condition but has compound leaves with each leaflet three-toothed, rather than simple and three-toothed as in the saxifrage.

Reproductive biology: Flowering occurs at the end of May through most of June, fruiting in July.

Populations newly discovered in IRNP.
SXT-38. Net Island, dryish rocks on NW-facing coast [BH; T67N-R34W, Sec. 25, NE of NE], 35 fruiting plants on northwest coast headland, 12 August 1998. UTM = 16U0384657, 5336737.
This is the only occurrence of this species south of Blake Point on the northwest shore of Isle Royale.

Potential threats; management. The IRNP populations are significant in that they represent the only sites in the 48 contiguous states. No direct human influences threaten this species, but this is a potentially sensitive species to climatic warming.

Monitored populations and monitoring recommendations. JEJ-007 (Scoville Point), 020 (Heron Island), 022 (Porter Island), JEJ-025 (Long Island), 027 (Blake Point Signal Light), 036 (Passage Island Lighthouse).

Best reference: Voss (1985: 325-326).

Name. Senecio indecorus Greene, Rayless mountain ragwort (Packera indecora (Greenm.) A. Love & D. Love). Acronym used in this report: SNI.

Family. Asteraceae (Sunflower).

Distribution and Conservation Status:
Global: G5; northern and western North America.
U.S.: South to California, Wyoming, Minnesota, Wisconsin, and Michigan.
Michigan: S1; Threatened; uncommon in Keweenaw Peninsula of U.P.
Adjacent Canadian mainland: Fairly common.
IRNP: Occasional in NE half of island.

Habitat and associates in IRNP: Senecio indecorus grows in moist shoreline habitats, either on sheltered gravelly shores with such species as Carex flava, Euthamia graminifolia, and Halenia deflexa, or along the margins of rock pools and wet crevices in more exposed lakeward sites. Populations rarely exceed a dozen or two individuals at a given site.

Appearance and similar species: Rayless mountain ragwort is a perennial herb 10-50 cm tall. The leaves (1.5-4 cm long and 1-2.5 cm wide) are mostly basal and are narrowly elliptical and cuneate at the base while tapering-acute at the tip; the few stem leaves are reduced in size and pinnate. The inflorescence is few-flowered (2-10); the heads have involucres 6-8 mm high, and have ray yellowish-orange ray flowers 1-1.5 cm long. Although many manuals state that ray flowers are rarely developed (hence indecorus, or "not showy,") in the Lake Superior region most populations have well-developed ray flowers (Robert R. Kowal, pers. comm.). The only other common ragwort species on Isle Royale, S. pauperculus, differs in its more elliptical leaf blades that are rounded at both the base and apex. The ragworts are a difficult group taxonomically, and when in doubt specimens should be sent to Dr. Robert R. Kowal of the Department of Botany, University of Wisconsin-Madison for identification. See further notes under Senecio "insula-regalis".

Reproductive biology: Flowering occurs in late June and July, fruiting in August.

Populations newly discovered in IRNP.
SNI-40. Shoreline ca. 1 km SW of Little Boat Harbor [PH; T63N-R37W, Sec. 1], reported by Will MacKinnon from here in 1997, 5 plants seen here on 22 July 1998. UTM = 16T0354411, 5304695.
SNI-41. Shoreline 2 km SW of Little Boat Harbor [PH; T63N-R37W, Sec. 12, NW of NW], 5 plants scattered along shore, 2 July 1998.

Potential threats; management. Rayless mountain ragwort does not appear to be threatened by human disturbance in the Park, and it is probable that many more undiscovered populations remain. Climate change may be the only threat to this species in IRNP.
Monitored populations and monitoring recommendations. This species is monitored within the following plots: JEJ-001 (Mott Island Central SE Coast), 002 (Mott Island SE Coast Trailside), 009 (Inner Hill Island), 013 (West Caribou Island South Tip Cleft), and 015 (East Caribou Island SE Coast).

Best reference: Barkley, T.M. 1963. Preliminary reports on the flora of Wisconsin. No. 49. Compositae-II. The genus Senecio (the ragworts) in Wisconsin. Transactions of Wisconsin

Name. Senecio "insulae-regalis" R.R. Kowal ined., Isle Royale ragwort (Packera "insulae-regalis"). Acronym used in this report: SNR.

Family. Asteraceae (Sunflower).

Distribution and Conservation Status:
Global: Unknown.
U.S.: Unknown.
Michigan: Unknown.
IRNP: Rare; in all the world known only from a colony along the Greenstone Ridge Trail near the Mt. Franklin overlook.

Habitat and associates in IRNP: Rich ridgetop boreal forest; details and associates are given below.

Appearance and similar species: This new species is related to the locally common rayless ragwort (Senecio indecorus), from which it differs in being a self-incompatible hexaploid (6N) rather than a self-compatible octoploid (8N). The ray flowers are also larger and showier than in S. indecorus.

Reproductive biology: Flowering occurs in July and fruiting a few weeks later.

Historically known populations in IRNP:
SNR-1. Summit of Mt. Franklin [BH; T66N-R34W, Sec. 12, NW of SW], patch in spongy, black, humus-rich soil under white spruce (Picea glauca), with bracken fern (Pteridium aquilinium), wild-lily-of-the-valley (Maianthemum canadense), Canada bluegrass (Poa compressa), wild strawberry (Fragaria virginiana), and bigleaf aster (Aster macrophyllus), 16 July 1972, M. Nee (WIS).

1993 Re-Survey by Judziewicz:
This colony was relocated on 7 August 1993; several dozen old flowering and fruiting plants were noted, plus an undetermined number of sterile individuals. Exact directions are as follows: colony borders the SE side of the Greenstone Ridge Hiking Trail, 22-28 meters SW of the Mt. Franklin overlook, in an open 8-25 cm dbh white spruce stand with bracken fern, bigleaf aster and wild sarsaparilla (Aralia nudicaulis) dominant in the understory; other associates in addition to those listed by Nee were rice grass (Oryzopsis asperifolia), juneberry (Amelanchier sp.), cow-wheat (Melampyrum lineare), Canada hawkweed (Hieracium kalmii), spurred-gentian (Halenia deflexa), thimbleberry (Rubus parviflorus), round-lobed hepatica (Hepatica americana), ciliolate aster (Aster ciliolatus), and one-sided pyrola (Pyrola secunda).

1994 Re-Survey by Judziewicz:
This site was re-visited on 26 July 1994. The "Isle Royale ragwort" appears to be suffering from competition or encroachment from bracken fern, wild sarsaparilla, and bigleaf aster. A total of 200 individuals were noted, nearly all within 40 cm of the edge of the trail (none more than 1 m from the edge) where foot traffic had reduced competition; there were only three fruiting plants, the rest were sterile.

1997 Re-Survey by Judziewicz: On 5 June 1997 the site was revisited. The exact same areal extent of plants was found as in 1994: the colony was 22-28 m south of the Mt. Franklin overlook, on the southeast side of the trail. It was a 6 x 0.1-0.5 (-1.0) meters patch under an an

overstory of scattered 6-9" dbh balsam fir, white spruce, and quaking aspen. Dominant understory associates were Pteridium aquilinium, Diervilla lonicera, Aralia nudicaulis, Aster macrophyllus, and Amelanchier sp. Also present were Oryzopsis asperifolia, Hepatica americana, Aster ciliolatus, Castilleja septentrionalis, Danthonia spicata, Rubus parviflorus, Lonicera dioica, Maianthemum canadense, and Hieracium sp. There were 440 stems: 5% robust (leaf blades at least 2 cm long, plant up to 7 cm tall), 20% "moderate" (blades 1-2 cm long), and the rest smaller. The colony looked healthier than in 1994. No buds were seen. The largest plants have ovate, subcordate blades 2-2.5 cm long, petioles to 5 cm long with cobwebby hairs, these also present on the blade but soon wearing off. A few small (less than 1 cm long) blades had purple undersides.

1998 (June) Re-Survey by Robert R. Kowal: In late June 1998, Robert R. Kowal of the Department of Botany, University of Wisconsin-Madison surveyed the colony and collected live plants to grow in the greenhouse. In June 1999 these plants flowered in the greenhouse, and Kowal is actively studying the cytology of this species (personal communication).

1998 (25 August) Re-Survey by Judziewicz: UTM = 383664, 5331296. The population had much the same areal extent as in June 1998. The GPS was used to establish its exact location. Three or four old fruiting stalks (with the fruits all dropped) were observed.

Populations newly discovered in IRNP. None.

Potential threats; management. Forest encroachment. It is possible that the maintenance of the trail benefits this species. Fire may also benefit it; we simply don't know.

Monitored populations and monitoring recommendations. Uncertain; forest encroachment might be negatively impacting this site.

Best reference:

Barkley, T.M. 1963. Preliminary reports on the flora of Wisconsin. No. 49. Compositae-II. The genus Senecio (the ragworts) in Wisconsin. Transactions of Wisconsin Academy of Sciences, Arts, and Letters 52: 343-352.

Name. Tofieldia glutinosa (Michaux) Pers., False asphodel. Acronym used in this report: TOG.

Family. Liliaceae (Lily).

Distribution and Conservation Status:
Global: Northern North America.
U.S.: Alaska; south to Minnesota, Indiana, Ohio, and North Carolina.
Michigan: Occasional throughout.
Adjacent Canadian mainland: Present (Crowe 1993).
IRNP: Occasional along SE coast in NE half of island; also Passage Island and inland near Lake Halloran.

Habitat and associates in IRNP: In IRNP, false asphodel grows on the margins of shoreline rockpools and moist crevices, or less commonly inland in calcareous bog mats. Typical shoreline associates include Scirpus cespitosus, bog bilberry (Vaccinium uliginosum), butterwort (Pinguicula vulgaris), northern spikemoss (Selaginella selaginoides), shrubby cinquefoil (Potentilla fruticosa), sundew (Drosera rotundifolia), and birdseye primrose (Primula mistassinica). Tofieldia glutinosa and T. pusilla often occur in the same habitat on IRNP, but rarely grow side by side.

Appearance and similar species: False asphodels are grasslike or rushlike perennial herbs that are inconspicuous when not in flower or fruit. Tofieldia glutinosa is 8-20 cm tall with all but one of the grasslike 5-10 cm long leaves clustered near the base of the plant. The 20-35 cm long scape bearing terminal inflorescence is sticky with tiny glands (hence the name glutinosa). The glandular inflorescence is a short dense raceme 2-4 cm long, bearing small, clustered, greenish-white flowers with 3 sepals and petals (each about 4 mm long) and 6 stamens. The fruit is a 5-6 mm long elliptical capsule that is often conspicuous due to its reddish color.

Reproductive biology: Flowering occurs in late June and early July, fruiting in late July and August.

Populations newly discovered in IRNP.
TOG-25. "Crowberry Point", a small juniper (both species)-dominated coastal bald on the shore of the main island between North Gap and McGinty Cove [WI; T64N-R39W, Sec. 35, NW of NE], with Potentilla fruticosa, Deschampsia cespitosa, Primula, Physocarpus, Danthonia, Trisetum, Pinguicula, Chamaedaphne, Andromeda, Ledum, Arctostaphylos, Carex lenticularis, Tofieldia glutinosa, Prenanthes recemosa, Scirpus cespitosus, Calamagrostis canadensis, Empetrum nigrum, several plants, 26 July 1998,
TOG-26. Wave-spashed crevices just W of Little Greenstone Harbor [LR: T65N-R35W, Sec. 34, NE of NW], a dozen plants in various crevice splash pools, 15 August 1998. UTM = 0370425, 5316564.
TOG-27. Splash pools east of Attwood BEach on the south coast, 21 July 1998, T63N-R37W, Sec. 16, NE of NE, a few plants.

Potential threats:. Populations appear stable and free from the threat of human disturbance.
Monitored populations and monitoring recommendations. JEJ-003 (Mott Island Bilberry-Butterwort Site) and 012 (Outer Hill Island).

Best references: Gleason & Cronquist (1952: I: 404-406); Voss (1972: 422

Name. Trisetum spicatum (L.) Richter, Downy oat-grass. Acronym used in this report: TRI.

Family. Poaceae (Grass).

Distribution and Conservation Status:

Global: G5; northern Eurasia; northern and western North America; the mountains of Mexico, Hispaniola, and Central and South America.

U.S.: Alaska; south to California, New Mexico, Minnesota, Pennsylvania, North Carolina, and Connecticut.

Michigan: S2; Special Concern; locally common along the N shore of the Keweenaw Peninsula; also Lake Superior shoreline further south and on Drummond Island.

Adjacent Canadian mainland: Common.

IRNP: Fairly common, mostly on SE-facing coasts in the NE half of the island; rare inland, where only noted on Mt. Franklin and on a headland at the E end of Siskiwit Lake.

Habitat and associates in IRNP: This is a grass with two main habitat preferences in IRNP:

1) Moderately moist crevices on exposed, rocky, Lake Superior shorelines, with such associates as harebell (Campanula rotundifolia), yarrow (Achillea millefolium), tufted hairgrass (Deschampsia cespitosa), three-toothed cinquefoil (Potentilla tridentata), Aster ptarmicoides, Artemisia campestris, Calamagrostis inexpansa, and ticklegrass (Agrostis hyemalis), as well as rare species like Draba arabisans, Ribes oxyacanthoides, Vaccinium uliginosum, Pinguicula vulgaris, Tofieldia spp., and Saxifraga (all three species).

2) Sheltered, gravelly or sandy Lake Superior shorelines protected from wave action, such as the shores of Lorelei Lane in Rock Harbor, or the shores of Beaver Island and Washington Harbor. Associates here are more varied and may include grass-leaved goldenrod (Euthamia graminifolia), eastern paintbrush (Castilleja septentrionalis), eyebright (Euphrasia arctica), and the sedges Carex atratiformis and C. norvegica.

Rarely, Trisetum spicatum is found inland, such as a few plants seen along the Greenstone Ridge Trail 200 m SW of Mt. Franklin Overlook; and on the bare rocky headland jutting into the E end of Lake Siskiwit.

Appearance and similar species. Downy oat-grass is a cespitose perennial grass about 10-40 cm tall. The foliage and inflorescence stalks (peduncles) are softly pubescent, a good character for identifying this species in sterile condition. The inflorescence is densely to loosely spikelike in appearance, ranging from 3-8 cm long and 0.5-1 cm in diameter. It soons turns a rather shiny straw color after flowering. The spikelets are 2-flowered; the glumes are awnless, and each lemma has a prominent, kinked awn emerging about 1/3 of the way from the tip, giving the inflorescence a somewhat bristly appearance. Taxonomically, Trisetum spicatum is a variable species that has been divided into numerous varieties that appear to freely intergrade. No varieties are recognized in this report. Several other grasses might be confused with downy oat-grass. Timothy (Phleum pratense), a common Eurasian weed of clearings, has densely spikelike inflorescences, but the glumes are short-awned and the single floret has an awnless lemma.

Reproductive biology. Flowering occurs in June; fruiting in July. Apparently little is known about the reproductive biology of this species.

Historically known populations in IRNP. Due to the large number of

historical and newly discovered sites, the following locations are not referenced with a map number. The sites are listed more-or-less from Windigo northeast to Passage Island. At all of the sites that were visited in 1993-1994, these populations were relocated. Many more sites were mapped by Crispin et al. (1984, 1985) and are included on the maps in this report.

Populations newly discovered in IRNP: Several dozen new populations were discovered during the course of this survey. These are summarized as follows:

Checker Point [PH; T64N-R37W, Sec. 35, SW], dozens, 22 July 1998.

Francis Point [PH; T63N-R37W, Sec. 2, NE of NE], a few, 22 July 1998.

Point Houghton west along south shore to more or less continuously to Attwood Beach, then sporadically west to Long Point [PH, FR; T64N-R36W, Sec. 32; T63N-R36W, Sec. 5-6; T63N-R37W, Sec. 1, 12, 11, 10, 16, 18; T63N-R38W, Sec. 24, 23, 27]; a total of ca. fruiting plants, 21-22 July 1998.

About 1 km W of Long Point on way west to The Head [FL; T63N-R38W, Sec. 28 SE], ca. 20 plants, 23 July 1998.

South side of Rainbow Point [FL; T63N-R38W, Sec. 30, SE of NW], a few plants, 23 July 1998.

Cumberland Point [FL; T63N-R39W, Sec. 14, SW of SW], a few plants on shoreline conglomerate, 1 August 1998.

Washington Island shorelines [WI; T63N-R39W, Sec. 9-10], widespread on shoreline rocks, especially on the south shore, a total of perhaps 500 plants, 31 July 1998.

Grace Island shorelines [WI; T63N-R39W, Sec. 2 SE], a few plants, 26 August 1998.

Johns Island south tip shoreline [WI; T63N-R39W, Sec. 3 SE], ca. 25 plants, 26 August 1998.

Thompson Island shorelines [WI; T63/64N-R39W, Sec. 2 SE and Sec. 35 SW of SW], a scattered plants, not common, 26 August 1998.

"Crowberry Point", a small juniper (both species)-dominated coastal bald on the shore of the main island between North Gap and McGinty Cove [WI; T64N-R39W, Sec. 35, NW of NE], with Potentilla fruticosa, Deschampsia cespitosa, Primula, Physocarpus, Danthonia, Trisetum, Pinguicula, Chamaedaphne, Andromeda, Ledum, Arctostaphylos, Carex lenticularis, Tofieldia glutinosa, Prenanthes recemosa, Scirpus cespitosus, Calamagrostis canadensis, Castilleja septentrionalis, Empetrum nigrum, ca. 50 plants, 26 July 1998.

McGinty Cove shorelines [WI; T64N-R39W, Sec. 25, NE], common, 26 July 1998.

North coast shorelines from 2.5-5 km NE of Huginnin Cove [WI; T64N-R38W, Sec. 19, 9, and 10], scattered on shoreline mossy ledges, at least 100 plants, 30 July 1998.

North coast shoreline from opposite Ollies Dogs Rocks to Little Todd Harbor [LT; T65N-R36-37W, Sec. 19 and 24 respectively], several dozen plants, 31 August 1998.

North coast from Todd Harbor to mouth of McCargoe Cove, including opposite Green Isle and on 12 O'Clock and Kamloops Points [TH, MC; T66N-R35W, Sec. 32, 29, 28, 13], ca. 200 plants total, 10 August 1998.

North coast shoreline from Indian Point to Herring Bay, Pickerel Cove and Robinson Bay peninsula [MC; T66N-R34-35W, Sections (west to east) 13, 18, 7 and 8], scattered along shoreline rocks, ca. 100 fruiting stems noted, 20 August 1998.

Islet at far SW tip of Amygdaloid Island [MC; T66N-R34W, Sec. 7, NE of NW], wave-splashed shoreline crevices, several plants, 21 August 1998. Also on several narrow points at SW end of Amygdaloid Island proper.

North coast of Amygdaloid Island near its eastern end [BH; T67N-

R34W, Sec. 34], dozens of plants, 21 August 1998.

Net Island, dryish rocks on NW-facing coast [BH; T67N-R34W, Sec. 25, NE of NE], ca. 25 plants on northwest coast headland, 12 August 1998.

Long Island in Siskiwit Bay [MB; T64N-R35W, Sec. 19], ca. 100 plants scattered on dry headlands on shoreline, 21 August 1998.

South shore along Malone Bay between Hat and Schooner Islands [MB; T65N-R35W, Sec. 32-33], dozens of fruiting plants, 15 August 1998.

Potential threats; management. Downy oat-grass is in no direct danger from human encroachment in the Park. The only possible threat might be from climatic warming.

Monitored populations and monitoring recommendations. TRI-001-003 (all three Mott Island sites), 005 (Raspberry Island), 006 (Smithwick Island), 009 (Inner Hill Island), 011 (Davidson Island), 012 (Outer Hill Island), 015 (West Caribou Island SE Coast), 016 (East Caribou Island NE Peninsula).

Best references: Voss (1972: 165).

Name. Viburnum edule (Michaux) Raf., Squashberry or mooseberry. Acronym used in this report: VIB.

Family. Caprifoliaceae (Honeysuckle).

Distribution and Conservation Status:
Global: G5; northern and western North America.
U.S.: Alaska; south to Oregon, Colorado, Minnesota (north shore and Border Lakes), Wisconsin (rare inland in the Blue Hills), Michigan, and Pennsylvania.
Michigan: S2S3; Threatened; documented only from IRNP, although there are several recent sight records from the U.P.
Adjacent Canadian mainland: Common.
IRNP: Common.

Habitat and associates in IRNP: This is a common shrub in moist, shaded, boreal (balsam-fir/white birch/white spruce) forests on Isle Royale, and is particularly common in the cooler, not-burned-in-1936, NE one-third of the island. It is also frequent on offshore islands and on Passage Island. Towards the SW end of the main island it is found in only the moister and shadier boreal forests.

Appearance and similar species: This is an easily recognized 0.5-2 m tall shrub. The leaves are opposite and shallowly 3-lobed, and 5-10 cm long. The inflorescences are short-peduncled cymes borne at branch tips, bearing masses of white, 5-merous flowers ca. 7 mm in diameter. The fruit is a sour, reddish-green drupe about 8-10 mm long. The only other Viburnum recorded from INRP is the rare V. opulus (Slavick & Janke 1993) from near Daisy Farm (but not seen there in 1993-1994). It resembles V. edule but differs in the presence of a prominent pair of glands on the petiole where it joins the blade; V. edule lacks such glands. In sterile condition, V. edule could possibly be confused with the shrubby mountain maple (Acer spicatum), but differs in its smooth and glabrous rather than finely hairy (in the maple) twigs and petioles.

Reproductive biology: Flowering occurs in June and July; fruiting in August and September.

Populations newly discovered in IRNP: Many (upwards of at least 100) new populations were seen during the course of this survey. There were so many that I did not record all of them. All recorded newly discovered populations are mapped in this section of the report, along with the sites documented by Crispin et al. (1984, 1985). However, these sites are not numbered or consistently mapped on the master topographic maps, in order to reduce clutter on them. Notable new sites found in this study include the islands off Washington Harbor; Houghton Point Ridge; the islands in Malone Bay; islands off the North Shore, such as Amygdaloid and Captain Kidd; and the entire Rock Harbor island chain from the Middle Islands to Bat Island.

Potential threats; management. This is the most ubiquitous "rare" plant on the island; NE of about Moskey Basin, it is difficult to find a 10 x 10 m plot without at least one stem of this species. As its alternate common name indicates, squashberry does appear to be a very favored browse of moose, and on the main island and on offshore islands it was difficult to find a stem that did not have some browse, and rare to find a stem exceeding 1 m in height or one that bore more than a few berries. The healthiest populations were seen on mooseless Passage Island and on Captain Kidd Island (the latter far enough from the mainland that moose appear not to visit it frequently, and also supporting some growths of

Canada yew).

Monitored populations and monitoring recommendations. JEJ-002 (Mott Island SE Coast Trailside), 013 (West Caribou Island South Tip Cleft), 014 (West Caribou Island Gilberts Hole), 024 (North Government Island), 031 (Passage Island Trail Boardwalk), 032 (Passage Island Boathouse Forest).

Best reference: Gleason (1952: III: 292).

## MONITORING: RESURVEY OF 38 PERMANENT PLOTS

The purpose of the monitoring component of this survey was to establish a system enabling the NPS to identify changes in federally- and state-listed species within their community types, and to determine existing threats to listed plants and their critical habitats, particularly anthropogenic stresses. While conducting the base-line inventory for listed plants and associated communities, permanent plots were established for the purpose of monitoring on an annual, biennial, triennial, or five-year basis. Sampling frequency was determined in consultation with the Natural Resource Management Specialist based upon the status of the species and potential threats. The protocol for establishing the monitoring plots was as follows:

1) Plot design. Each plot stake (see exceptions below) consisted of a 60 cm long 1" angle-iron (painted red in the upper half) driven halfway into the ground. A standard N.P.S. metal identification tag was attached with a heavy gauge wire to the top of each stake. Embossed on each tag was the standard plot identification number prefaced by "JEJ" (Judziewicz, Emmet J.), hyphen, plot number (001-039), hyphen, and finally the suffix "001." This last suffix allowed for the recording of GPS "waypoints" based on landmarks (headlands, docks, buildings) and particularly conspicuous rare plant colonies some distance from the stake. In the frequent cases where very rocky ground and thin soil prevailed and where crevices in which to drive in the stakes were few and hard to find, the stake was of necessity placed some meters away from the actual monitored population, often in crevices with some accumulation of soil within the treeline of rocky shores. In such cases the distances from the stake to the plot are given in meters along a particular compass bearing.

For each plot (if feasible given light, weather) two photographs were made using a Nikon Zoom Touch 400 camera: The first a general habitat shot (if possible made while standing over the stake and showing the most diverse and inclusive view of rare plant habitat), and a close-up of the rare plant(s) of most interest in the plot.

Demographic data was recorded in three main ways depending on the life form of the species being censused: 1) For clonal, ground-covering plants with low, spreading branches that are indistinguishable from erect stems, like crowberry (Empetrum nigrum) and bog bilberry (Vaccinium uliginosum), an estimate was made of the amount of area in sqaure meters covered by the clone; 2) in the case of clone-forming rosette plants like the saxifrages (Saxifraga paniculata and S. tricuspidata), the number of genets (separate clones)/ramets (shoots or rosettes within a discrete clone)/flowering stems was given; 3) for the special case of devils club (Oplopanax horridus), which grows in dense thickets and in which separate plants are also difficult to distinguish from one another, a transect method consisting of twelve 5 x 5 meter census compartments (total area: 0.03 hectare) was employed except for the case of Smithwick Island.

2) Relocating the plots. When possible, directions to the plot were made using direct compass bearings from landmarks such as headlands, large boulders, trails, docks, and buildings. Distances were determined by pacing and are provided in meters (in many cases supplemented by GPS waypoints).

3) GPS locations. A Trimble GPS (Global Positioning System) unit was used to record the exact locations of all stakes plus selected waypoints in UTM coordinates. The raw data was later corrected using the U.S. Forest Service base station in Escanaba, and this corrected data is that presented below. In several cases when stakes were located in forested areas it proved impossible to obtain GPS readings, and positions had to be taken from up to 10 m away from the stake. If this was done it is noted in each of the plot narratives below.

4) Number of plots and choice of species sampled. Thirty-eight (38)

permanent plots were established during this study. A total of 43 of IRNP's 102 sensitive vascular plant species were included in at least one monitoring plot. Emphasis was placed on arctic/alpine species of rocky shorelines, particularly the following four species: crowberry (Empetrum nigrum, EMP), encrusted saxifrage (Saxifraga paniculata, SXP), prickly saxifrage (S. tricuspidata, SXT), and alpine bilberry (Vaccinium uliginosum, VCU). There were several reasons for choosing to emphasize monitoring these particular species:

a) They are alpine/arctic species common along Hudson Bay, re-appearing (disjunct) to the south only along the shoreline of Lake Superior. Thus, they are rare in the Midwestern U.S. and IRNP represents the main Midwestern U.S. reservoir of populations for all four taxa. Equally importantly, they would probably receive the largest negative impacts from global climatic warming, if this occurs. I have chosen to emphasize this aspect of threat, given that human impacts on rare IRNP rare plants appears to be essentially negligible.

b) These species are easy for a layperson to spot and identify (their "search image" is easily acquired) and, at least in sterile condition, they are evident throughout the entire growing season.

c) They grow in discrete colonies whose area of coverage is easily estimated (EMP, VCU) or whose demographic data is easily tabulated (clumps/rosettes/flowering stems of SXP and SXT).

5) Presentation of results: Descriptions of each monitoring plot established are present below. Each plot write-up includes the following subheadings and information: a) Vascular plant permanent monitoring plot number; b) Location and informal name proposed for plot, including legal description of location, and specific directions for finding the metal marker stake; c) UTM coodinates of stake, from corrected GPS reading; d) UTM coordinates by GPS of additional waypoints, if any; e) Date of survey; f) Photographic information; g) A narrative description of the site, including plant community, general topography and vegetation, common associates, and rare species with the three-letter acronym used throughout this report; h) A table containing distances and bearings to rare plant populations, plus demographic data; i) suggested future monitoring protocol for the plot.

6) Distance and bearing from stake to rare populations. This information is given in terms of meters (measured by tape) and bearing or azimuth from stake (by compass reading). In some cases difficult topography (cliffs, thick forest) necessitated the use of a "hinge point," a second, unmarked point at a given distance and bearing from the stake from which rare plant population locations were in turn measured in terms of distance and bearing. Due to the varied topography of various sites it was not possible to maintain a constant radius from the stake within which rare plants were sampled; in general, however, I attempted to census all rare plants within 25 meters of the stake when possible (about 0.2 hectare total), although in many cases plants further away from the stake were included when the stake had to be sited inland in forests where there were soil pockets to drive it into.

7) Future monitoring recommendations. These are made at the end of each species account. Future monitoring should include, at a minimum, estimates of size/density/cover with distances and bearing taken from the stake. Plots should be monitored (at a minimum) every 5 years, or, better yet, every 3 years if feasible. Plots in the southwestern Rock Harbor island chain from the Caribou Islands to Davidson and Mad Island, along with trailside plots near Ransom Hill, Threemile Campground, and Scoville Point, are easily accessible and could be monitored more frequently if feasible.

LIST OF "JEJ" PLANT MONITORING PLOTS, ISLE ROYALE, 1993-1994.
(WITH ACRONYMS FOR SPECIES MONITORED WITHIN THEM)

1. Mott Island Central SE Coast (JEJ-001): CAS, SNI, SXP, TRI.
2. Mott Island SE Coast Trailside (JEJ-002): PIN, SNI, TRI, VIB.
3. Mott Island Bilberry-Butterwort Site (JEJ-003): PIN, TOG, TRI, VCU.
4. Bat Island, NE tip (JEJ-004): SXP, TRI.
5. Raspberry Island, NE tip (JEJ-005): CXM, TRI, VCU.
6. Smithwick Island Devil's Club Site (JEJ-006): OPL, RIB, TRI.
7. Scoville Point, Stoll Memorial Plaque (JEJ-007): EMP, POA, RIB, SXT, VCU.
8. Rock Harbor 1 km NE of Lodge (JEJ-008): CAS, CXA, EUP, SAG, TRI.
9. Inner Hill Island, Lorelei Lane (JEJ-009): CAS, EUP, PAR, SNI, TRI.
10. Threemile Parsley Fern Glades (JEJ-010): CRA.
11. Davidson Island, NE Point (JEJ-011): CBU, LYC, POA, TRI, VIB.
12. Outer Hill Island Rock Pool (JEJ-012), PIN, SEL, TOG, TRI, VCU.
13. West Caribou Island, South Tip Cleft (JEJ-013): CXA, PAR, PIN, POL, SAG, SNI, VIB.
14. West Caribou Island, Gilberts Hole (JEJ-014): CXM, POA, POL, VIB.
15. West Caribou Island, SE Coast (JEJ-015): SNI, SXP, TRI.
16. East Caribou Island, NE Peninsula (JEJ-016): SXP, TRI, VCU.
17. Mott Island, Small Boat Cove (JEJ-017): LON.
18. Ransom Hill Ram's Head Site (JEJ-018): CYP.
19. Mad Island Crowberry Heath (JEJ-019): EMP, SAG, VCU.
20. Heron Island Prickly Saxifrage Site (JEJ-020): PIN, SXT.
21. Shaw Island, SW tip (JEJ-021): CXM, EMP, PIN, SEL.
22. Porter Island, S Tip (JEJ-022): CRA, CXU, SXT.
23. Edwards Island, NE tip (JEJ-023): EMP, PIN, POL, SEL, TOP, VCU.
24. North Government Island, NE tip (JEJ-024): DRA, EMP, PIN, POA, RIB, SEL, SXP, VCU, VIB.
25. Long Island Prickly Saxifrage Site (JEJ-025): SXT.
26. Boys Island Devils Club Site (JEJ-026): DRE, OPL.
27. Blake Point Signal Light Rocks (JEJ-027): POA, RIB, SXP, SXT, VCU.
28. Blake Point Devils Club Site (JEJ-028): DRE, OPL.
29. Passage Island Mountain Cranberry Site (JEJ-029): LYS, VCI, VCU.
30. Passage Island Boat House Marsh (JEJ-030): LIS.
31. Passage Island Trail Boardwalk (JEJ-031): DRE, LUZ, OPL, VIB.
32. Passage Island Boat House Forest (JEJ-032): CAS, CXA, DRE, OPL, POL, VIB.
33. Passage Island, NW Coast Cliffs (JEJ-033): CXE, DRA, EMP, SXP.
34. Passage Island, Overlook Point (JEJ-034): ALL, EMP, PIN, SXP, VCU.
35. Passage Island, Anglica Pool (JEJ-035): CXG, DRO, EMP, LYS, MUH, PIN, TOP, VCU.
36. Passage Island Lighthouse, Old Radio Tower Pylons (JEJ-036): SXT.
37. Passage Island Lighthouse (JEJ-037): BOL, BOM, BOS, BOX, DRA.

(no plot #38)

39. Todd Harbor Fairybells Site (JEJ-039): DIS.

Vascular Plant Permanent Monitoring Plot Number: JEJ-001-001 (stake; see also additional waypoints below).

Location/informal name of plot: Mott Island Central SE Coast.

Legal description/Exact directions to plot: T66N-R33W, Sec. 18, NW of SE (Mott Island 7.5'). From Mott Island headquarters building, proceed 1.2 km NE on Lake Superior trail to junction with short "cross trail" at midpoint of island; then proceed off-trail due S 150 m to shoreline promontory opposite large near-shore islet. The stake had to be located somewhat inland in order to find sufficient soil to plant it firmly. It is 56 m at a bearing of 305 degrees from the Lake, inland at the NW base of the last ridge supporting an open forest of sapling balsam-fir. It can be most easily located by looking for a pair (2-3 m apart) of extremely "fat" (70 cm dbh) white cedars located 40 m inland from the shoreline. From these large cedars the stake is 16.5 m away at a bearing of 325 degrees.

UTM coordinates (by GPS reading): 001: 385783.1, 5329533.8.

Additional waypoints recorded by GPS reading:
JEJ-001-002: SXP subpopulation #1, SW limit of colony. UTM = 385809.6, 5329498.2.
JEJ-001-003: SXP subpopulation #5, NE limit of colony. UTM = 385840.4, 5329523.2.

Date surveyed: 9 August 1993.

Photos: Frame 19 (habitat); 20 (plants of SXP).

Narrative description of site: Bare basaltic rocky shoreline with arctic/alpine plant community growing in crevices, with scattered individuals of three-toothed cinquefoil (Potentilla tridentata), yarrow (Achillea millefolium), fescue (Festuca saximontana), rough goldenrod (Solidago hispida), harebell (Campanula rotundifolia), seedling/small saplings of white cedar, white spruce, and green alder; common juniper (Juniperus communis), and the rare species encrusted saxifrage (Saxifraga paniculata, SXP), eastern paintbrush (Castilleja septentrionalis, CAS), rayless ragwort (Senecio indecorus, SNI), and Trisetum spicatum (TRI). SXP grows 2-4 m above lake level, mostly on NW, N, or NE-facing slopes.

Three possible individuals of the extremely rare arctic cruciferous herb Braya humilis (BRA) were reported (not vouchered because of their rarity) from this site by Crispin et al. (Marr & Dunevitz sight record of 9 July 1984), probably from the large crevice near SXP-3-5. They could not be relocated in this survey, but future monitors should be alert to the possibility of the occurrence of this species here.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| SXP-1 | 125 | 39-41 | 40/292/29 |

[Colony occurs on a small hillock within an area 9 x 2 m parallel to shore. Rosettes/flowering stems in each clump:
5/0, 5/0, 1/0, 7/0, 1/0, 5/0, 11/1, 6/1, 9/1, 1/0, 1/0, 4/0, 5/2, 10/0, 12/0, 28/3, 11/0, 19/0, 18/1, 4/1, 2/0, 5/1, 1/0, 3/0, 1/0, 1/0, 15/0, 4/0, 6/1, 20/4, 8/1, 1/1, 5/1, 8/2, 1/0, 2/1, 10/0, 7/0, 15/3, 14/4]

[The distances to the remainder of the colonies were not measured directly due to intervening vegetation. From SXP-1 it is 23 m at a bearing of 45 degrees to the lakeside mouth of the large crevice along which grow SXP-3-5. Other rare species growing near the inland terminus of this crevice include CAS (1 plant) and TRI (5 clumps with 5 flowering stems.]

SXP-2 11/ 73/ 5
[Colony in small crevice: 13/2, 13/1, 14/0, 1/0, 1/0, 5/0, 11/2, 1/0, 2/0, 4/0, 8/0]

SXP-3 15/135/34
[Colony on small NE-facing hillock with few associates: 30/5, 12/2, 8/12, 4/2, 3/0, 1/1, 6/0, 6/2, 12/2, 15/2, 8/2, 7/0, 12/2, 7/1, 4/1]

SXP-4 9/ 91/ 7
[Colony in large crevice, with healthiest-looking plants seen at this plot: 2/0, 35/3, 13/0, 1/0, 1/0, 18/3, 13/1, 5/0, 3/0]

SXP-5 24/205/23
[Colony on large hillock on E side of crevice, directly opposite the off-shore islet: 11/2, 20/2, 13/2, 2/1, 14/1, 5/0, 2/0, 4/1, 7/1, 15/1, 12/1, 10/1, 5/0, 12/2, 6/0, 6/0, 4/1, 10/1, 15/2, 5/0, 6/1, 3/0, 17/3, 1/0]

Totals 99/796/98

Future monitoring protocol: This site should be monitored every 3-5 years, or every 1-2 years if resources permit. It is a 15 minute walk from Mott Island headquarters.

**1998 MONITORING**

Date resurveyed: 14 August 1998.

| Species and subpopulation number | | Demographic data |
|---|---|---|
| SXP-1: | | 17/169/17 |
| SXP-2: | | 14/91/2 |
| SXP-3: | | 7/79/4 |
| SXP-4: | | 23/159/21 |
| SXP-5: | | 35/263/12 |
| | TOTAL, 1998: | 96/756/56 |
| | TOTAL, 1993: | 99/796/98 |
| Change from 1993-1998 (%): | | -3/-5/-42 |

Species new to site:
TRI-1 10/10/24

Comments on change from 1993/4-1998: In 1998, no stems of SXP with mature fruits were observed. Flowering was reduced 42% from 1993-4, although numbers of genets and ramets declined only marginally. The flowers apparently did not develop into fruits.

Vascular Plant Permanent Monitoring Plot Number: JEJ-002-001 (stake; see additional waypoint below).

Location/informal name of plot: Mott Island SE Coast Trailside.

Legal description/Exact directions to plot: T66N-R33W, Sec. 18, NE of SE of SW (Mott Island 7.5'). From Mott Island headquarters, proceed 700 m NE on Lake Superior trail to trailside, lakeside "stopping spot" with a vista of Lake Superior. Proceed 23 m further NE on trail, as it starts to turn inland. Stake is 4.5 m off the trail to the right (southeast) in an open balsam-fir forest, concealed (from trail hikers) by thimbleberry bushes. Rare plant community being monitored is a shoreline rock pool 22 m away at a bearing of 175 degrees from the stake, below the edge of a 3 m tall cliff 19 m from the stake (the pool is visible at a bearing of 115 degrees from the trailside vista mentioned above). It is 36 m from the stake through the pool to the edge of Lake Superior, and 8-10 m from the pool to the Lake.

A second habitat monitored is a small crevice 9 m from the stake at a bearing of 140 degrees; a third habitat is the boreal forest around the stake.

UTM coordinates (by GPS reading): 001: 385536.4, 5329368.4.

Additional waypoint recorded as GPS reading:
JEJ-002-002: Center of rock pool 22 m from stake at a bearing of 175 degrees. UTM = 385538.9, 5329349.7.

Date surveyed: 9 August 1993.

Photos: Frames 1 (habitat; looking N across small pool); 2 (plants of PIN).

Narrative description of site: Principal habitat monitored is a small (3 x 2 m) rock pool 0.7 vertical m above the Lake, with abundant butterwort (Pinguicula vulgaris, PIN) on its margins. Associates were Trisetum spicatum (TRI), arctic primrose (Primula mistassinica), harebell (Campanula rotundifolia), brook lobelia (Lobelia kalmii), rough goldenrod (Solidago hispida), wormwood (Artemisia campestris), and yarrow (Achillea millefolium).

A second rare plant population monitored is a colony of rayless ragwort (Senecio indecorus, SNI) in a small, shaded crevice SE of the stake, with green alder (Alnus viridis), ninebark (Physocarpus opulifolius), and bluejoint (Calamagrostis canadensis) as associates.

The third habitat is the open balsam-fir/white birch boreal forest around the stake, with thimbleberry (Rubus parviflorus) common in the understory. Plants of severely moose-browsed squashberry (Viburnum edule, VIB) occurs in the immediate vicinty of the stake.

| Species | Azimuth | Distance | Demographic data (flowering stems) |
|---|---|---|---|
| PIN | [302 plants, 140 with old inflorescences, were counted in an area 7 x 2 m surrounding the pool; there was good regeneration in all size classes] | | |
| SNI | 140 | 9 | 6 vigorous plants averaging 70 cm tall |
| TRI | [1 clump with 5 old flowering stems on margin of rock pool] | | |
| VIB | 20 | 6 | 2 saplings 70 and 100 ca tall. |
| VIB | 230-260 | 3-5 | 7 saplings 30, 30, 30, 40, 40, 40, and 60 cm tall. |

Future monitoring protocol: This site should be monitored every 3-5 years, or every 1-2 years if resources permit. It is a 10 minute walk from Mott Island

headquarters.

**1998 MONITORING**

Date resurveyed: 14 August 1998.

Species and subpopulation number (% coverage; or genets/ramets/flowering and/or fruiting stems) — Demographic data

PIN (80 plants, 46 with old inflorescences, plus about 30 dead (some of these in fruit).

SNI: 7 fruiting plants 70-80 cm tall.

TRI: (1 clump with 3 fruiting stems).

Comments on changes from 1993-4 to 1998: PIN declined here from 1993-1998; total plants declined by 74%, flowering plants 64%. SNI appeared to be stable.

Vascular Plant Permanent Monitoring Plot Number: JEJ-003-001 (stake; see additional waypoint below).

Location/informal name of plot: Mott Island Bilberry-Butterwort Site.

Legal description/Exact directions to plot: T66N-R33W, Sec. 18, NE of SE (Mott Island 7.5' topo). From Mott Island headquarters, proceed 1.6 km NE on Lake Superior-side trail to very deep (125 m long x 40 m wide) narrow cove (see map) with cobble and driftwood beach located ca. 0.5 km SW of the NE tip of Mott Island. Walk off trail 125 m E along S side of cove to exposed headland. From tip of headland, stake is 47 m away inland at a bearing of 135 degrees, in cobbly gravel of a crevice just beyond (NE of) a krumholtz of white cedar, green alder, and balsam-fir. From the stake it is 11 m at a bearing of 160 degrees to the lakeshore.

UTM coordinates (by GPS reading): 001: 386126.2, 5329794.2.

Additional waypoint recorded as GPS reading:
JEJ-003-002: NE tip of headland 47 m NE of stake (two small rock pools separate the stake from this headland). UTM = 386154.0, 5329803.9.

Date surveyed: 10 August 1993.

Photos: Frames 3 (habitat looking NE from stake); 4 (PIN next to rock pool); 5-6 (VCU close-ups).

Narrative description of site: Site is an exposed rocky Lake Superior shoreline community with two diverse small rock or splash pools (both 3 m above the lake, the largest 5 x 3 m in size) and wet crevices trending 60-240 degrees. Trees are nearly absent and common species present include Labrador-tea (Ledum groenlandicum), blueberry (Vaccinium angustifolium), common juniper (Juniperus communis), arctic primrose (Primula mistassinica), Scirpus cespitosus, sundew (Drosera rotundifolia), three-toothed cinquefoil (Potentilla tridentata), and the rare species butterwort (Pinguicula vulgaris, PIN), false asphodel (Tofieldia glutinosa, TOG), Trisetum spicatum (TRI), and alpine bilberry (Vaccinium uliginosum, VCU).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| PIN | ca. 0 | ca. 10 | [ca. 100 plants on NE side of small ledge] |
| PIN | [Ca. 1,000 plants fringing rock pools between stake and extreme NE tip of point] | | |
| TOG | [30 plants fringing rock pools between stake and point] | | |
| TRI | [occasional; 10 clumps on hillock at very end of point] | | |
| VCU | 30 | 18 | 0.01 sq. m |
| VCU | 50 | 23-24 | 1 sq. m in an area 2.5 x 0.75 m on 35 degree W-facing slope |
| VCU | 55 | 9.5-11 | 0.05 sq. m |
| VCU | 110 | 6-7 | 0.10 sq. m |
| VCU | 240 | 4 | 0.10 sq. m |

Future monitoring protocol: This site should be monitored every 3-5 years, or every 1-2 years if resources permit. It is a 30 minute walk from Mott Island headquarters.

**1998 MONITORING**

Date resurveyed: 14 August 1998.

| Species and subpopulation number (% coverage; or genets/ramets/flowering and/or fruiting stems) | Demographic data |
|---|---|
| LYS: New to site, 3 small clumps each 0.005 sq m noted 5 m north of pool. | |
| PIN | 1998: 345/96<br>1993: 1000s/n.r.<br>Change: declined at least 65% |
| SXP: New to site, 25 m from stake (7 m SE of E end of rock pool); | 1998: 1/12/2 noted. |
| TOG | 1993: 30<br>1998: 15 dried and in fruit<br>Change: -50% |
| TRI: | 1993: 10/n.r.<br>1998: 25/60<br>Change: +250% |
| VCU: | 1993: 5 colonies with total area of ca. 1.25 sq m.<br>1998: 5 colonies with total area of ca. 0.79 sq m.<br>Change: -37% |

Comments on changes from 1993-4 to 1998: PIN declined by at least 65% here; VCU appeared to also decline significantly.

Vascular Plant Permanent Monitoring Plot Number: JEJ-004-001 (stake, plus additional waypoint below).

Location/informal name of plot: Bat Island, NE tip.

Legal description/Exact directions to plot: T66N-R33W, Sec. 3, NE of NE (Rock Harbor 7.5' topo). Land canoe on Rock Harbor side of Bat Island, then walk to NE tip. Stake is on cliff-top 4 m above water and 19 m from extreme NE tip of island at a bearing of 230 degrees.

UTM coordinates (by GPS reading): 001: 391249.5, 5333506.3.

Additional waypoints (GPS reading):
JEJ-004-002 (one SXT colony). UTM = 391255.5, 5333522.5.
JEJ-004-003 (VCU colony). UTM = 391233.4, 5333458.0.

Date surveyed: 11 August 1993.

Photos: Frame 7 (plant of SXP); 8 (habitat, looking N, orange hat for scale with SXP in mat of bearberry-juniper, etc.).

Narrative description of site: Sheer north-facing cliff-top rocky shoreline community with mat of creeping juniper (Juniperus horizontalis), bearberry (Arctostaphylos uva-ursi), showy mountain-ash (Sorbus decora), fescue (Festuca saximontana), harebell (Campanula rotundifolia), Canada bluegrass (Poa compressa), and three-toothed cinquefoil (Potentilla tridentata). Rare species present: encrusted saxifrage (Saxifraga paniculata, SXP) and alpine bilberry (Vaccinium uliginosum, VCU), both 4-5 vertical m above lake level.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| SXP | 50 | 10.0 | 1/66/10 [JEJ-004-002] |
| SXP | 50 | 19.0 | 1/36/ 8 |
| VCU | ca. 180 | ca. 50 | 0.2 sq. m |

Future monitoring protocol: This plot should be monitored every 3-5 years.

**1998 MONITORING**

Date resurveyed: 20 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| SXP: Not relocated in 1998, decline = 100%. | |
| VCU | 1993: 0.2 sq m<br>1998: 0.1 sq m<br>Change: -50% |

Comments on changes from 1993-4 to 1998: VCU declined slightly, but it is not clear that the decline was significant. SXP disappeared completely.

Vascular Plant Permanent Monitoring Plot Number: JEJ-005-001 (stake; see also addtional waypoints below).

Location/informal name of plot: Raspberry Island, NE tip.

Legal description/Exact directions to plot: T66N-R33W, Sec. 3, SW of NE (Rock Harbor 7.5' topo). From Raspberry Island dock, proceed by trail to SE coast, then follow coast 0.7 km NE to tip of island. Stake is in krumholtz 54 m from and at a bearing of 290 degrees from the extreme NE tip of the island.

UTM coordinates (by GPS reading): 001: 390803.6, 5333146.6.

Additional waypoints (GPS readings):
JEJ-005-002. Colony of VCU on SE-facing coast. UTM = 390744.8, 5333090.5.
JEJ-005-003. Colony of VCU. UTM = 390821.7, 5333148.2.
JEJ-005-004. Colony of VCU 123 m away at 213 degrees. UTM = 390856.1, 5333175.6.

Date surveyed: 11 August 1993.

Photos: Frame 9 (View NW of point with VCU).

Narrative description of site: Rocky shoreline headland with three-toothed cinquefoil (Potentilla tridentata), rough goldenrod (Solidago hispida), Solidago ptarmicoides, harebell (Campanula rotundifolia),pussy-toes (Antennaria neglecta), tufted hairgrass (Deschampsia cespitosa), fescue (Festuca saximontana), Scirpus cespitosus, and the rare species alpine bilberry (Vaccinium uliginosum, VCU), Carex norvegica (media) (CXM), and Trisetum spicatum (TRI).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CXM | | | [a few clumps near stake] |
| VCU | | | [a few clumps near stake] |
| VCU | 110 | 54 | 6 clumps [JEJ-005 -004] |
| VCU | 123 | 123 | 2 clumps [JEJ-005 -002] |

Future monitoring protocol: This plot should be monitored every 3-5 years.

**1998 MONITORING**

Date resurveyed: 20 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CXM: Not noted in 1998, but could have died back by this date. | |
| VCU | 1993: 8 clumps<br>1998: 3 clumps/1.16 sq m<br>Change: -38% (clumps) |

Comments on changes from 1993-4 to 1998: VCU declined from 8 to 3 clumps in five years.

Vascular Plant Permanent Monitoring Plot Number: JEJ-006-001 (stake; see others below).

Location/informal name of plot: Smithwick Island Devil's Club Site.

Legal description/Exact directions to plot: T66N-R33W, Sec. 4, SW of SE of SE (Rock Harbor 7.5' topo). Land canoe at cove at NE end of Smithwick Island, then walk 580 m SW on central ridge of island to stake in center of devil's club area.

UTM coordinates (by GPS reading): 001: 389152.4, 5332256.5.

Additional GPS "waypoints" recorded:
JEJ-006-002. Extreme NE tip of Smithwick Island. UTM = 389660.1, 5332517.5.
JEJ-006-003. Southwestern most limit of devil's club populations. UTM = 389024.0, 5332128.4.
JEJ-006-004. Northeastern most limit of devil's club populations. UTM = 389316.1, 5332375.9.

Date surveyed: 11 August 1993.

Photos: 9-12 (OPL habitat and plants).

Narrative description of site: This is a white birch/balsam-fir/showy mountain-ash forest in the interior of the island with devils-club (Oplopanax horridus, OPL) common in the understory for about 383 x 50 m from 372 to 755 m SW of the NE tip of the island. The NW part of the population is on a ridge with deciduous trees dominant, trending in the SW into a central trough between two ridges with balsam-fir dominant. The stake is ca. 580 m from the NE tip of the island, in an open mountain-ash (Sorbus decora) forest with scattered white spruce and balsam-fir and a dense understory of woodreed (Cinna latifolia), woodfern (Dryopteris carthusiana and/or expansa), red elder (Sambucus racemosa), red raspberry (Rubus idaeus), twinflower (Linnaea borealis), blue lettuce (Lactuca biennis), fringed bindweed (Polygonum cilinode), and Canada yew (Taxus canadensis). Towards the SW end of the devils club area the forest is an open white birch/balsam-fir/mountain-ash stand with the following common in the understory: wild sarsaparilla (Aralia nudicaulis), oak fern (Gymnocarpium dryopteris), bedstraw (Galium triflorum), bunchberry (Cornus canadensis), twinflower, side-flowered pyrola (Pyrola secunda), squashberry (Viburnum edule), bluebead (Clintonia borealis), red baneberry (Actaea rubra), and rosy twisted-stalk (Streptopus roseus). A secondary monitoring site is the rock shoreline at the extreme NE tip of Smithwick Island (JEJ-006-002), with Ribes oxyacanthoides (RIB, 1 plant) and Trisetum spicatum (TRI, several plants).

Demographic data: This is the only one of five devils club (OPL) monitoring plots (JEJ-026, 028, 031, 032) not based on a 30 m transect from the metal stake in the direction of the densest concentration of stems. Within 20 m of the stake there were at least 7 vigorous clumps of OPL. Each was from 2-7 m in diameter and had several dozen 2-3 m tall stems with abundant young fruit.

Future monitoring protocol: It is recommended that all devils club plots be surveyed in the manner described above every 3 to 5 years.

**1998 MONITORING**

Date resurveyed: 26 August 1998.

Species and subpopulation number — Demographic data

OPL: no quantitative data in 1993.

Established monitored grid running 310 degrees (roughly NW) from the relocated stake.

| Subcompartment no. | No. stems |
|---|---|
| 1 | 0 |
| 2 | 3 |
| 3 | 74 |
| 4 | 55 |
| 5 | 51 |
| 6 | 26 |
| 7 | 5 |
| 8 | 11 |
| 9 | 48 |
| 10 | 57 |
| 11 | 9 |
| 12 | 3 |
| TOTAL: | 342 in 300 sq m. (1.14/sq. m) |

Comments on changes from 1993-4 to 1998: About 100 stems had old dried inflorescences; only 10 had a few mature (dried) fruits. This population seems drought-stressed compared with the August 1993 survey; the main stand of plants was more open, with many dead or dying stems.

Vascular Plant Permanent Monitoring Plot Number: JEJ-007-001 (there is no stake, the reference point is the Stoll Memorial Plaque cairn; see also additional waypoints below).

Location/informal name of plot: Scoville Point Stoll Memorial.

Legal description/Exact directions to plot: T67N-R33W, Sec. 35, NW of NE (Rock Harbor 7.5' topo). Walk 3 km long Stoll Trail from Rock Harbor dock to Stoll Memorial Plaque.

UTM coordinates (by GPS reading): 001: 392117.1, 5335201.6.

Additional waypoints recorded by GPS readings:
JEJ-007-002. Base of old sign (angle iron set in concrete) at very tip of "main prong" of Scoville Point; 133 m from Stoll Plaque. UTM = 392235.4, 5335263.4.
JEJ-007-003. Tip of "NE prong" of Scoville Point. UTM = 392219.2, 5335223.8.
JEJ-007-004. Farthest NE colony of VCU on "NE prong" of Scoville Point. UTM = 392162.3, 5335196.4.
JEJ-007-005. NE end of largest (ca. 150 m long) Scoville Point rock pool. UTM = 392099.3, 5335176.0.
JEJ-007-006. SW end of largest (ca. 150 m long) Scoville Point rock pool. UTM = 392014.2, 5335110.6.
JEJ-007-007. Shoreline colony of VCU at tip of Dassler House "prong" of Scoville Point. UTM = 392147.5, 5335352.6.
JEJ-007-008. Colony of POA on N side of Dassler House. UTM = 392126.9, 5335348.6.

Date surveyed: 12 August 1993.

Photos: Frame 13 (looking NE across largest pool from JEJ-007-006); 14-15 (heath of EMP and VCU on "main prong" of Scoville Point.

Narrative description of site: This is a very diverse mix of rocky shoreline plant communities, with dry glades, heath communities, and especially long, large crevices and rock pools, all with all the common ericaceous and sedge species (including abundant Scirpus cespitosus), shrubs (common and creeping junipers, bearberry, blueberry, shrubby cinquefoil, prickly rose), and herbs (Campanula rotundifolia), yarrow (Achillea millefolium), sundew (Drosera rotundifolia), rough goldenrod (Solidago hispida), three-toothed cinquefoil (Potentilla tridentata), and Deschampsia cespitosa.

Aside from Passage Island with 34 species, Scoville Point ranks with Blake Point and North Government Island in harboring the greatest diversity of rare plants in the Park. The following 16 rare species have been found within 500 m of the Stoll Memorial Plaque:

Calypso orchid (Calyspso bulbosa, CAL)
Mountain parsley fern (Cryptogramma acrostichoides, CRA)
Fragrant fern (Dryopteris fragrans, DRF)
Crowberry (Empetrum nigrum, EMP)
Hudson Bay eyebright (Euphrasia arctica, EUP)
Fir clubmoss (Lycopodium selago)
Butterwort (Pinguicula vulgaris, PIN)
Alpine bluegrass (Poa alpina, POA)
Hawthorn-leaved gooseberry (Ribes oxyacanthoides, RIB)
Pearlwort (Sagina nodosa, SAG)
Northern spikemoss (Selaginella selaginoides, SEL)
Balsam willow (Salix pyrifolia)
Rayless mountain ragwort (Senecio indecorus, SNI)
Prickly saxifrage (Saxifraga tricuspidata)
False asphodel (Tofieldia glutinosa)
Dwarf false asphodel (Tofieldia pusilla)

Downy oat-grass (Trisetum spicatum)
Alpine bilberry (Vaccinium uliginosum)
Squashberry (Viburnum edule)

However the following species, present on both Blake Point and Passage Island, are curiously absent: wild chives (Allium schoenoprasum) and encrusted saxifrage (Saxifraga paniculata).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| EMP-1 | [15 x 2 m along area (4 sq. m) slightly closer to JEJ-007-001 than to 007-002] | | |
| EMP-2 | [3 and 6 sq. m patches slightly closer to 002 than 001] | | |
| EMP-3 | [5 sq. m patch a few m SW of trees at tip of "main prong" (JEJ-007-002] | | |
| POA | [50-100 plants in bearberry cliff-edge heath on N side of Dassler House: See "Special Plant Survey Form" for details.] | | |
| RIB | [1 plant at tip of "main prong"] | | |
| SXT | [Common in dry ground in vicinity of Stoll Plaque] | | |
| VCU | [Occasional in EMP heath between Plaque and tip of "main prong."] | | |

Future monitoring protocol: Plot should be monitored every 3-5 years. It is a 40 minute walk by trail and bushwhacking from Rock Harbor dock, or a 5 minute walk from Dassler House dock.

**1998 MONITORING**

Date resurveyed: 17 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| EMP | total: 10-11 sq m<br>ca. 20% of mats brown, dried. |

POA: 1998: 5 trampled clumps on N side of Dassler house, under eavesdrop; plus one clump with 15 flowering stems on bluff above Dassler dock.

POT: new to site; 1 clump with several fruiting plants on Dassler Point bay.

RIB: not relocated in 1998.

SAG: new to site; 10 plants with 3 stems in flower on Dassler Point bay.

SXT by Stoll Plaque

| | | |
|---|---|---|
| 0 (bearing) | 5.0 m | 30/1 |
| 0 | 1.9-2.2 | 19/3, 12/0, 38/5 |
| 45 | 4.5 | 26/10 |
| 67 | 1.3 | 30/0 |
| 67 | 1.5 | 70/15 |
| 225 | 0 | 15/0, 22/0, 12/0 |
| 225 | 1.6 | 25/3 |
| 225 | 2.1 | 20/1 |
| 225 | 2.9 | 90/18 |
| 225 | 4.2 | 42/0 |
| 225 | 4.8 | 120/5 |

| | | |
|---|---|---|
| 270 | 2.3-2.8 | 10/0, 25/0 |
| 337 | 7 | 25/0 |
| | total: | 18/631/61 |

1993: number not recorded.

SXT at end of Main Prong of point: 10/175/20 in 1998

TOP: not relocated in 1998; perhaps died back by this date.

TRI: 5 clumps noted in 1998.

VCU: 1998: a total of ca. 5 sq m of mats, with 50% badly burned by drought and 10% dead; no fruits noted. Data not recorded in 1993.

Comments on changes from 1993-4 to 1998: EMP declined significantly from 18 to 10-11 sq. m from 1993-1998. Many of the still-living mats were browning and drought-stressed.

Vascular Plant Permanent Monitoring Plot Number: JEJ-008-001 (stake; see additional waypoint readings below).

Location/informal name of plot: Rock Harbor 1 km NE of Lodge.

Legal description/Exact directions to plot: T67N-R33W, Sec. 34, SE of SW (Rock Harbor 7.5' topo). From Rock Harbor Lodge complex, walk 500 m NE of Rock Harbor side Stoll Trail, then follow rocky shoreline 400 m NE to small point. Stake is in boreal forest a few m SW of extreme NE tip of point.

UTM coordinates (by GPS reading): 001: 390382.8, 5333791.6.

Additional waypoints recorded by GPS readings:
JEJ-008-002: Extreme NE tip of small point. UTM = 390395.9, 5333804.6.
JEJ-008-003: Shoreline colony of EUP ca. 30 m SW of JEJ-008-002 point. UTM = 390351.2, 5333754.9.

Date surveyed: 12 August 1993.

Narrative description of site: Rocky shoreline headland of Rock Harbor with very little space between the water and boreal forest. Shoreline rock species present include arctic primrose (Primula mistassinica), grass-leaved goldenrod (Euthamia graminifolia), Carex flava, C. atratiformis (CXA), eastern paintbrush (Castilleja septentrionalis, CAS), Hudson Bay eyebright (Euphrasia arctica, EUP), pearlwort (Sagina nodosa, SAG), and Trisetum spicatum (TRI).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CAS | | | [several plants at JEJ-008-003 site] |
| CXA | | | [several plants at JEJ-008-003 site] |
| EUP | | | [20 plants at JEJ-008-003 site] |
| SAG | | | [2 plants at JEJ-008-003 site] |
| TRI | 20 | 13 | 1 clump |
| TRI | 20 | 17.5 | 1 clump |
| TRI | 20 | 23 | 1 clump |

Future monitoring protocol: Plot should be monitored every 3-5 years. It is a 20 minute walk by trail and bushwhacking from Rock Harbor dock.

**1998 MONITORING**

Date resurveyed: 17 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CAS | 1993: several plants<br>1998: 10 plants |
| CXA | 1993: several plants<br>1998: not relocated; perhaps died back by now. |
| EUP | 1993: 20 plants.<br>1998: not relocated. |
| SAG | 1993: 2 plants<br>1998: not relocated. |

Vascular Plant Permanent Monitoring Plot Number: JEJ-008-001 (stake; see additional waypoint readings below).

Location/informal name of plot: Rock Harbor 1 km NE of Lodge.

Legal description/Exact directions to plot: T67N-R33W, Sec. 34, SE of SW (Rock Harbor 7.5' topo). From Rock Harbor Lodge complex, walk 500 m NE of Rock Harbor side Stoll Trail, then follow rocky shoreline 400 m NE to small point. Stake is in boreal forest a few m SW of extreme NE tip of point.

UTM coordinates (by GPS reading): 001: 390382.8, 5333791.6.

Additional waypoints recorded by GPS readings:
JEJ-008-002: Extreme NE tip of small point. UTM = 390395.9, 5333804.6.
JEJ-008-003: Shoreline colony of EUP ca. 30 m SW of JEJ-008-002 point. UTM = 390351.2, 5333754.9.

Date surveyed: 12 August 1993.

Narrative description of site: Rocky shoreline headland of Rock Harbor with very little space between the water and boreal forest. Shoreline rock species present include arctic primrose (Primula mistassinica), grass-leaved goldenrod (Euthamia graminifolia), Carex flava, C. atratiformis (CXA), eastern paintbrush (Castilleja septentrionalis, CAS), Hudson Bay eyebright (Euphrasia arctica, EUP), pearlwort (Sagina nodosa, SAG), and Trisetum spicatum (TRI).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CAS | | | [several plants at JEJ-008-003 site] |
| CXA | | | [several plants at JEJ-008-003 site] |
| EUP | | | [20 plants at JEJ-008-003 site] |
| SAG | | | [2 plants at JEJ-008-003 site] |
| TRI | 20 | 13 | 1 clump |
| TRI | 20 | 17.5 | 1 clump |
| TRI | 20 | 23 | 1 clump |

Future monitoring protocol: Plot should be monitored every 3-5 years. It is a 20 minute walk by trail and bushwhacking from Rock Harbor dock.

**1998 MONITORING**

Date resurveyed: 17 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CAS | 1993: several plants<br>1998: 10 plants |
| CXA | 1993: several plants<br>1998: not relocated;<br>perhaps died back by now. |
| EUP | 1993: 20 plants.<br>1998: not relocated. |
| SAG | 1993: 2 plants<br>1998: not relocated. |

| | |
|---|---|
| TRI | 1993: 3 clumps |
| | 1998: 2 clumps |

Comments on changes from 1993-4 to 1998: This site is small and has marginal habitat for arctic-alpine plants; changes from 1993-1998 are probably not significant.

Vascular Plant Permanent Monitoring Plot Number: JEJ-009-001.

Location/informal name of plot: Inner Hill Island, Lorelei Lane.

Legal description/Exact directions to plot: T66N-R33W, Sec. 19, NE of NW of NW (Mott Island 7.5' topo). Land canoe on SE (Lorelei Lane) side of Inner Hill Island ca. 75 m SW of NE tip. The stake is in a small clearing 5 m inland from and 1 vertical m above Lorelei Lane.

UTM coordinates (by GPS reading): 386874.9, 5330517.0.

Date surveyed: 12 August 1993.

Narrative description of site: This is a sheltered gravelly shoreline, partly shaded by waterside overhanging trees of balsam-fir and white spruce and the shrub ninebark (Physocarpus opulifolius), on the Lorelei Lane (SE-facing) side of Inner Hill Island, not far from the NE tip of the island. "Common" plant species present at the site included wild mint (Mentha arvensis), strawberry (Fragaria virginiana), chickweed (Cerastium vulgatum), harebell (Campanula rotundifolia), fireweed (Epilobium angustifolium), spurred-gentian (Halenia deflexa), red-stemmed gentian (Gentiana rubricaulis), a native hawkweed (Hieracium canadense), and the sedges Carex aurea and Cx. stipata.

Rare plants present, all found along the 5 meters of shoreline nearest the stake, were:

Castilleja septentrionalis (CAS), 8 flowering clumps.
Euphrasia arctica (EUP), ca. 60 flwering plants.
Parnassia palustris (PAR), 12 sterile and 8 large flowering plants.
Senecio indecorus (SNI), 14 flowering plants.
Trisetum spicatum (TRI), 3 clumps with 17 flowering stems.

Future monitoring protocol: This plot is an easy ten minute paddle from Davidson Island and should be monitored every 3-5 years, or more preferably every 1-2 years.

**1998 MONITORING**

Date resurveyed: 18 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CAS | 1993: 8 plants.<br>1998: not relocated. |
| EUP | 1993: 60 flowering planrs.<br>1998: 4 flowering plants. |
| PAR | 1993: 8 large flowering and 12 sterile plants.<br>1998: not relocated. |
| SNI | 1993: 14 flowering plants.<br>1998: not relocated. |
| TRI | 1993: 3 clumps, 17 flowering stems.<br>1998: not relocated. |

Comments on changes from 1993-4 to 1998: Four species (CAS, PAR, SNI, and TRI) were not relocated here, and the one that was relocated (EUP) declined from 60 to 4 individuals. It is possible that the lateness of the 1998 survey meant that these July-flowering species had more of less died back by 18 August 1998.

Vascular Plant Permanent Monitoring Plot Number: JEJ-010-001 (stake; see additional waypoints below).

Location/informal name of plot: Threemile Parsley Fern Glades.

Legal description/Exact directions to plot: T66N-R33W, Sec. 8, NW of SW (Belle Harbor 7.5' topo). From Threemile Campground dock, walk 300-400 m NE on Rock Harbor Trail to small harborside point; walk 19 m W to clump of small (not large) waterside white cedars (JEJ-010-004). Then proceed 71 m W (270 degress) to stake, located in a small area of dense swampy woods at the S base of the glades (it proved difficult to set the stake anywhere in the bare rock of the glades).

UTM coordinates (by GPS reading): (due to interference, the GPS reading had to be taken from a rock hillock located 27 m W of the stake), 001: 386517.3, 5331212.8.

Additional waypoints recorded by GPS reading:
JEJ-010-002. SW-most plants of CRA in glade. UTM = 386450.1, 5331197.7.
JEJ-010-003. N-most plants of CRA in glade. UTM = 386488.2, 5331219.7.
JEJ-010-004. Harborside cedars used to locate stake. UTM = 386628.9, 5331222.4.
JEJ-010-005. Base of main Threemile Campground dock. UTM = 386271.9, 5331064.1.

Date surveyed: 14 August 1993.

Narrative description of site: Bare, dry, 20 degree sloping, south and southeast-facing basalt glades with abundant but scattered plants of mountain parsley fern (Cryptogramma acrostichoides, CRA). Common associates were bearberry (Arctostaphylos uva-ursi), rough goldenrod (Solidago hispida), tufted hairgrass (Deschampsia cespitosa), three-toothed cinquefoil (Potentilla tridentata), rusty woodsia (Woodsia ilvensis), rock spikemoss (Selaginella rupestris), Canada bluegrass (Poa compressa), and stunted white spruce.

In 1984, Crispin et al. inventoried this site and found at least 78 clumps of CRA. In 1993, there were at least 150 clumps averaging 30 cm in diameter and 30 cm tall over a several hectare area. The plants appear to prefer lower slopes of the glades rather than the summits. Clumps are rather evenly spaced, usually at least a meter apart.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CRA | 0-20 | 6-20 | 37 clumps |
| CRA | 270 | 27 | at least 20 clumps |

Future monitoring protocol: This site should be monitored on a 3-5 year basis; it is an easy 10 minute paddle and 5 minute walk from Davidson Island.

**1998 MONITORING**

Date resurveyed: 17 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CRA | 1993: 57 clumps |
| CRA | 1998: 76 clumps |
| | Change: +33% |

Comments on changes from 1993-4 to 1998: Parsley fern increased by about one-third at this site. It may be siginificant that this species is drought-adapted.

Vascular Plant Permanent Monitoring Plot Number: JEJ-011-002 (stake); JEJ-011-001 (base of Davidson Island dock); JEJ-011-003 (extreme NE tip of island).

Location/informal name of plot: Davidson Island NE Point.

Legal description/Exact directions to plot: T66N-R33W, Sec. 8, NW of SE (Belle Harbor 7.5' topo). From Davidson Island house, proceed ca. 350 m NE on Rock Harborside trail to small point jutting into the harbor. Take side trail on the left (NW) 9 m to stake.

UTM coordinates (by GPS reading): 001: 387246.4, 5330827.8; 002: 387467.8, 5331093.0; 003: 387630.9, 5331117.9. Note that the stake is located at 002, not at 001 as is conventional.

Dates surveyed: 14 August 1993, 23 May 1994.

Photos: Frame 18 (habitat looking N from stake, with POA at bottom); 19 (robust POA plant).

Narrative description of site: This is a tiny opening, fringed with small balsam-fir, white birch, and green alder, in which the rare alpine bluegrass (Poa alpina, POA) grows in a dense bearberry (Arctostaphylos uva-ursi) and common juniper (Juniperus communis) mat on thin soil over rock, on a level area about 1.5 vertical m above Rock Harbor. "Common" associates were cow-wheat (Melampyrum lineare) and twinflower (Linnaea borealis). "Rare" associates were Lycopodium complanatum (LYC), Trisetum spicatum (TRI), and Viburnum edule (VIB). A small but dense colony of Calypso bulbosa (CAL) also grew nearby (23 May 1994), at the N side of the junction of the loop trail with the 9 m side trail leading to the stake; it grew under balsam-fir in a dense growth of Aralia nudicaulis, Clintonia borealis, Geocaulon lividum, and Maianthemum canadense and was entirely shaded out by these herbs by the first week in June: it was the first Calypso colony in IRNP to finish flowering.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CBU | ca. 90 | 10 | 57/15 [23 May 1994] |
| LYC | [within 3 m of stake, plants covered ca. 0.5 sq. m] | | |
| POA (1984, Crispin et al.) | | | 8 plants reported. |
| (14 Aug. 1993) | | | 11/3 (8 total, 3 fertile) |
| | 85 | 2 | 1 clump + 6 fl. stems |
| | 270 | 2 | 1 clump + 3 fl. stems |
| (July 1994) | | | 5/2 |
| TRI | 265 | 10 | 11/7 (on shoreline) |
| VIB | [within 10 m of stake were 35 plants 0.3-1.2 m tall] | | |

Future monitoring protocol: This plot can (and should) be easily monitored on an annual or biennial basis, with visits in May to monitor Calypso and late June or July for the other species. Low spreading branches of balsam-fir and common juniper (along with vigorous bearberry) may be shading and out-competing POA at this site. Plants of VIB had "witches brooms" of heavy moose browse; only a few fruits were noted.

**1998 MONITORING**

Date resurveyed: 26 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CBU | 1998: new leaves evident, but no. plants uncertain |
| POA | 1998: 13 robust fruiting plants w/I 1 m of stake; 3 more from 1-2 m away. |

Comments on changes from 1993-4 to 1998: POA increased from 8 to 11 to 13 plants from 1984 to 1993 to 1998. The dense, circular CBU colony appears to have been damaged by infall of trees limbs and branches from 1993-1998 - perhaps part of the natural dynamics of this species.

Vascular Plant Permanent Monitoring Plot Number: JEJ-012-001 (stake); JEJ-012-002 (largest mine pit); JEJ-012-003 (SW end of farthest SW small rock pool). JEJ-012-004 (uncertain what this refers to; GPS reading indicates point may be in Lake Superior E of the plot).

Location/informal name of plot: Outer Hill Island Rock Pool.

Legal description/Exact directions to plot: T66N-R33W, Sec. 19, NE of NW (Mott Island 7.5' topo). Land canoe in sheltered cove on Lorelei Lane side of Outer Hill Island 100 m NE of SW tip. Walk SE into forest to largest mine pit, then walk 20 m at 140 degrees to the stake, located on a small mound in an open Abies balsamea forest. Monitored area is a series of rock pools on the Lake Superior shoreline, the principal and largest pool located 17 m from the stake at a bearing of 150 degrees (this location is the "hinge point" from which several of the rare species bearings and distances are taken), past some large (60 cm dbh) white cedars. The hinge point is located along a 64 m long crevice that trends 100-280 degrees.

UTM coordinates (by GPS reading): 001: 386906.5, 5330365.4; 002: 386895.7, 5330382.0; 003: 386883.6, 5330340.6; 004: 386961.8, 5330361.9.

Date surveyed: 15 August 1994.

Photos: Frames 20 (habitat); 21 (PIN and SEL).

Narrative description of site: Lake Superior shoreline crevice and rock pool commumity, with the following dominants, all among very scattered 3-5 m tall trees of balsam-fir and white cedar: green alder (Alnus viridis), shrubby cinquefoil (Potentilla fruticosa), blueberry (Vaccinium angustifolium), alpine bilberry (V. uliginosum, VCU), Scirpus cespitosus, sundew (Drosera rotundifolia), and mosses. Rare species present included butterwort (Pinguicula vulgaris, PIN), northern spikemoss (Selaginella selaginoides, SEL), Tofieldia glutinosa (TOG), and Trisetum spicatum (TRI).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| PIN | 125 | 25 | 10 plants |
| PIN | 135 | 29 | 26 plants |
| VCU | 125 | 25 | 0.04 sq. m |
| VCU | 165 | 27.5 | 0.02 sq. m |
| VCU | 180 | 27-30 | at least 2.5 sq. m |
| To "hinge point" on NW side of largest rock pool: | | | |
| | 150 | 17 | |
| To further (SE) side of largest rock pool: | | | |
| | 150 | 25 | |
| To Lake Superior waterside: | | | |
| | 150 | 38 | |

[All distances and bearings that follow are from "hinge point", from SW to NE]

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| Crevice emerges from Lake: | | | |
| | 280 | 49 | |
| Farthest SW rock pool: | | | |
| SW end | 280 | 41 | [=JEJ-012-003] |
| PIN | 280 | 33 | 10 plants |
| NE end | 280 | 28 | |
| PIN | 280 | 28 | 19 plants |

| | | | |
|---|---|---|---|
| Largest rock pool: | | | |
| SW end | 280 | 11.5 | |
| Hinge point | --- | 0 | |
| PIN | --- | 0 | 18 plants |
| SEL | --- | 0 | 8 stems |
| NE end | 100 | 12.5 | |
| PIN | 100 | 12.5 | 22 plants |
| VCU | 100 | 12.5 | 0.01 sq. m |
| VCU | 100 | 29-34 | 4, 0.2 sq. m |
| Farthest NE rock pool: | | | |
| SW end | 100 | 34 | |
| VCU | 120 | 37 | 3, 0.4 sq. m |
| NE end | 100 | 40.5 | |
| VCU | 100 | 40.5-44.5 | 4, 0.05 sq. m |
| TRI | 100 | 54 | 3/22 |
| Crevice re-enters Lake: | | | |
| | 100 | 64 | |

Future monitoring protocol: This site should be monitored every 3-5 years, or more frequently (every 1-2 years?). It is an easy 10 minute paddle and walk from Davidson Island.

**1998 MONITORING**

Date resurveyed: 18 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| PIN (SW rock pool) | 1993: 26 plants<br>1998: 1 plant (2 fruiting stalks) |
| PIN (largest rock pool) | 1993: 18 plants<br>1998: 0 plants |
| VCU | 1993: not seen<br>1998: 0.02 sq m |
| PIN (NE end of rock pool) | 1993: 22 plants<br>1998: 0 plants |
| TOG | 1993: not seen.<br>1998: 15 fruiting stalks. |
| VCU | 1993: 4 clumps, 0.2 sq m<br>1998: 2 clumps, 0.04 sq m |
| VCU (farthest NE rock pool) | 1993: 7 clumps, 0.45 sq m<br>1998: 5 clumps, 1.04 sq m |
| TRI | 1993: 3/22<br>1998: not relocated |

Comments on changes from 1993-4 to 1998: PIN died off dramatically here, faling from 66 plants to just 1. VCU apparently increased slightly from an aggregated cover of 0.65 sq. m in 1993 to 1.10 sq. m in 1998.

Vascular Plant Permanent Monitoring Plot Number: JEJ-013-001.

Location/informal name of plot: West Caribou Island South Tip Cleft.

Legal description/Exact directions to plot: T66N-R34W, Sec. 24, SW of SW (Mott Island 7.5' topo). From Caribou Island Campground, hike off-trail 0.5 km E to west-east running cleft at extreme S tip of island. Stake is located midway along the cleft, about 8 m E of large 4 x 2 x 2 m boulder on bottom of cleft.

UTM coordinates (by GPS reading): 383390.7, 5327741.9.

Date surveyed: 17 August 1993.

Narrative description of site: The cleft is a low (only ca. 20-40 cm above Lake level) wet depression with a rare plant community found at the mossy base of the steep (50 degrees) N-facing rock face, with a few small trees of white birch, balsam-fir, and green alder. Common plants present included alpine bistort (Polygonum viviparum, POL, with abundant fruit), butterwort (Pinguicula vulgaris, PIN), miterwort (Mitella nuda), strawberry (Fragaria vesca), Canada hawkweed (Hieracium canadense), dwarf raspberry (Rubus pubescens), harebell (Campanula rotundifolia), rough goldenrod (Solidago hispida), grass-of-Parnassus (Parnassia palustris, PAL), eastern paintbrush (Castilleja septentrionalis, CAS), Carex atratiformis (CXA), rayless ragwort (Senecio indecorus, SNI), squashberry (Viburnum edule, VIB), tufted hairgrass (Deschampsia cespitosa), prickly rose (Rosa acicularis), and bedstraw (Galium triflorum).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CXA | ca. 45 | ca. 10 | 5 plants |
| PAR | 270 | 3 | 5 plants |
| PIN | | [within 15 m of stake] | 45 plants |
| POL | 90-270 | (from 5 m E to 2 m W of stake) | 70 plants |
| SNI | 90 | ca. 20 | 2 plants |
| VIB | | [within 15 m of stake] | 6 plants |

Future monitoring protocol: This plot should be monitored every 3-5 years.

**1998 MONITORING**

Date resurveyed: 18 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CAS | 1993: not noted.<br>1998: several plants present. |
| CXA | 1993: 5 plants<br>1998: 12 fruiting stalks |
| PAR | 1993: 5 plants<br>1998: 1 plant (with 3 fruiting stalks) |
| PIN | 1993: 45 plants<br>1998: 5 plants with 2 fruiting stalks (4 m W of stake) |

| | |
|---|---|
| POL | 1993: 70 plants<br>1998: 6 old fruiting stalks |
| SNI | 1993: 2 plants<br>1998: not relocated |
| VIB | 1993: 6 plants<br>1998: 6 plants |

Comments on changes from 1993-4 to 1998: PIN declined dramatically (90%), POL by a similar figure.

Vascular Plant Permanent Monitoring Plot Number: JEJ-014-001.

Location/informal name of plot: West Caribou Island, Gilberts Hole.

Legal description/Exact directions to plot: T66N-R34W, Sec. 24, NE of SW (Mott Island 7.5' topo). Canoe into Gilberts Hole between East and West Caribou Islands. Site is in small cove on N shore of West Caribou Island just E of the narrowest point in the Hole. Stake is 4 m S (inland from) the waterline, in a 3-9" dbh Abies balsamea stand.

UTM coordinates (by GPS reading): 383740.5, 5328159.6.

Date surveyed: 17 August 1993.

Narrative description of site: The waterline of this small, N-facing and sloping (10 degrees) cove has a narrow gravelly beach with abundant alpine bistort (Polygonum viviparum, POL). Other rare plants present were one plant of alpine bluegrass (Poa alpina, POA), Carex norvegica (media) (CXM), and squashberry (Viburnum edule, VIB). Common associated species were Poa glauca, Streptopus roseus, Alnus incana seedlings, Rubus parviflorus, Coptis trifolia, Cornus canadensis, Linnaea borealis, Gymnocarpium dryopteris, Aster macrophyllus, Prunella vulgaris, Aralia nudicaulis, Carex aurea, Phalaris arundinacea, Maianthemum canadense, and Lycopodium annotinum.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CXM | [10 plants scattered along shoreline between stake and cove] | | |
| POA | [a single sterile plant along the shoreline] | | |
| POL | [along shoreline for 23 m, from 15 m W of closest part of cove to stake, to 8 m E of stake-cove line; a total of ca. 90 plants in abundant fruit] | | |
| VIB | [common as 20-40 cm tall seedlings in Abies balsamea forest surrounding stake] | | |

Future monitoring protocol: This plot should be monitored every 3-5 years.

**1998 MONITORING**

Date resurveyed: 18 August 1998.

| Species and subpopulation number (% coverage; or genets/ramets/flowering and/or fruiting stems) | Demographic data |
|---|---|
| CAS | 1993: not noted<br>1998: ca. 20 old plants |
| CXM | 1993: 10 plants<br>1998: not seen, perhaps past fruit |
| POA | 1993: 1 plant<br>1998: not seen. |
| POL | 1993: ca 90 plants<br>1998: 132 old flowering stalks, but only 4 with bulbils. |

Comments on changes from 1993-4 to 1998: POL increased by 46%, from 90 to 132 plants.

Vascular Plant Permanent Monitoring Plot Number: JEJ-015-001 [stake; see also waypoints below].

Location/informal name of plot: West Caribou Island SE Coast.

Legal description/Exact directions to plot: T66N-R34W, Sec. 24, NE of SW (Mott Island 7.5' topo). Canoe into Gilberts Hole between East and West Caribou Islands. Beach canoe at small cove on N shore of West Caribou Island just E of the narrowest point in the Hole (JEJ-014-001). Then bushwhack through forest 150 m SE to site on headland on SE (Lake Superior) coast. The stake is in dense boreal forest dominated by balsam-fir, in a crevice under thimbleberry (Rubus parviflorus) bushes. From the stake, it is 30 m at a bearing of 12 degrees down a driftwood log-choked crevice to Lake Superior on the N; or, 58 m at a bearing of 120 degrees to Lake Superior on the SE.

UTM coordinates (by GPS reading): 001: 383800.0, 5328061.6.

Additional waypoints recorded by GPS readings:
JEJ-015-002: "North colony" of SXP. UTM: 383828.2, 5328043.4.
JEJ-015-003: "South colony" of SXP. UTM: 383802.8, 5328047.1.

Date surveyed: 17 August 1993.

Narrative description of site: Rocky exposed, SE-facing shoreline of Lake Superior, with a few stunted white cedar saplings, otherwise bare rock with the following very scattered shrubs and herbs: harebell (Campanula rotundifolia), rough goldenrod (Solidago hispida), three-toothed cinquefoil (Potentilla tridentata), beach wormwood (Artemisia camprestris), rayless ragwort (Senecio indecorus, SNI), Trisetum spicatum (TRI), and encrusted saxifrage (Saxifraga paniculata, SXP).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| SNI | 120 | 38 | At least 20 plants |
| SXP | 120 | 38 | North Colony [JEJ-015-002; this colony extends for 10 x 3 m on a N-facing "shelf" with a slope of ca. 30 degrees] |
| SXP | 175 | 26 | South Colony [JEJ-015-003; both of these SXP colonies are 28-31 m apart on the same crevice trending from 240 to 60 degrees] |
| TRI | [several plants within 40 m of stake] | | |

Future monitoring protocol: This plot should be monitored every 3-5 years.

**1998 MONITORING**

Date resurveyed: 18 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| SNI | 1993: at least 20 plants<br>1998: 5 fruiting plants + 10 seedlings |

| | |
|---|---|
| SXP (North Colony) | 1993: demographic data not recorded.<br>1998: 26/265/4 |
| SXP (South Colony) | 1993: data not recorded.<br>1998: 4/79/2 |
| TRI | 1993: not recorded<br>1998: several plants |

Comments on changes from 1993-4 to 1998: SNI appeared to decline significantly.

Vascular Plant Permanent Monitoring Plot Number: JEJ-016-001 (stake; see additional waypoint readings).

Location/informal name of plot: East Caribou Island, NE Peninsula.

Legal description/Exact directions to plot: T66N-R34W, Sec. 24, NE of NE (Mott Island 7.5' topo). From Mott Island-East Caribou Island footbridge, proceed 100 m SE along shore, then walk up steep hill on informal trail ca. 15 m, then turn left (E) onto small narrow peninsula at NE tip of East Caribou Island. Stake is 24 m due E of the informal trail in a swale in a 2-4" dbh Abies balsamea "krumholtz" located 116 m from extreme NE tip of peninsula at a bearing of 255 degrees from the tip.

UTM coordinates (by GPS reading): (due to interference from trees, reading was taken from 7 m E of the stake), 001:384571.5, 5328762.7.

Additional waypoints recorded by GPS reading:
JEJ-016-002: VCU colony. UTM = 384623.0, 5328766.4.
JEJ-016-003: Extreme NE tip of peninsula. UTM = 384676.8, 5328780.9.

Date surveyed: 18 August 1993.

Narrative description of site: Rocky headland with sprawling balsam-fir/cedar/green alder krumholtz grading NE into heath community, then bare rock at the tip. Alpine bilberry (Vaccinium uliginosum, VCU) grows with the krumholtz trees plus blueberry (V. angustifolium); encrusted saxifrage (Saxifraga paniculata, SXP) grows in bare crevices with few associates save Trisetum spicatum, rough goldenrod (Solidago hispida), and three-toothed cinquefoil (Potentilla tridentata).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| SXP | 70 | 67-70 | 11/239/73 |
| SXP | 80 | 68 | 7/128/ 9 |
| | [this colony 7 m S of main colony; 4 m from lake on S and 2 vertical m above it] | | |
| VCU | 70 | 55-63 | 1 sq. m; along N-facing shelf 3 m above lake in 8 x 0.5 m zone. |

Future monitoring protocol: This plot should be monitored annually or biennially. It is a 10 minute walk from Mott Island headquarters. The SXP looked in poor vigor, and blueberry (Vaccinium angustifolium) may be competing with the alpine bilberry.

**1998 MONITORING**

Date resurveyed: 8 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| SXP (NW side colony) | 1993: 11/239/73<br>1998: 9/387/27 |
| SXP (SE side colony) | 1993: 7/128/9<br>1998: 8/85/17<br>Change (%): -5/+30/-46 |
| TRI | 1993: not recorded |

| | |
|---|---|
| | 1998: several plants |
| VCU | 1993: 1 sq m total |
| | 1998: 1 sq m total |

Comments on changes from 1993-4 to 1998: Th number of ramets and fruiting stems of SXP declined significantly, although the number of genets remained constant.

Vascular Plant Permanent Monitoring Plot Number: JEJ-017-001.

Location/informal name of plot: Mott Island Small Boat Cove.

Legal description/Exact directions to plot: T66N-R34W, Sec. 13, SE of SE of SE (Mott Island 7.5' topo). From Mott Island headquarters dock, walk 200 m SW to Small Boat Cove. The stake is on the peninsula on the NW side of the cove, a few meters past (SW of) where the last small boat is docked, and 4.5 m inland (E) of the cove. From the stake, it is 44 m at a bearing of 40 degrees to the head of the cove.

UTM coordinates (by GPS reading): 384690.4, 5329082.6.

Date surveyed: 18 August 1993.

Narrative description of site: Disturbed boreal forest of white birch and balsam-fir on the SW peninsula of the Small Boat Cove. It monitors a plant of involucred honeysuckle (Lonicera involucrata, LON) 4 m N of the stake. The plant was a single clump 1.2 m in diameter with 15 stems ranging from 20-80 cm tall.

Future monitoring protocol: This plot should be monitored annually or biennially; number and length of stems and evidence of flowering and/or fruiting should be recorded.

**1998 MONITORING**

Date resurveyed: 8 August 1998.

Species and subpopulation number — Demographic data

LON (1998): Both doing as well as in 1993; 2 small clumps 1 m apart, one with 2 stems 20 cm tall, the other with 4 stems 15 cm tall.

VIB (1998): common in NW quad, with 8 clumps 15-45 cm tall, moderate moose browse on tallest stem.

Comments on changes from 1993-4 to 1998: See above; LON appears to have declined somewhat.

Vascular Plant Permanent Monitoring Plot Number: JEJ-018-001.

Location/informal name of plot: Ransom Hill Ram's Head Site.

Legal description/Exact directions to plot: T66N-R34W, Sec. 22, NW of NE of SE (Mott Island 7.5' topo). From Daisy Farm Campground, proceed 1 km N on Mt. Ojibway Trail. Site is on first steep bare rock glade slope at first switchback (turn right off trail as trail swings left). The stake is 17 m away from this switchback at a bearing of 60 degrees, in a small swale partly hidden by juniper, bracken fern, and fir saplings (to prevent its being visible from the trail). Elevation ca. 820 feet.

UTM coordinates (by GPS reading): 381084.1, 5328286.9.

Date surveyed: 18 August 1993.

Narrative description of site: Site is a barren, heath-covered basalt glade (scattered balsam-fir present) with about a 10 degree slope to the S with bedrock 2-6 cm below the surface. A colony of ram's-head lady's-slipper (Cypripedium arietinum, CYP) was found here with the following associates: dominant, barren strawberry (Waldsteinia fragarioides), bracken fern (Pteridium aquilinium), and bearberry (Arctostaphylos uva-ursi); also present were northern comandra (Geocaulon lividum), dogbane (Apocynum sp.), Danthonia spicata, Deschampsia flexuosa, Oryzopsis asperifolia, Aster ciliolatus, Canada hawkweed (Hieracium canadense), king devil hawkweed (H. florentinum), and the orchids Malaxis unifolia and Spiranthes gracilis.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CYP | 240 | 4-6 | 38/20 |
| [2 plants with mature capsules; also plants within a diameter of 2 m. There were also 5 juveniles noted] | | | |

Future monitoring protocol: This is site is accessible by 15 minute walk from Daisy Farm Campground and could easily be monitored annually or biennially.

**1998 MONITORING**

Date resurveyed: 15 August 1998.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CYP | various | 2-6 | 67/15 |

Comments on change from 1993-1998: CYP increased significantly here.

Vascular Plant Permanent Monitoring Plot Number: JEJ-019-001.

Location/informal name of plot: Mad Island Crowberry Heath.

Legal description/Exact directions to plot: T66N-R33W, Sec. NW of SE of SE (Mott Island). Take canoe from Davidson Island dock 456 m E to the largest and highest of the Mad Islands. Landing is difficult; the best place is midway along the NW-facing coast, where the canoe can be dragged up on a small rock shelf. Then walk to the NE end of the islet. The stake is 4-5 vertical m above Lake in a crevice 5 m S of the water's edge at the NE margin of where low white cedar mats end. From the stake it is 49 m at a bearing of 60 degrees to the NE tip of the islet; 8-9 m S to the middle of a small rock pool on the SE coast; and 33 m at a bearing of 120 degrees to the SE coast water's edge.

UTM coordinates (by GPS reading): 387689.7, 5330933.4.

Date surveyed: 19 August 1993.

Photos: 6 August 1993.

Narrative description of site: This is a rocky Lake Superior shoreline site grading up to a stunted krumholtz of white cedar and green alder (Alnus viridis) around the stake, where the dominants are crowberry (Empetrum nigrum, EMP), alpine bilberry (Vaccinium uliginosum, VCU), and some blueberry (V. angustifolium), bearberry (Arctostaphylos uva-ursi), and creeping juniper (Juniperus horizontalis).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| EMP | 315-355 | 1.2-3.2 | 0.4 sq. m in moss mat 3-4 vertical m above Lake on N-facing shelf. |
| SAG | 120 | 33 | 32 plants in open splash crevices 0.5 m above Lake. |
| SAG | [there were also 6 plants at the canoe landing site on the NW-facing coast] | | |
| VCU | [0.01 sq. m were found immediately around the stake; on the tiny islet a few m off the NE tip of the main islet, VCU was dominant with 5-10 sq. m of coverage] | | |

Future monitoring protocol: This site should be monitored every 3-5 years, or more frequently (every 1-2 years?). It is an easy 5 minute paddle and walk from Davidson Island dock.

**1998 MONITORING**

Date resurveyed: 26 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| EMP | 1993: 0.4 sq m<br>1998: 0.06 sq m |
| SAG | 1993: 32 plants<br>1998: 37 plants (1 in flower, 12 in young fruit, 15 in bud). |

| | |
|---|---|
| VCU | 1993: 0.01 sq m<br>1998: not relocated. |

Comments on change from 1993-1998: EMP declined dramatically here, and the small colony of VCU disappeared. SAG increased slightly, reflecting a significant increase in the Rock harbor area from 1993-1998, perhaps associated with lower lake levels.

Vascular Plant Permanent Monitoring Plot Number: JEJ-020-001.

Location/informal name of plot: Heron Island Prickly Saxifrage Site.

Legal description/Exact directions to plot: T66N-R33W, Sec. 8, NE of SE (Belle Harbor 7.5' topo). Accessible by canoe from Davidson or Tookers Islands; site is near summit of Heron Island near its SW tip. From the extreme SW tip of the island it is 42 m at 50 degrees to the stake, 6 vertical m above Lake level; from the stake it is 8 m (down a sheer cliff) at 340 degrees to the water's edge of Rock Harbor, and 21 m at 160 degrees to the water's edge of Lake Superior.

UTM coordinates (by GPS reading): 388074.1, 5331206.9.

Date surveyed: 19 August 1993.

Narrative description of site: The main population monitored is prickly saxifrage (Saxifraga tricuspidata, SXT). It grows in open, dry heath vegetation 4-5 vertical m above Lake level on a SSE-facing 25-30 degree slope. Associates (all scattered and apparently not competing with SXT) were creeping juniper (Juniperus horizontalis), bearberry (Arctostaphylos uva-ursi), rough goldenrod (Solidago hispida), fescue (Festuca saximontana), harebell (Campanula rotundifolia), ticklegrass (Agrostis hyemalis), and three-toothed cinquefoil (Potentilla tridentata).

A secondary habitat monitored was a pair of tiny rock pools with butterwort (Pinguicula vulgaris, PIN) on the coast about 33-39 m SSE of the stake.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| PIN | 105 | 39 | 500 plants on both ends of small pool. |
| PIN | 120 | 33 | 200 plants. |
| SXT | 100-200 | 3.0-8.5 | 13/663/154 |

[The 13 clumps had the following rosettes/old flowering stems: 21/0, 24/1, 7/1, 32/13, 85/28, 10/0, 73/14, 24/0, 98/22, 36/13, ca. 200/ca. 40, 24/7, 39/15. No seed set was noted.]

Future monitoring protocol: This site should be monitored every 3-5 years. Although less than 1 km from Davidson Island dock, a gap in the island chain means exposure to the open waves of Lake Superior and the more sheltered NW-facing coast is a series of sheer cliffs with no landing spots. I suggest landing at the NE end of the island, but only in very calm weather.

**1998 MONITORING**

Date resurveyed: 25 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| DRA | 1993: not seen.<br>1998: 5 clumps, 1 fruiting |
| EMP | 1993: not seen.<br>1998: 0.1 sq m patch 15 m from stake at bearing of 110 degrees. |

| | |
|---|---|
| PIN | 1993: 700 plants total.<br>1998: 48 plants with 18 fruiting stems.<br>change: -92% |
| SXT | 1993: 13/663/164<br>1998: 4/119/3<br>change (%): -69/-74/-98 |

Comments on change from 1993-1998: Two species, DRA and EMP appeared here in 1998 for the first time. PIN and SXT declined dramatically.

Vascular Plant Permanent Monitoring Plot Number: JEJ-021-001.

Location/informal name of plot: Shaw Island SW tip.

Legal description/Exact directions to plot: T66N-R33W, Sec. 6, SW of NW. Accessible by canoe from Tookers Island; site is at extreme SW tip of Shaw Island. Stake (without identification tag, which was not attached) is 25 m from extreme SW tip of island at a bearing of 60 degrees, on small "krumholtzed" ridgetop in dense shrubby coniferous (white cedar dominant; also balsam-fir and green alder) krumholtz on narrow (3 m to Lake on either side) peninsula.

UTM coordinates (by GPS reading): 388354.4, 5331693.4.

Date surveyed: 19 August 1993.

Photos: 3 (EMP habitat, looking SW: mat is in lower right corner); 4 (EMP mat close-up); 5 (cove shoreline with CXM, PIN, and SEL; pen points to SEL).

Narrative description of site: Site is an exposed rocky headland at the SW tip of Shaw Island. It also includes a sheltered, shaded, mossy, N-facing cove shoreline habitat 10 m NE of the stake with the rare species Carex norvegica (media) (CXM), butterwort (Pinguicula vulgaris, PIN), and northern spikemoss (Selaginella selaginoides, SEL); other associates were arctic primrose (Primula mistassinica), one-sided pyrola (Pyrola secunda), rough goldenrod (Solidago hispida), and tufted hairgrass (Deschampsia cespitosa).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CXM | 310 | 9-10 | 20 plants, co -dominant |
| PIN | 310 | 9-10 | Several plants |
| SEL | 310 | 9-10 | Colony 2 x 0.5 m, ca. 100 stems on mossy shaded bank 0.5 m above water. |
| EMP | 255 | 17.0-18.5 | 1 sq. m mat [9 m from SW tip, 1 m above Lake] |

Future monitoring protocol: This site should be monitored every 3-5 years. It is a 20 minute canoe paddle from Davidson Island, or 5 minutes from Tookers Island dock.

**1998 MONITORING**

Date resurveyed: 25 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CXM | 1993: 20 plants<br>1998: 22 plants, all past fruit. |
| EMP | 1993: 1 sq m<br>1998: 0.8 sq m |
| PIN | 1993: several plants.<br>1998: not seen. |

Comments on change from 1993-1998: CXM and EMP remained stable, but PIN apparently disappeared from this site.

Vascular Plant Permanent Monitoring Plot Number: JEJ-022-001.

Location/informal name of plot: Porter Island South Tip.

Legal description/Exact directions to plot: T67N-R33W, Sec. 26, SW of NE (Rock Harbor 7.5' topo). SE-facing shore of Porter Island 50 m NE of S tip of island; the stake is in a slight depression 15.5 m inland from (bearing is 160 degrees to Lake) and 2-3 m above the Lake.

UTM coordinates (by GPS reading): 392577.504, 5336372.547.

Date surveyed: 11 June 1994.

Photos: Roll 5, Frame 22 (habitat with position of stake); 23 (plants of SXT).

Narrative description of site: This is a juniper (Juniperus communis and J. horizontalis)-bearberry (Arctostaphylos uva-ursi)-blueberry (Vaccinium angustifolium) dominated waterside glade community with a SE-facing aspect. Other associates were rusty woodsia (Woodsia ilvensis), Cladonia, three-toothed cinquefoil (Potentilla tridentata), Solidago (Aster) ptarmicoides, Poa glauca, Prenanthes racemosa, harebell (Campanula rotundifolia), and the following rare species: Carex umbellata (CXU); mountain parsley fern (Cryptogramma acrostichoides, CRA); and prickly saxifrage (Saxifraga tricuspidata, SXT).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CRA | 230 | 5.5-6.0 | 3 clumps |
| CRA | [ca. 25 more clumps uphill, outside plot] | | |
| CXU | 140 | 10.0 | 12 fruiting clumps |
| SXT | 118 | 8.0 | 1/ 25/ 7 |
| SXT | 118 | 11.2 | 2/ 50/20 |
| SXT | 127 | 11.1 | 2/ 20/12 |
| SXT | 130 | 9.4 | 1/ 20/ 0 |
| SXT | 135 | 9.7 | 2/ 95/ 1 |
| SXT | 150 | 9.3 | 2/ 85/12 |
| Total SXT | | | 10/295/52 |

Future monitoring protocol: It is recommended that all prickly saxifrage plots should be surveyed in the manner described above every 3 to 5 years.

**1998 MONITORING**

Date resurveyed: 20 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CRA | 1994: 3 clumps<br>1998: not seen |
| CXU | 1994: 12 fruiting clumps<br>1998: not seen, perhaps past fruit |
| SXT | 1994: 10/295/52<br>1998: 3/94/4<br>change (%): -70/-68/-92 |

Comments on change from 1993-1998: SXT declined dramatically here.

Vascular Plant Permanent Monitoring Plot Number: JEJ-023-001.

Location/informal name of plot: Edwards Island NE tip.

Legal description/Exact directions to plot: T67N-R33W, Sec. 25, SE of NE of NW (Rock Harbor 7.5'). Stake is ca. 70 m SW of the extreme NE tip of Edwards Island, 20 m SW of (and within) the limit of stunted conifers.

UTM coordinates (by GPS reading): 393892.554, 5336587.516.

Date surveyed: 12 June 1994.

Narrative description of site: This site is a shoreline rock heath dominated by common juniper (Juniperus communis) and bearberry (Arctostaphylos uva-ursi); associates included wood lily (Lilium philadelphicum), Scirpus cespitosus, Trisetum spicatum, dwarfed white cedar (Thuja occidentalis), and bog rosemary (Andromeda glaucophylla). Rare species present include crowberry (Empetrum nigrum, EMP), alpine bistort (Polygonum viviparum, POL), butterwort (Pinguicula vulgaris, PIN), northern spikemoss (Selaginella selaginoides, SEL), dwarf false asphodel (Tofieldia pusilla, TOP), and alpine bilberry (Vaccinium uliginosum, VCU). Rare species within a 30 m radius of the stake were recorded.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| EMP | 18-38 | 9-11.2 | 1 sq. m |
| EMP | 300 | 17.0 | 4 sq. m |
| EMP | 303 | 8.7-11.5 | 1 sq. m |
| PIN | 95 | 14.5 | 20 flowering |
| POL | 90 | 12.5 | 4 |
| SEL | 90 | 12.5 | 5 |
| TOP | 90 | 12.5 | 2 |
| VCU | 18 | 9.0 | 1 sq. m |
| VCU | 38 | 14.0 | 1 sq. m |
| VCU | 43 | 11.2 | 2 sq. m |
| VCU | 90 | 12.5 | 0.5 sq. m |
| VCU | 270 | 21.0 | 1.5 sq. m. |
| VCU | 295 | 15.5 | 2 sq. m |

Future monitoring protocol: It is recommended that all prickly saxifrage plots should be surveyed in the manner described above every 3 to 5 years.

**1998 MONITORING**

Date resurveyed: 20 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| EMP | 1994: 6 sq m<br>1998: 5.5 sq m |
| PIN | 1994: 20 flowering plants<br>1998: 7 sterile plants |
| POL | 1994: 4 plants<br>1998: not seen |

| | |
|---|---|
| TOP | 1994: 2 plants<br>1998: 5 sterile plants |
| VCU | 1994: 8 sq m total<br>1998: 9-10 sq m total |

Comments on change from 1993-1998: The two heath-forming shrubs EMP and VCU appeared stable, but PIN declined significantly.

Vascular Plant Permanent Monitoring Plot Number: JEJ-024-001.

Location/informal name of plot: North Government Island, NE tip.

Legal description/Exact directions to plot: T67N-R33W, Sec. 24, SE of SE (Rock Harbor 7.5' topo). Land canoe at SE tip of North Government Island and walk along SE coast rocks to extreme NE tip.

UTM coordinates (by GPS reading): 394532.573, 5337102.562.

Date surveyed: 12 June 1994.

Photos: Roll 6, Frames 1-8.

Narrative description of site: This site is a shoreline rock heath with boggy splash pools dominated by common and creeping junipers (Juniperus communis and J. horizontalis), the rare crowberry (Empetrum nigrum, EMP), and bearberry (Arctostaphylos uva-ursi); associates included three-toothed cinquefoil (Potentilla tridentata), lyre-leaved rock cress (Arabis lyrata), Scirpus cespitosus, Trisetum spicatum, yarrow (Achillea millefolium), harebell (Campanula rotundifolia), shrubby cinquefoil (Potentilla fruticosa), dwarfed white spruce (Picea glauca), dwarfed white cedar (Thuja occidentalis), Labrador tea (Ledum groenlandicum), and bog rosemary (Andromeda glaucophylla). Rare species present include twisted whitlow-grass (Draba arabisans, DRA), butterwort (Pinguicula vulgaris, PIN), alpine bluegrass (Poa allpina, POA), hawthorn-leaved gooseberry (Ribes oxyacanthoides, RIB), encrusted saxifrage (Saxifraga paniculata, SXP), northern spikemoss (Selaginella selaginoides, SEL), dwarf false asphodel (Tofieldia pusilla, TOP), alpine bilberry (Vaccinium uliginosum, VCU), and squashberry (Viburnum edule, VIB).

Rare species within a 30 m radius of the stake were recorded; PIN, SEL, and TOP were found mainly around a rock pool 30 m away at a bearing of 210 degrees from the stake.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| DRA | 300 | 6.2 | 4 flowering |
| EMP | 120 | 5.4 | 2 sq. m |
| EMP | 280 | 10 | 3 sq. m |
| PIN | [ca. 50 plants within 30 m radius] | | |
| POA | 185 | 10.2 | 1 flowering |
| RIB | [within 2 m of stake, 11 juvenile plants] | | |
| RIB | 284 | 2.8 | 1 |
| RIB | 300 | 1.6 | 3 |
| RIB | 310 | 7.3 | 3 |
| RIB | 335 | 2.2 | 1 |
| SXP | 73 | 8.6 | 1/ 20/ 2 |
| SXP | 308 | 9.0 | 10/440/20 |
| SXP | 300-315 | 4.4-6.0 | 20/750/50 |
| SEL | [10-20 plants within 30 m radius] | | |
| TOP | [ca. 50 plants within 30 m radius; a total of 100-200 on this island] | | |
| VCU | 100 | 5.6 | 2 sq. m |

| | | | |
|---|---|---|---|
| VIB | 100 | 2.5 | 5 plants |

Future monitoring protocol: It is recommended that this plot should be surveyed in the manner described above every 3 to 5 years.

**1998 MONITORING**

Date resurveyed: 20 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| DRA | 1994: 4 flowering.<br>1998: 15 old fruiting stems |
| EMP | 1994: 5 sq m<br>1998: 5 sq m |
| PIN | 1994: ca. 50 plants<br>1998: none seen; only 10 living plants seen within 30 m of stake. |
| POA | 1994: 1 flowering plant.<br>1998: none seen. |
| RIB | 1994: 8 plants.<br>1998: 3 stressed plants ca. 0.4 m tall. |
| SXT (not SXP as in 1995 report) | 1994: 31/1210/72<br>1998: >15/800-1000/70<br>change (%): -50/-25/-3 |
| TOP | 1994: 50 plants within 30 m of stake.<br>1998: 4 fruiting plants within 30 m. |
| VCU | 1994: 2 sq m.<br>1998: 3.2 sq m (95% bronzed - leaves dead, probably due to drought). |

Comments on change from 1993-1998: The heaths EMP and VCU were stable or slightly increased, as did SXT. DRA increased somewhat. PIN and TOP, two splash pool species, declined significantly.

Vascular Plant Permanent Monitoring Plot Number: JEJ-025-001.

Location/informal name of plot: Long Island Prickly Saxifrage Site.

Legal description/Exact directions to plot: T67N-R33W, Sec. 24, SE of SW (Rock Harbor 7.5' topo). Land canoe at NE end of island, then walk 300 m SW along central ridge to highest point of island.

UTM coordinates (by GPS reading): 393642.123, 5337082.150.

Date surveyed: 12 June 1994.

Narrative description of site: Dry, xeric, open, treeless juniper-heath community on bare basalt, ca. 7-8 m (vertical) above Lake, with prickly saxifrage (Saxifraga tricuspidata, SXT) locally common. Associates: common juniper (Juniperus communis), velvetleaf blueberry (Vaccinium myrtilloides), bearberry (Arctostaphylos uva-ursi), rusty woodsia (Woodsia ilvensis), fescue (Festuca saximontana), and tufted hairgrass (Deschampsia cespitosa).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| SXT | 90 | 6.2-7.5 | 10/1000/600, Vigorous |
| " | 116 | 13.8-16.2 | 7/1000/400, vigorous |
| " | 162 | 9.1 | 1/ 150/ 40 |
| " | 182 | 9-12 | 15/ 700/250 |
| " | 202 | 24.1 | 3/ 100/ 20, senescent |
| " | 211 | 27-30 | 12/ 600/ 25 |
| Total | | | 48/3550/1335 |

SXT is common on Long Island with a total of at least 150 clumps and 10,000 rosettes scattered throughout, mostly in the NE half.

Future monitoring protocol: It is recommended that all prickly saxifrage plots should be surveyed in the manner described above every 3 to 5 years.

**1998 MONITORING**

Date resurveyed: 20 August 1998.

| Species and subpopulation number | | Demographic data |
|---|---|---|
| SXT | 90 m from stake | 1994: 10/1000/600<br>1998: 7/151/28 |
| | 116 m | 1994: 7/1000/400<br>1998: 7/248/62 |
| | 162 m | 1994: 1/150/40<br>1998: 0 |
| | 182 m | 1994: 15/700/250<br>1998: 4/233/82 |

| | |
|---|---|
| 202 m | 1994: 3/100/20<br>1998: 0 |
| 211 m | 1994: 12/600/25<br>1998: 4/171/48 |
| TOTALS | 1994: 48/3550/1335<br>1998: 22/803/220<br>change (%): -54/-77/-84 |

Comments on change from 1993-1998: SXT decreased significantly here, with 2 of 6 subpopulations disappearing entirely.

Vascular Plant Permanent Monitoring Plot Number: JEJ-026-001.

Location/informal name of plot: Boys Island Devils Club Site.

Legal description/Exact directions to plot: T67N-R33W, Sec. 24, SW of NE of SW (Rock Harbor 7.5' topo). From Merritt Lane Campground, canoe to NE end of Boys Island; walk 150 m SW to NE end of large opening in forest with devils club (Oplopanax horridus) dominant in the understory. From the stake, it is 32 m at a bearing of 130 degrees to the water's edge on the SE side of the island.

UTM coordinates (by GPS reading): 393597.539, 5337327.510.

Date surveyed: 13 June 1994, with Jim Meeker.

Photos: Roll 6, Slides 17-19 looking SW from stake.

Narrative description of site: Large glade in very open 15-50 cm dbh Picea glauca stand in interior of Boys Island; devils club dominant in understory. Other associates were oak fern (Gymnocarpium dryopteris; common), thimbleberry (Rubus parviflorus), cow parsnip (Heracleum lanantum), bunchberry (Cornus canadensis), miterwort (Mitella nuda), Canada mayflower (Maianthemum canadense), wild sarsaparilla (Aralia nudicaulis), rosy twisted-stalk (Streptopus roseus), and squashberry (Viburnum edule).

Demographic data: This (and 4 of 5) devils club monitoring plots (JEJ-026, 028, 031, 032) are based on a 30 m transect from the metal stake in the direction of the densest concentration of stems. From this 30 m baseline, counts were made of numbers of stems in each of six 5 x 5 m compartments on each side of the center line, proceeding clockwise from the stake. Thus subcompartments 1-6 proceed on the left side of the transect line towards the end of transect; 7-12 proceed back to the stake on the right side of the transect. This results in a total of 12 (twelve) 5 x 5 m compartments with a total area of 300 sq. m (0.03 ha). Numbers of stems were counted, because devils club reproduces in IRNP chiefly by decumbent and rooting stems (vegetatively) and it was difficult to discern individual plants. Presumably, many populations of devils club in the Park are genetically identical clones, because of the predominance of this vegetative mode of reproduction.

Bearing (azimuth) of 30 m transect from stake: 220 degrees.

In addition to the following within-plot stems, there were 45 more stems (not in the plot) seen within this population. 100-200 m SW of the plot, there were 31 more stems scattered throughout the forest.

**1998 MONITORING**

| Subplot number | 1994 | 1998 |
|---|---|---|
| 1 | 79 | 91 (27 in fruit) |
| 2 | 109 | 74 (19) |
| 3 | 65 | 23 (4) |
| 4 | 26 | 60 (14) |
| 5 | 26 | 30 (8) |
| 6 | 28 | 46 (8) |
| 7 | 27 | 24 (4) |
| 8 | 25 | 21 (2) |
| 9 | 37 | 14 (2) |
| 10 | 23 | 24 (7) |
| 11 | 7 | 9 (2) |
| 12 | 4 | 14 (3) |
| Total: | 456 stems | 434 stems (104 in fruit) |

(1.52/sq. m) (1.45/sq. m)
change, 1994-1998: -5%

Comments on change from 1993-1998: OPL declined slightly and probably not significantly here.

Vascular Plant Permanent Monitoring Plot Number: JEJ-027-001.

Location/informal name of plot: Blake Point Signal Light Rocks.

Legal description/Exact directions to plot: T67N-R33W, Sec. 24, SW of NE of NE (Rock Harbor 7.5' topo). From Blake Point Signal Light, walk 26.7 m at a bearing of 198 degrees to the stake; alternately, the stake is 9.0 m at a bearing of 302 degrees from the 6 m tall "boulder-islet" 35 m SSE of the signal light. This stake was not relocated on 20 September 1994, and may have been removed by a visitor.

UTM coordinates (by GPS reading): 394287.557, 5338262.517.

Date surveyed: 13 June 1994.

Photos: Roll 6, Frames 24-25.

Narrative description of site: This is an exposed, rocky shoreline habitat with some juniper-heath vegetation at higher levels, but few well-developed rock pools. Many rare species occur from the signal light SSE to a small but prominent "boulder-islet:" alpine bluegrass (Poa alpina, POA), hawthorn-leaved gooseberry (Ribes oxyacanthoides, RIB), encrusted and prickly saxifrages (Saxifraga paniculata, SXP and S. tricuspidata, SXT), and alpine bilberry (Vaccinium uliginosum, VCU).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| POA | 0 | 17.6, 17.9 | 2 flowering plants |
| POA | 354 | 14.2 | 2 flowering plants |
| RIB | 43 | 3.5 | 1 plant |
| SXP | 38 | 18-19 | 3/104/ 11 |
| SXP | 40 | 17.2-18.4 | 14/400/ 11 |
| SXP | 45 | 21.2-25.0 | 15/300/ 10 |
| SXP | 152 | 6.4 | 1/ 15/ 1 |
| SXP | 178 | 5.5 | 2/ 75/ 3 |
| Total | | | 35/894/ 36 |
| SXT | 5 | 18.4 | 1/ 15/ 6 |
| SXT | 356 | 14.2 | 1/ 80/ 10 |
| Total | | | 2/ 95/ 16 |
| VCU | 43 | 21.8 | 0.5 sq. m |
| VCU | 55 | 7.3-10.1 | 0.5 sq. m |

Future monitoring protocol: This site should be surveyed every 3-5 years.

**1998 MONITORING**

Date resurveyed: 20 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| POA | 1994: 4 flowering plants<br>1998: 1 sterile plant |
| RIB | 1994: 1 plant<br>1998: not seen |
| SXP | 1994: 35/894/36<br>1998: 10/245/24 |

| | |
|---|---|
| | change (%): -73/-73/-33 |
| SXT | 1994: 2/95/16<br>1998: not seen |
| VCU | 1994: 1.0 sq m<br>1998: 1.9 sq m |

Comments on change from 1993-1998: The saxifrages SXP and SXT declined dramatically (SXP) and disappeared (SXT). The heath-forming shrub VCU increased significantly.

Vascular Plant Permanent Monitoring Plot Number: JEJ-028-001.

Location/informal name of plot: Blake Point Devils Club Site.

Legal description/Exact directions to plot: T67N-R33W, Sec, 24, NE of SW of NE (Rock Harbor 7.5' topo). From Blake Point Signal Light, walk 100 m SSW to head of dense patch of devils club near the mouth of large valley ("Devil's Valley"). From stake, Lake Superior is 32.5 m away at a bearing of 85 degrees.

UTM coordinates (by GPS reading): 394247.529, 5338202.554.

Date surveyed: 13 June 1994.

Photos: Roll 7, Frames 1-2.

Narrative description of site: This is a very dense thicket (probably the densest in Midwestern North America) of devils club (Oplopanax horridus, OPL) at the "mouth" of "Devil's Valley" (Cebelak 1983), the long, SW-NE running depression that extends from behind Merritt Lane Campground to the tip of Blake Point. The OPL grows in a very open (canopy coverage ca. 20%) forest "dominated" by a stand of dead white birch, with occasional 15-30 cm dbh showy mountain-ash and white spruce. Spreading woodfern (Dryopteris expansa, DRE) is co-dominant in the understory with devils club. Other common associates were Canada yew (Taxus canadensis), white mandarin (Streptopus amplexifolius), rosy twisted-stalk (S. roseus), cow parsnip (Heracleum lanatum), Canada mayflower (Maianthemum canadense), and oak fern (Gymnocaroium dryopteris).

Demographic data: The extreme density of devils club stems, and time constraints, did not permit establishment of the 30 m transect base line and 12 subcompartments. Instead, stems were counted within a 3 m radius of the stake. There were 148 stems within this radius, giving a mean density of 5.23 stems/sq. m, by far the highest of any devils club monitoring plot.

Future monitoring protocol: It is recommended that all devils club plots should be surveyed in the manner described above every 3 to 5 years.

**1998 MONITORING**

Date resurveyed: 20 August 1998.

Species and subpopulation number — Demographic data
(% coverage; or genets/ramets/flowering and/or fruiting stems)

| Subcompartment number | Number of devils club stems 1998 |
|---|---|
| | 104 (28 in fruit) |
| 2 | 32 (15) |
| 3 | 29 (14) |
| 4 | 21 (7) |
| 5 | 21 (10) |
| 6 | 63 (30) |
| 7 | 30 (4) |
| 8 | 6 (0) |
| 9 | 7 (4) |
| 10 | 27 (15) |
| TOTAL | 340 (127 in fruit) (1.13/sq m) |

Stems within 3 meters of the stake:

| 1994 | 1998 |
|---|---|
| 148 (5.23/sq. m) | 76 (2.69/sq. m) including 18 fruiting stems and 100 dead stems |

Comments on change from 1993-1998: OPL declined by about half in the vicinty of the survey stake.

Vascular Plant Permanent Monitoring Plot Number: JEJ-029-001.

Location/informal name of plot: Passage Island Mountain Cranberry Site.

Legal description/Exact directions to plot: T67N-R32W, Sec. 4, NW of SE of SE. From Passage Island Lighthouse, walk 729 m (straight line distance) NE along rocks of SE-facing coast.

UTM coordinates (by GPS reading): 399127.795, 5342290.894.

Date surveyed: 21 June 1994.

Narrative description of site: A population of mountain cranberry (Vaccinium vitis-idaea, VCI; collected as Judziewicz 10932, MICH) 7 m long (from NW to SE) and 1-2 m wide was discovered 4-7 vertical meters above Lake Superior and about 5-12 meters inland, at the base of a small (2-3 meters high) northeast-facing rock ledge partially shaded by a small tree (20 cm d.b.h.) of white cedar and saplings of white birch and balsam-fir. The plants grew mostly on the margins of a mat of Sphagnum compactum DC. (Judziewicz 10933, MICH; determined by Dr. Howard Crum) moss and comprised a vigorous colony 7 meters long and 1-2 meters wide with about 1,000-1,250 trailing stems ranging from 3-10 cm long. About 125-150 inflorescences were observed; each had 1-3 flowers in bud (the majority) or in anthesis (a few). The colony was in ripening fruit on 15 August 1994. The scattered associates included bunchberry (Cornus canadensis), wild-lily-of-the-valley (Maianthemum canadense), Labrador tea (Ledum groenlandicum), the sedges Carex deflexa and Scirpus cespitosus, three-toothed cinquefoil (Potentilla tridentata), small patches of fir clubmoss (Lycopodium selago, LYS) and alpine bilberry (Vaccinium uliginosum, VCU), and two species of bluejoint grass (Calamagrostis canadensis and C. stricta).

The colony of VCI ranged from 3.8-8.5 m from the stake at a bearing of 280 (at 3.8 m) to 218 degrees (at 8.2 m). Two other rare species were present near the stake: VCU, 0.01 sq. m; and LYS, 1 plant with 6 stems ca. 5 m at a bearing of 160 degrees from the stake.

Future monitoring protocol: This site should be monitored every 3-5 years.

**1998 MONITORING**

TRI: 1998, 1 fruiting stem 9.3 m from stake at 180 degrees.

VCU: 1998: 0.1 sq m red-brown-leaved mat 4.5 m from stake at a bearing of 220 degrees.

Vaccinium vitis-idaea (VCI or VVI): 1998: The Vaccinium vitis-idaea colony is 5 x 0.5-1.3 m with about 800-1000 stems. 40% of the stems had bright green leaves; 50% were stressed with yellowish- or reddish-green leaves; and 10% were brown and dead. Fruits were common (ca. 150), but many over-ripe and puckered or shriveled. The sphagnum bed in which the plants grow is yellowish and dead.

Comments on change from 1994-1998: See above. The mountain-cranberry colony is apparently stable in the last four years.

Vascular Plant Permanent Monitoring Plot Number: JEJ-030-001.

Location/informal name of plot: Passage Island Boat House Marsh.

Legal description/Exact directions to plot: T67N-R32W, Sec. 4, 1/4 mile E of center. From Passage Island Boat House, walk 55 m W on trail to pit toilet; then walk 18.3 m at a bearing of 217 degrees to stake. Two old, dying trunks of Sorbus decora are within 2 m of the stake.

UTM coordinates (by GPS reading): 001: 399262.789, 5342652.914.

Additional nearby landmarks for which GPS readings were taken:
JEJ-030-002: Boat Cove Pit Toilet. UTM = 399274.915, 5342671.806.
JEJ-030-003: Boat House (SW side). Apparently not recorded.

Date surveyed: 21 June 1994.

Photos: Roll X, Frame 1 (plants), 2 (habitat).

Narrative description of site: Auricled twayblade (Listera auriculata, LIS) colonies in red-osier dogwood (Cornus sericea)-dominated coldwater-seepage shrub swamp, main colony with 76 total plants with 24 in bud 21 June 1994, in fruit 15 August 1994; with the following associates: Calamagrostis canadensis, Streptopus amplexifolius, Athyrium filix-femina, Heracleum lanatum, Dryopteris carthusiana, Mitella nuda, Epilobium ciliatum, Galium triflorum, Ranunculus abortivus, Circaea alpina, Stellaria sp., Trillium cernuum, and Barbarea sp. There were 20 other plants of L. auriculata, with 11 in bud, within 10 m of the main colony. The plants growth in thick herbaceous and woody vegetation and are difficult to find. Specifically, colonies of LIS are located as follows relative to the stake:

| Bearing (degrees) | Distance (m) | No. plants (total/fertile) |
|---|---|---|
| ca. 75 | ca. 10 | several |
| 125 | 7.4 | 16/11 |
| 210-280 | 0.6-3.1 | 76/24 in 3 sq. m |

Future monitoring protocol: This site should be monitored every 3-5 years.

**1998 MONITORING**

Listera auriculata was not relocated in spite of an intensive search during the 1998 re-survey. The plants may have died back by this time of year, or simply been outcompeted by very rank growths of bluejoint (Calamagrostis canadensis), meadow-rue (Thalictrum dasycarpum), and red-osier dogwood (Cornus stolonifera).

Vascular Plant Permanent Monitoring Plot Number: JEJ-031-001.

Location/informal name of plot: Passage Island Trail Boardwalk.

Legal description/Exact directions to plot: T67N-R32W, Sec. 4, SE of SW. From the S end of the wooden trail boardwalk 800 m SW of Boat Cove; then proceed 22 m S along the trail (towards the Lighthouse) to a flat, steplike rock. Then walk 12 m off-trail at a bearing of 235 degrees to metal stake.

UTM coordinates (by GPS reading): 001: 398701.086, 5342160.377.

Additional nearby landmarks for which GPS readings were taken:
JEJ-031-002: Center of wooden trail boardwalk 800 m SW of Boat Cove. UTM = 398715.207, 5342185.559.
JEJ-031-003: Highest, most prominent trail overlook on ridge top 350 m NE of Lighthouse. UTM = 398694.432, 5342069.145.

Date surveyed: 22 June 1994.

Narrative description of site: Very open (ca. 25% canopy coverage) boreal forest of 15-25 cm dbh Abies balsamea and 5-15 cm dbh Sorbus decora with Oplopanax horridus (OPL), Dryopteris expansa (DRE), red raspberry (Rubus idaeus), red elder (Sambucus racemosa), and Canada yew (Taxus canadensis) dominant in the understory; squashberry (Viburnum edule) present; and very few understory herbs. Also LUZ (Luzula parviflora) along trail (see demographic data after devils club data).

Demographic data: This (and 4 of 5) devils club monitoring plots (JEJ-026, 028, 031, 032) are based on a 30 m transect from the metal stake in the direction of the densest concentration of stems. From this 30 m baseline, counts were made of numbers of stems in each of six 5 x 5 m compartments on each side of the center line, proceeding clockwise from the stake. Thus subcompartments 1-6 proceed on the left side of the transect line towards the end of transect; 7-12 proceed back to the stake on the right side of the transect. This results in a total of 12 (twelve) 5 x 5 m compartments with a total area of 300 sq. m (0.03 ha). Numbers of stems were counted, because devils club reproduces in IRNP chiefly by decumbent and rooting stems (vegetatively) and it was difficult to discern individual plants. Presumably, many populations of devils club in the Park are genetically identical clones, because of the predominance of this vegetative mode of reproduction.

Bearing (azimuth) of 30 m transect from stake: 225 degrees (SW).

Four clumps (ranging from 25-40 (-50) cm tall) of small-flowered woodrush (Luzula parviflora) are found in the area of the trail nearest the stake. From the S end of the boardwalk, proceed S on the trail towards the Lighthouse to the following colonies:

| Distance from boardwalk (m) | Bearing | No. flowering stems |
|---|---|---|
| 22 | | [flat, steplike rock noted |
| 23 | | above] |
| 24.5 | Right side of trail | 42 |
| 25.0 | Left side of trail | 6 |
| 25.0 | 1 m off right side of trail | 22 |
| 25.8-26.2 | Right side of trail | 47 |
| Total | | 117 |

Future monitoring protocol: It is recommended that all devils club plots should be surveyed in the manner described above every 3 to 5 years.

**1998 MONITORING**

Date resurveyed: 22 August 1998.

DRE = Dryopteris expansa; OPL = Oplopanax horridus; VIB = Viburnum edule; A = Adult plants (at least 1 m tall); J = Juvenile plants.

| Subcompartment number | Number of stems of: DRE | OPL | VIB |
|---|---|---|---|
| 1 | 15 | 8 A, 16 J | 0 |
| 2 | 16 | 11 A, 10 J | 1 A, 3 J |
| 3 | 12 | 20 A, 14 J | 0 |
| 4 | 8 | 22 A, 9 J | 0 |
| 5 | 7 | 30 A, 10 J | 0 |
| 6 | 12 | 17 A, 5 J | 0 |
| 7 | 19 | 24 A, 7 J | 0 |
| 8 | 20 | 14 A, 13 J | 0 |
| 9 | 17 | 17 A, 12 J | 0 |
| 10 | 6 | 8 A, 6 J | 7 A, 3 J |
| 11 | 12 | 7 A, 7 J | 11 A, 2 J |
| 12 | 14 | 6 A, 19 J | 0 |
| (Totals for 1994: | 152 | 447 A, 44 J (1.64/sq. m) | 6 A) |
| Totals: | 158 (0.53/sq. m) | 184 A, 138 J (1.07/sq. m) | 19 A, 8 J |
| Change, 1994-1998 | +4% | -59%/+214% | +450% |

Comments on changes from 1994-1998: The understroy fern DRE remained stable; the undersrory shrub VIB greatly increased, while number of adult plants of OPL decreased significantly, while junvenile somewhat increased. LUZ was not relocated along the trail, perhaps reflecting the lateness of the survey.

Vascular Plant Permanent Monitoring Plot Number: JEJ-032-001.

Location/informal name of plot: Passage Island Boat House Forest.

Legal description/Exact directions to plot: T67N-R32W, Sec. 4, SE of SW of NE. From Passage Island Boat House, proceed 55 m by Trail E to pit toilet. Metal stake is 30 m away at a bearing of 285 degrees from the pit toilet. (See map for JEJ-030, Passage Island Boat House Marsh).

UTM coordinates (by GPS reading): 399245.707, 5342677.566.

Date surveyed: 22 June 1994.

Narrative description of site: Mature even-aged 15-40 cm dbh Abies balsamea forest with mostly open understory that does include devils club (Oplopanax horridus, OPL), sqaushberry (Viburnum edule, VIB), and spreading woodfern (Dryopteris expansa, DRE). Numerous herb species grow near the trail including the rare Carex atratiformis (CXA), eastern paintbrush (Castilleja septentrionalis, CAS), small-flowered woodrush (Luzula parviflora, LUZ), and alpine bistort (Polygonum viviparum, POL). Other herbs present include Clintonia borealis, Maianthemum canadense, Mitella nuda, Moneses uniflora, Cinna latifolia, and Platanthera obtusata. Skunk currant (Ribes glandulosum) is occasional, and Canada yew (Taxus canadensis) covers about 10% of the plot.

Demographic data: This (and 4 of 5) devils club monitoring plots (JEJ-026, 028, 031, 032) are based on a 30 m transect from the metal stake in the direction of the densest concentration of stems. From this 30 m baseline, counts were made of numbers of stems in each of six 5 x 5 m compartments on each side of the center line, proceeding clockwise from the stake. Thus subcompartments 1-6 proceed on the left side of the transect line towards the end of transect; 7-12 proceed back to the stake on the right side of the transect. This results in a total of 12 (twelve) 5 x 5 m compartments with a total area of 300 sq. m (0.03 ha). Numbers of stems were counted, because devils club reproduces in IRNP chiefly by decumbent and rooting stems (vegetatively) and it was difficult to discern individual plants. Presumably, many populations of devils club in the Park are genetically identical clones, because of the predominance of this vegetative mode of reproduction.

Bearing (azimuth) of 30 m transect from stake: 75 degrees (to Boat Cove Pit Toilet).

DRE = Dryopteris expansa; OPL = Oplopanax horridus; VIB = Viburnum edule; A = Adult plants (at least 1 m tall); J = Juvenile plants.

| Subcompartment number | Number of stems of: DRE | OPL | VIB |
|---|---|---|---|
| 1 | 7 | 4 A, 39 J | 0 |
| 2 | 13 | 14 A, 23 J | 0 |
| 3 | 7 | 17 A, 29 J | 0 |
| 4 | 4 | 6 A, 13 J | 12 A |
| 5 | 0 | 3 A, 10 J | 14 J |
| 6 | 1 | 9 A, 5 J | 18 J |
| 7 | 1 | 0 A, 5 J | 19 J |
| 8 | 0 | 1 A, 24 J | 8 J |
| 9 | 2 | 0 A, 9 J | 5 J |
| 10 | 0 | 0 A, 25 J | 0 |
| 11 | 0 | 6 A, 5 J | 3 J |
| 12 | 1 | 0 A, 14 J | 0 |
| Totals: | 36 (0.12/sq. m) | 60 A, 201 J (0.89/sq. m) | 12 A, 67 J (0.30/sq. m) |

In summary, DRE was very vigorous in the area of the plot; OPL, vigorous, particularly in the sub-adult and juvenile size classes; and VIB, vigorous, with five flowering individuals.

Carex atratiformis (CXA): 1 clump on S side of trail in subcomp. 1.

Castilleja septemtrionalis (CAS): 7 plants on S side of trail in subcomp. 1.

Luzula parviflora (LUZ): 23 small (less than 12 cm tall) N trailside plants (12 in flower) 18-19 m from stake.

Polygonum viviparum (POL): 450 robust but sterile plants in a colony 2.5 m long and 1 m wide along the trail (mostly on its N side) 19-22 m from the stake. Associates: a dense moss mat; also twinflower (Linnaea borealis), shining clubmoss (Lycopodium lucidulum), and Clintonia borealis.

Future monitoring protocol: It is recommended that all devils club plots should be surveyed in the manner described above every 3 to 5 years.

**1998 MONITORING**

Date resurveyed: 22 August 1998.

DRE = Dryopteris expansa; OPL = Oplopanax horridus; VIB = Viburnum edule; A = Adult plants (at least 1 m tall); J = Juvenile plants.

| Subcompartment number | Number of stems of: DRE | OPL | VIB |
|---|---|---|---|
| 1 | 2 | 0 A, 1 J | 12 A, 14 J |
| 2 | 1 | 5 A, 19 J | 6 A, 5 J |
| 3 | 2 | 0 A, 18 J | 1 A, 10 J |
| 4 | 0 | 1 A, 18 J | 4 J |
| 5 | 0 | 1 A, 10 J | 1 A, 5 J |
| 6 | 0 | 1 A, 19 J | 1 J |
| 7 | 9 | 3 A, 20 J | 0 |
| 8 | 10 | 1 A, 18 J | 0 |
| 9 | 6 | 1 A, 24 J | 0 |
| 10 | 4 | 0 A, 13 J | 11 A, 5 J |
| 11 | 2 | 0 A, 3 J | 20 A, 10 J2 |
| 12 | 5 | 5 A, 2 J | 6 A, 4 J |
| Totals: | 41 (0.14/sq. m) | 18 A, 165 J (0.64/sq. m) | 57 A, 58 J |
| Change, 1994-1998 | +14% | -70%/-18% | +46% |

| | |
|---|---|
| CXA | 1994: 1 clump<br>1998: not seen, too late in year. |
| CAS | 1994: 7 plants.<br>1998: 23 plants. |
| LUZ | 1994: 23 plants.<br>1998: not seen, too late in year. |
| POL | 1994: 450 plants.<br>1998: not seen, too late in year. |

Comments on changes from 1994-1998: Among the shrubs, OPL declined significantly, while VIB significantly increased; among the herbs, CAS and DRE increased, while LUZ and POL were not relocated, perhaps because of the lateness of the 1998 survey date.

Vascular Plant Permanent Monitoring Plot Number: JEJ-033-001.

Location/informal name of plot: Passage Island NW Coast Cliffs.

Legal description/Exact directions to plot: T67N-R32W, Sec. 4, NE of SW. From Passage Island Boathouse, walk 600 m SW on Trail to Lighthouse (another 150 m walk would bring one to the boardwalk). Walk off-trail 37 m at bearing of 300 degrees through shrubby semi-open area to cliff edge on NW-facing coast. Stake is 2 m from cliff edge.

UTM coordinates (by GPS reading): 398768.576, 5342331.782.

Date surveyed: 22 June 1994.

Photos: Roll X, Frames 4 (close-up of large senescing clump of SXP), 5 (view of habitat looking NE).

Narrative description of site: Sheer NW-facing cliffs with few species other than yarrow (Achillea millefolium), ebony sedge (Carex eburnea, CXE), and the rare encrusted saxifrage (Saxifraga paniculata, SXP), all grow just below the rim. A few plants of the rare twisted whitlow-grass (Draba arabisans, DRA) and crowberry (Empetrum nigrum, EMP) also grow on this cliff edge.

The immediate cliff-top vegetation is dominated by shrubs: swamp buckthorn (Rhamnus alnifolius), green alder (Alnus viridis), creeping juniper (Juniperus horizontalis), red-osier dogwood (Cornus sericea), and seedlings of white birch (Betula papyrifera) and showy mountain-ash (Sorbus decora).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| DRA | 355 | 2.8 | 3 plants |
| EM | 15 | 5.6 | 0.03 sq. m |
| SXP | 240 | 0-8.0 | 18/700/12 |
| SXP | [more plants can be seen on inaccessible cliff faces to the SW] | | |

Future monitoring protocol: Few plants of encrusted saxifrage were fertile at this site, and many colonies appear senescent. This site should be monitored every 3-5 years.

**1998 MONITORING**

Date resurveyed: 22 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| DRA | 1994: 3 plants<br>1998: not seen. |
| EMP | 1994: 0.03 sq m<br>1998: 0.03 sq m |
| SXP | 1994: 18/700/12<br>1998: 20/523/15<br>change (%): +11/-25/+25 |

Comments on changes from 1994-1998: SXP remained more or less stable during these four years.

Vascular Plant Permanent Monitoring Plot Number: JEJ-034-001.

Location/informal name of plot: Passage Island Overlook Point.

Legal description/Exact directions to plot: T67N-R32W, Sec. 4, SE of SW. From Passage Island Boat House, walk 800 m SW on Trail to Lighthouse. Just before (ca. 10 m) boardwalk, walk 100 m WSW off-trail to prominent headland with barely-connected "islet" 4 m above the Lake covered with a stunted balsam-fir forest. The stake is in krumholtz ca. 3 m above lake level on NE side of islet.

UTM coordinates (by GPS reading): 398613.030, 5342119.923.

Date surveyed: 22 June 1994.

Photos: Roll 4?, Frames 8 (view NE from stake through ALL colony), 9 (view NW from stake through EMP patch), 10 (ALL and Primula mistassinica), and 10 (EMP and SXP together).

Narrative description of site: This is a very heterogeneous mixture of rocky shoreline habitats including small N-facing rock faces, wet crevices, and small rock pools. Besides common species such as Scirpus cespitosus, Deschampsia cespitosa, Potentilla anserina, P. fruticosa, P. tridentata, Primula mistassinica, Tofieldia glutinosa, and Campanula rotundifolia, and the rare species wild chives (Allium schoenoprasum, ALL); crowberry (Empetrum nigrum, EMP); butterwort (Pinguicula vulgaris, PIN), encrusted saxifrage (Saxifraga paniculata, SXP), and alpine bilberry (Vaccinium uliginosum, VCU).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| ALL | 50 | 8.4-13.7 | 142/22 stems E of rock |
| [both this and the following are part of a 7 x 5.3 m habitat] | | | |
| ALL | 50 | | 32/8 stems W of rock |
| EMP | 330 | 0.7-3.7 | 12 sq. m (4 x 3) |
| PIN | 50 | 8.4-13.7 | 55/32 |
| [The following azimuths and distances are given from a "hinge point" 5.5 m and at an azimuth of 310 degrees from the stake] | | | |
| ALL | 235 | 8-14 | 95/27, vigorous |
| | [then 1-2 m at 315 degrees] | | |
| EMP | 235 | 5-15 | at least 5 sq. m |
| SXP | 235 | 4-15 | 16/2000/35, vigorous |
| VCU | 235 | 10-15 | 0.05 sq. m |

Future monitoring protocol: This site should be monitored every 3-5 years.

**1998 MONITORING**

Date resurveyed: 22 August 1998.

| Species and subpopulation number (% coverage; or genets/ramets/flowering and/or fruiting stems) | Demographic data |
|---|---|
| ALL | 1994: 269/57<br>1998: 276/99 |

| | |
|---|---|
| EMP | 1994: 17 sq. m<br>1998: 14 sq. m (10% dead, another 15% stressed) |
| PAR | 1994: not seen.<br>1998: 4 flowering, 26 in fruit. |
| SAG | 1994: not seen.<br>1998: rare, a few plants. |
| SXP | 1994: 16/2000/35<br>1998: 16/ 450/23 |
| SXT | 1994: not seen.<br>1998: 4/460/113 14 m from stake at 260 degrees. |
| VCU | 1994: 0.05 sq m<br>1998: 0.05 sq m |

Comments on changes from 1994-1998: ALL, VCU, and EMP remained about stable, although mats of EMP certainly appeared to be more drought-stressed in 1998 than they were four years earlier. The appearance of four significany clumps of SXT here is puzzling - it is possible that they were overlooked in 1994. SXP definitely declined in vigor in the last four years.

Vascular Plant Permanent Monitoring Plot Number: JEJ-035-001.

Location/informal name of plot: Passage Island Anglica Pool.

Legal description/Exact directions to plot: T67N-R32W, Sec. 4, SE of SW. From Passage Island Lighthouse, walk 100 m NE to three pylons marking base of old radio tower, then walk 60 m ENE to large (40 m long) rock pool (this is the largest rock pool on Passage Island). The stake is in an ericad swamp 5.7 m from the pool at a bearing of 300 degrees; 126 m straight line from S door of lighthouse.

UTM coordinates (by GPS reading): 398662.187, 5341907.447.

Date surveyed: 23 June 1994.

Narrative description of site: Large ice-scoured rock pool 125 m NE of lighthouse, with abundant English sundew (Drosera anglica, DRO), Scirpus cespitosus, Potentilla fruticosa, P. tridentata, Alnus viridis, Empetrum nigrum (EMP), Tofieldia pusilla (TOP), numerous ericads (Andromeda, Chamaedaphne, Kalmia, Ledum, Vaccinium oxycoccos, V. uliginosum, VCU), sedges (Carex gynocrates (CXG); C. castanea, C. limosa, C. deflexa), Tofieldia glutinosa (TOG), Menyanthes trifoliata, Solidago uliginosa, Myrica gale, Pinguicula vulgaris (PIN), fir clubmoss (Lycopodium selago, LYS), and the rare grass Muhlenbergia uniflora (MUH).

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| CXG | 100-120 | 5.7-6.2 | Several plants along 3 m of shore |
| DRO | 70-175 | 10.7-28 | Ca. 600-800 plants in a zone 0.1-0.4 m wide along NW edge of pool. |
| EMP | 200 | 13 | 0.01 sq. m |
| LYS | 200 | 13 | 9 clumps, 36 stems |
| MUH | 100-120 | 5.7-6.2 | Several plants along 3 m of shore |
| PIN | 100-120 | 5.7-6.2 | 60 plants |
| PIN | 210 | 14.5 | 30 flowering |
| TOP | 100-120 | 5.7-6.2 | Several plants along 3 m of shore |
| VCU | 70-100 | ca. 20 | Total 1 sq. m |

Future monitoring protocol: This site should be monitored every 3-5 years.

**1998 MONITORING**

Date resurveyed: 22 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| CXG | 1994: several plants.<br>1998: not seen, perhaps past |

| | |
|---|---|
| | flower. |
| DRO | 1994: 600-800 plants.<br>1998: 350 plants (72 in fruit). |
| EMP | 1994: 0.01 sq m<br>1998: not seen. |
| LYS | 1994: 9 clumps, 36 stems<br>1998: 6 clumps, 65 stems |
| MUH | 1994: several plants.<br>1998: 75 plants in fruit. |
| PIN | 1994: 60 plants (30 in flower).<br>1998: 10 plants. |
| TOP | 1994: several plants.<br>1998: 7 plants. |
| VCU | 1994: 1 sq. m<br>1998: 1 sq. m |

Comments on changes from 1994-1998: DRO decreased by more than half from 1995-1998. Pin declined significantly during this period.

Vascular Plant Permanent Monitoring Plot Number: JEJ-036-001 (see additional waypoint below).

Location/informal name of plot: Passage Island Lighthouse Old Radio Tower Pylons.

Legal description/Exact directions to plot: T67N-R32W, Sec. 4, SE of SW. From Passage Island Lighthouse, walk 75 m NNE to three pylons marking base of old radio tower. There is no stake; reference point is the SE corner of the southernmost of the 1 x 1 x 1.5 m tall pylon bases.

UTM coordinates (by GPS reading): 001: 398599.638, 5341900.507.

Additional waypoint (GPS reading): JEJ-036-002: Heliport, center cross. UTM = 398588.486, 5341860.344.

Date surveyed: 23 June 1994.

Narrative description of site: Bare, dry, rocky, weedy ground around old radio tower pylons; few associates save Canada bluegrass (Poa compressa) and a few Trisetum spicatum.

| Species | Azimuth | Distance | Demographic data |
|---|---|---|---|
| SXT | 45 | 2.2 | 3/112/69 |
| | (Then 0.9 m at 135 degrees) | | |
| SXT | 45 | 3.2 | 4/218/39 |
| | (Then 0.4 m at 135 degrees) | | |
| Total | | | 7/330/108 |

Future monitoring protocol: This prickly saxifrage plot should be monitored every 3-5 years.

**1998 MONITORING**

Date resurveyed: 22 August 1998.

| Species and subpopulation number | Demographic data |
|---|---|
| SXT | 1993: 7/330/108<br>1998: 6/264/ 24<br>change (%): -14/-20/-82 |

Comments on changes from 1994-1998: SXT declined slightly during these four years.

Vascular Plant Permanent Monitoring Plot Number: JEJ-037-001.

Location/informal name of plot: Passage Island Lighthouse.

Legal description/Exact directions to plot: T67N-R32W, Sec. 9, NW of NE of NW. South (main door) of Passage Island Lighthouse; site is not marked by a stake.

UTM coordinates (by GPS reading): 001 (South door of Lighthouse): 398568.623, 5341823.448.

Date surveyed: 23 June 1994.

Narrative description of site:

1) JEJ-037-001. There were 275 plants of Draba arabisans in the immediate vicinity of Lighthouse (within 5 m of the house):

2) JEJ-037-002. Moonwort (Botrychium species) genus community in dry grassy soil on both sides of the sidewalk from the tramway turntable to the fog building (a distance of 26.5 m), especially on the E side of sidewalk in crevices in rocks. Associates of this community: bluejoint (Calamagrostis canadensis), Canada bluegrass (Poa compressa), downy oat-grass (Trisetum spicatum), three-toothed cinquefoil (Potentilla tridentata), beach pea (Lathyrus maritimus), yarrow (Achillea millefolium), blue-eyed grass (Sisyrinchium sp.), field strawberry (Fragaria virginiana), red raspberry (Rubus idaeus), timothy (Phleum pratense), dandelion (Taraxacum officinale), and caraway (Carum carvi). Present here are at least three species of Botrychium: common moonwort (B. lunaria, BOL), mingan moonwort (B. minganense, BOM), and least moonwort (B. simplex, BOX), and possibly (according to Don and Joyce Drife), B. spathulatum, BOS.

Photos: Frames 15 (looking S to foghouse) and 16 (large plant of BOL with pen for scale).

BOL: 1) 83 plants in a 6 x 1 m area along E side of sidewalk from turntable S of turntable.

2) 51 plants in 3 x 2 area on E side of sidewalk 10 m S of turntable.

BOM, BOS, and BOX (not distinguished): 3) 18 plants in 2 x 0.6 m area on E side of sidewalk 13 m S of turntable.

4) 4 plants in 1 sq. m area on E side of sidewalk 16 m S of turntable.

5) 25 plants in 3 sq. m area on W side of sidewalk from 0-7 m S of turntable.

Future monitoring protocol: This plot should be monitored every three to five years.

**1998 MONITORING**

Date resurveyed: 22 August 1998.

| Species and subpopulation number | Demographic data | |
|---|---|---|
| | 1994 | 1998 |
| DRA - S side | 67 | 11 |
| - SW side | 174 | 52 |
| - W side | 30 | 87 |
| - N side | 0 | 31 |
| - E side | 4 | 23 |
| total | 275 | 204 |
| | change = -26% | |

Comments on changes from 1994-1998: DRA declined slightly in these four years.

[note: due to misnumbering there is no plot JEJ-038]

Vascular Plant Permanent Monitoring Plot Number: JEJ-039-001.

Location/informal name of plot: Todd Harbor Fairybells Site.

Legal description/Exact directions to plot: T65N-R36W, Sec. 1, SE of SE (Todd Harbor 7.5' topo). From Todd Harbor Campground, walk 1 km ENE on old Minong Ridge Trail towards McCargoe Cove. There is no stake; plants of Prosartes (Disporum) trachycarpa are several m to the left of the old trail, ca. 50-70 m from the large eagle nest white pine.

UTM coordinates (by GPS reading): 365124.119, 5323603.509.

Date surveyed: 20 September 1994.

Narrative description of site: Walk 800-900 meters east of the point where the Minong Ridge Trail arrives at the water's edge at Todd Harbor Campground. The plants are 3-4 meters north of (on the uphill side of) the old trail (48 03' N, 88 49' W; T65N-R36W, Sec. 1, NW of SE of SE; elevation about 740 feet), near the ridge summit. Three plants were observed, two in abundant fruit (Judziewicz 11102, MICH), on 29 August 1994, on a gentle, 20 degree southeast-facing slope under an old, open stand of 30-45 cm diameter quaking aspen (Populus tremuloides), with scattered white spruce and a few balsam-fir saplings. Dominant understory associates were big-leaved aster and wild sarsaparilla, with a few small individuals of thimbleberry (Rubus parviflorus) and round-leaved dogwood (Cornus rugosa). The fruits had fallen by the time of a visit on 20 September 1994.

Future monitoring protocol: This site should be monitored every 3-5 years.

**1998 MONITORING**

Not resurveyed in 1998.

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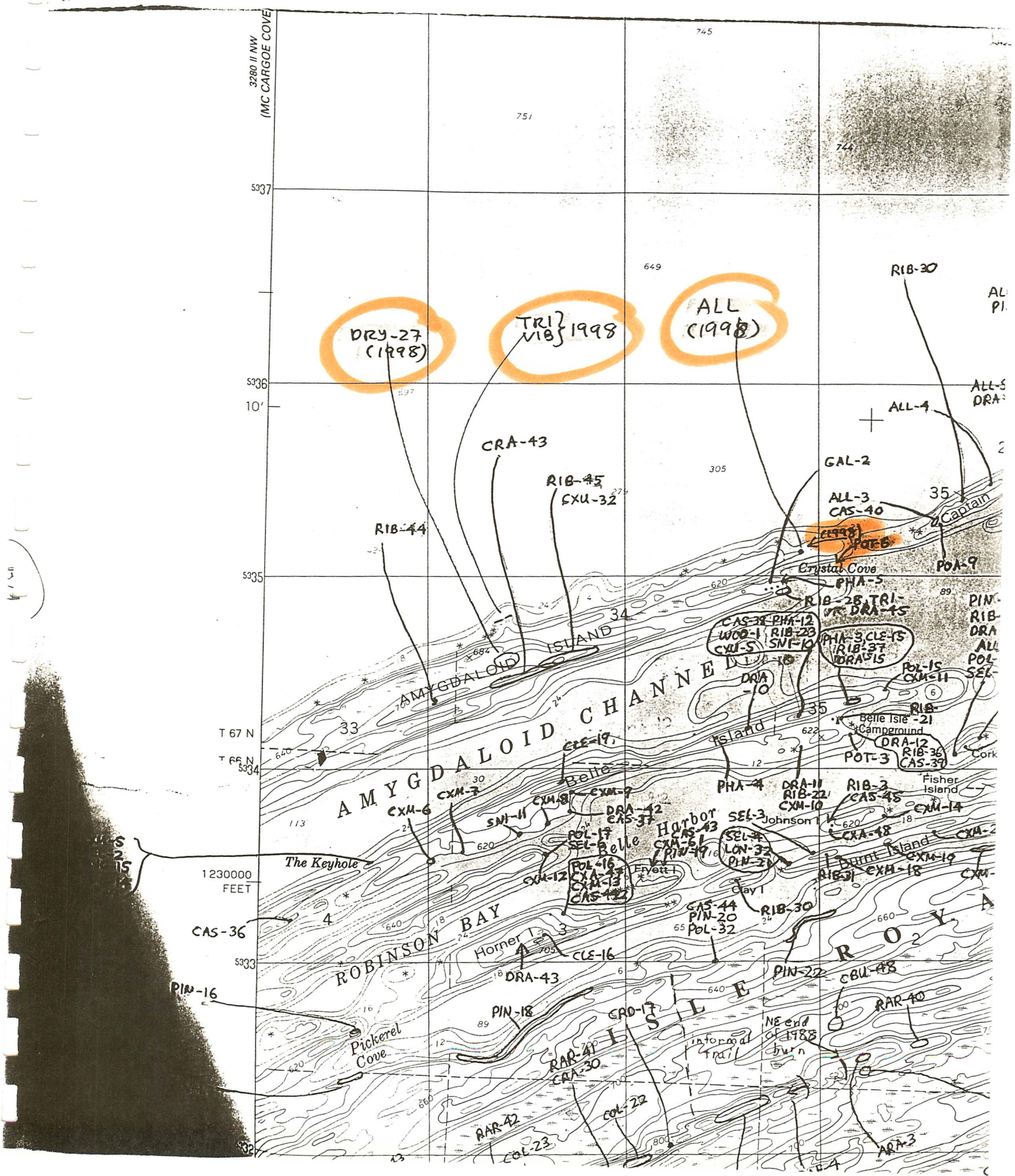
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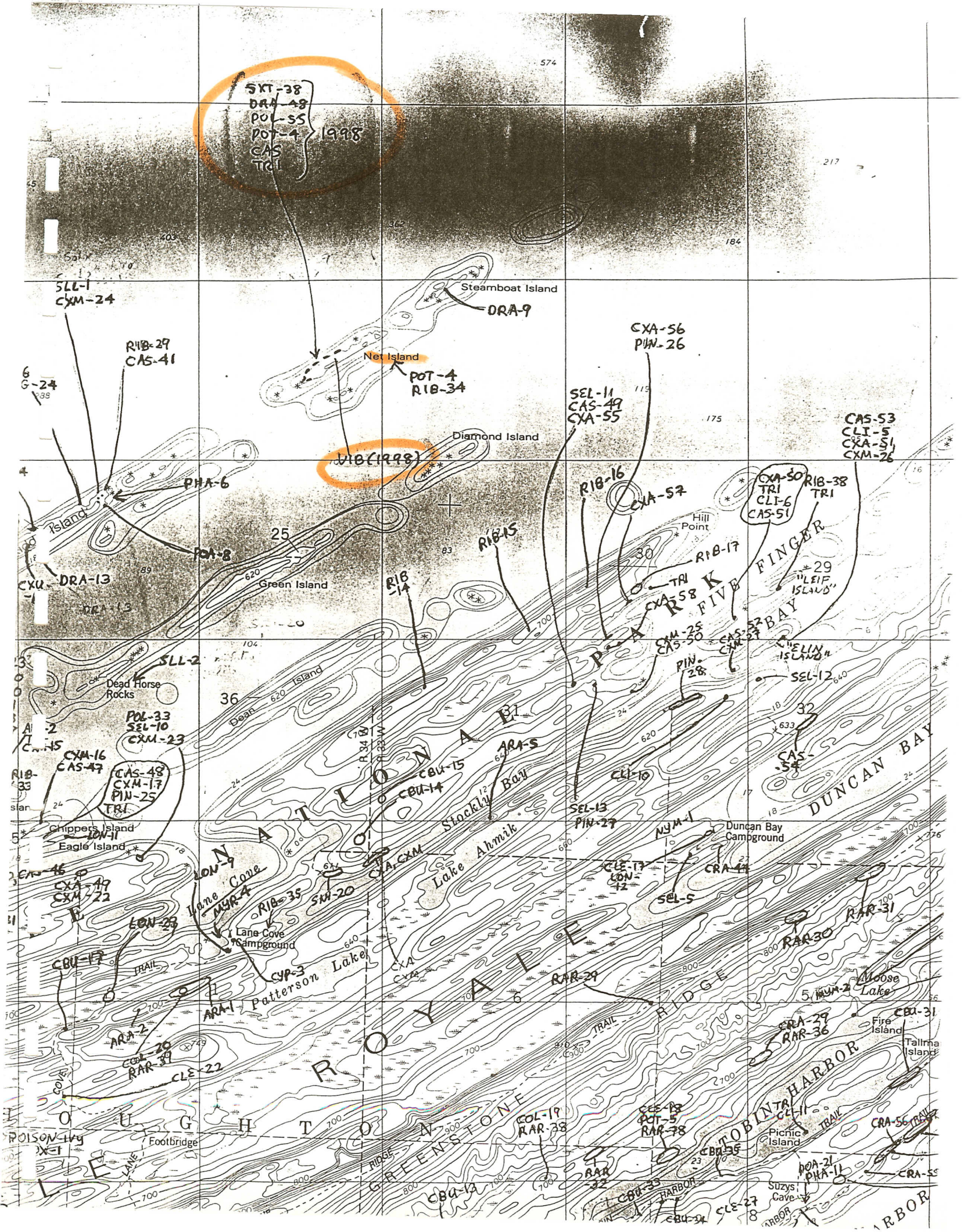
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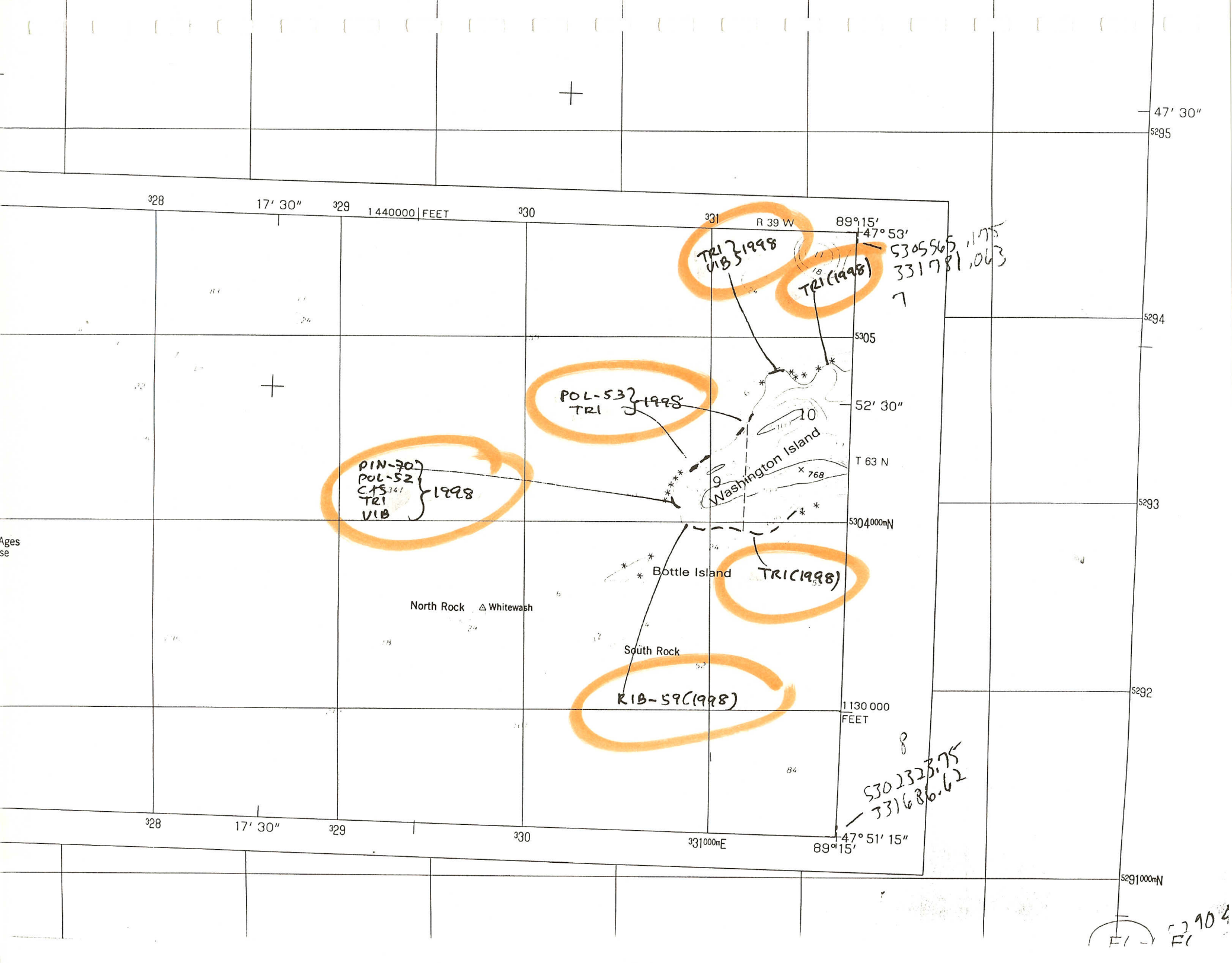
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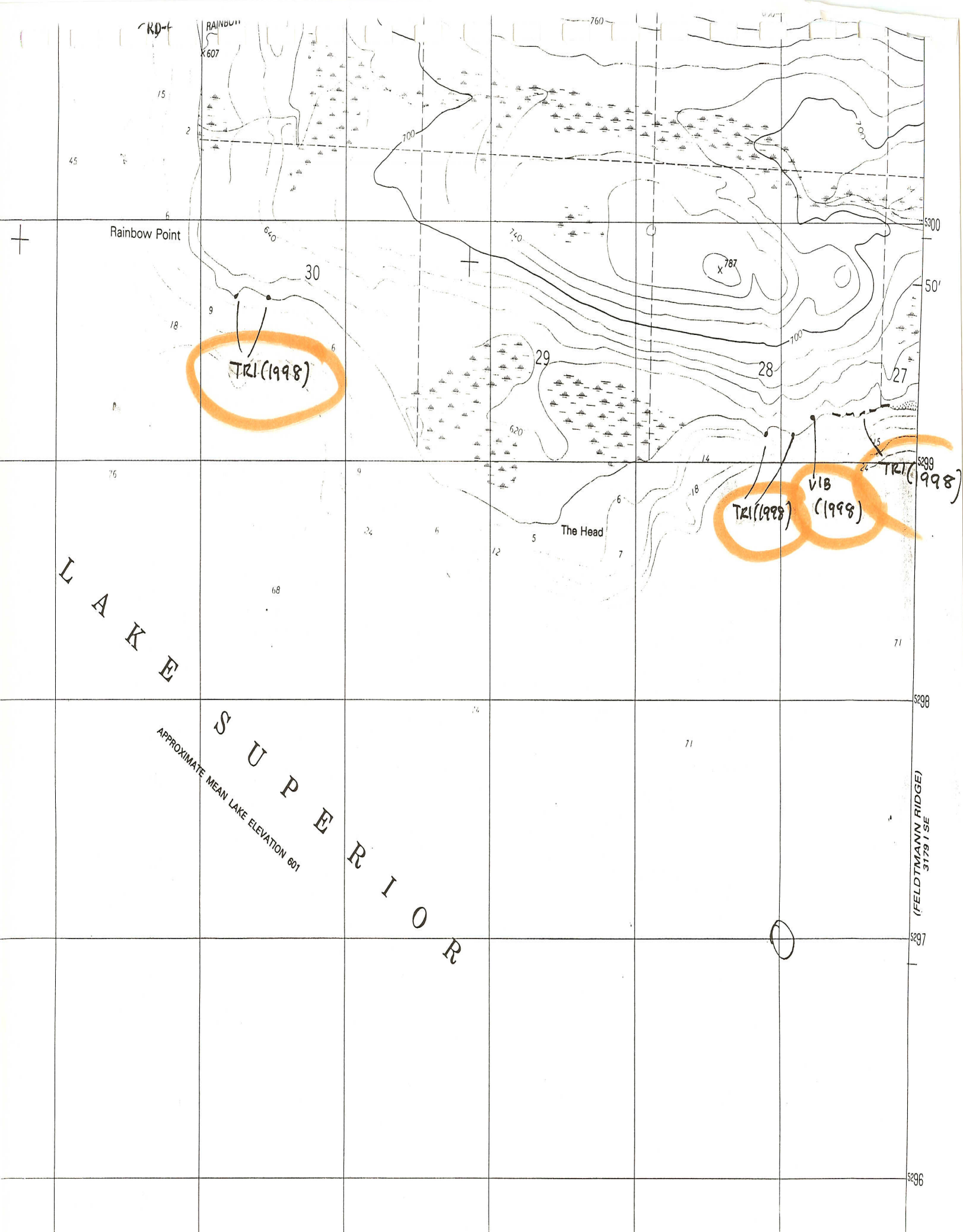
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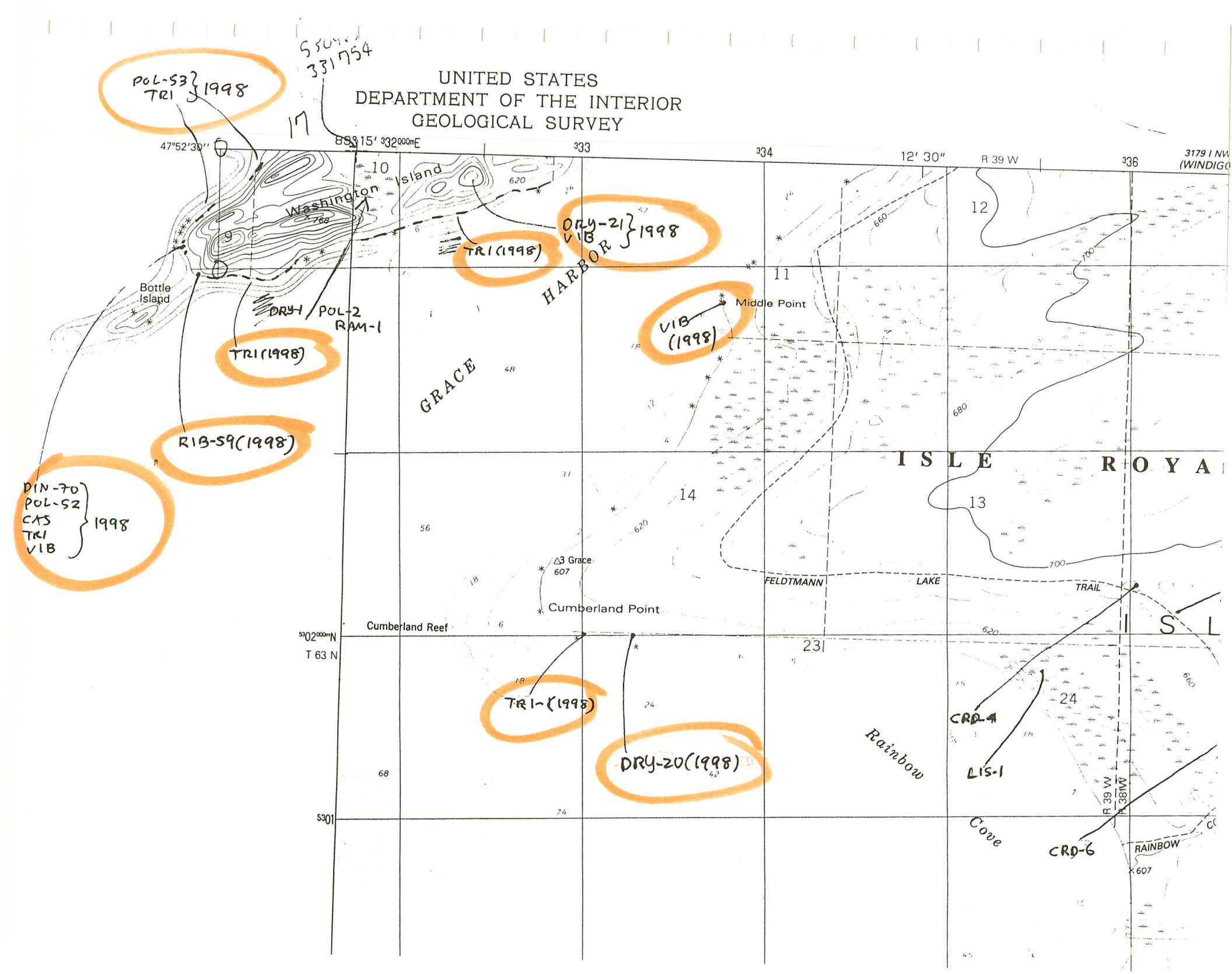
Viburnum edule (VIB)
Woodsia alpina (WOO)

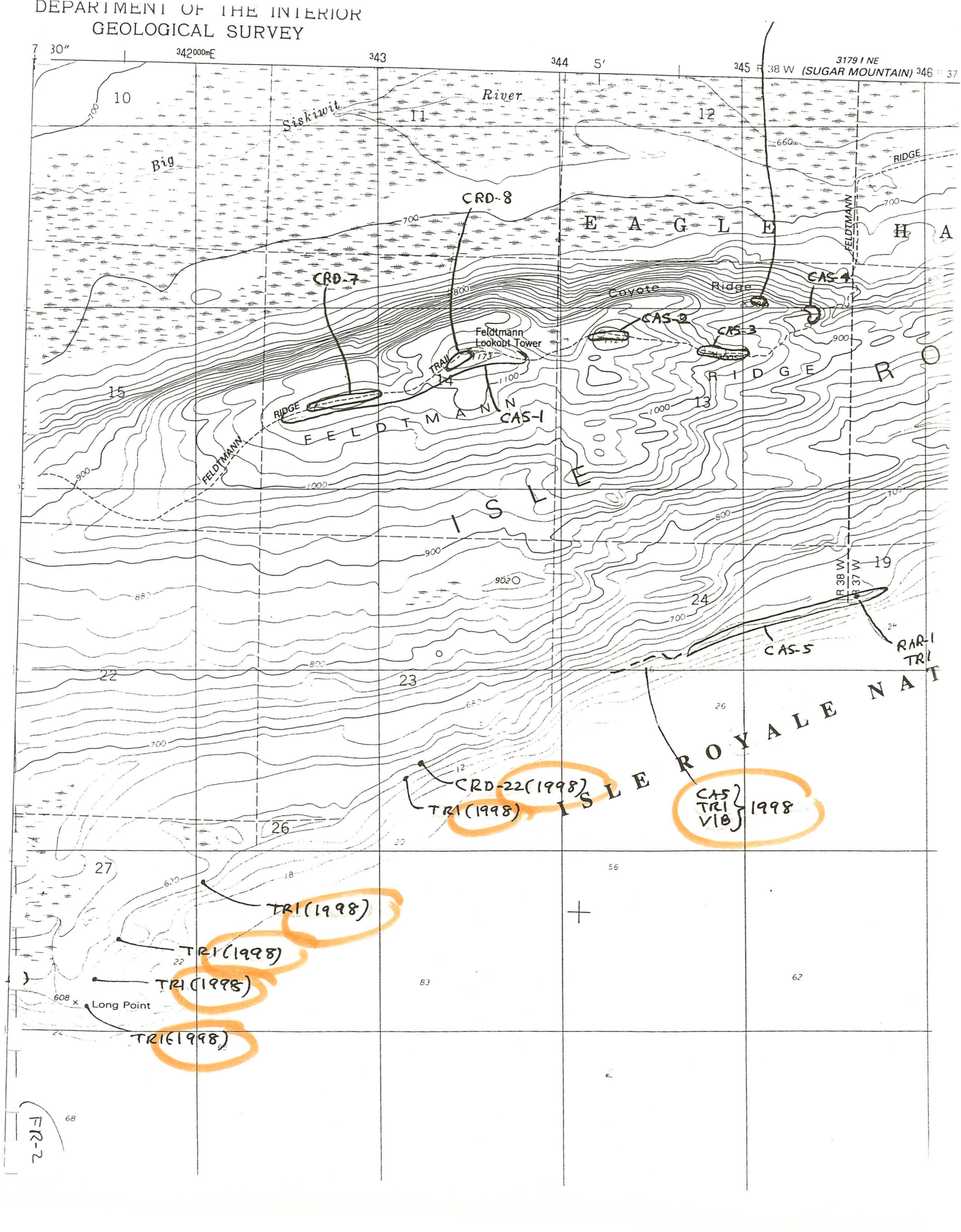



SXT-38
DRA-48
POL-55
POT-4
CAS
TRI
1998
SLL-1
CXM-24
RIB-29
CAS-41
Steamboat Island
DRA-9
Net Island
POT-4
RIB-34
CXA-56
PIN-26
SEL-11
CAS-49
CXA-55
CAS-53
CLI-5
CXA-51
CXM-26
Diamond Island
RIB(1998)
PHA-6
Island
POA-8
DRA-13
Green Island
RIB-16
CXA-57
CXA-50
TRI
CLI-6
CAS-51
RIB-38
TRI
Hill Point
RIB-17
TRI
CXA-58
RIB-15
RIB-14
SLL-2
Dead Horse Rocks
Dean Island
POL-33
SEL-10
CXM-23
CXM-16
CAS-47
CAS-48
CXM-17
PIN-25
TRI
Chippers Island
LON-11
Eagle Island
CXA-49
CXM-22
LON-9
Lane Cove
NYM-4
RIB-35
SXM-20
Lane Cove Campground
CYP-3
Patterson Lake
ARA-1
ARA-2
CBU-17
LON-23
COL-20
RAR-37
CLE-22
CBU-15
CBU-14
Stuckly Bay
ARA-5
Lake Ahmik
CXA, CXM
CLE-13
PIN-27
CLI-10
SEL-12
CAS-54
PIN-28
CXM-25
CAS-50
CAS-52
CXM-27
"ELIN ISLAND"
"LEIF ISLAND"
FIVE FINGER BAY
DUNCAN BAY
Duncan Bay Campground
NYM-1
CLE-17
LON-12
SEL-5
CRA-44
RAR-30
RAR-31
RAR-29
Moose Lake
NYM-2
CRA-39
RAR-36
Fire Island
CBU-31
Tallma Island
TOBIN HARBOR
CLI-11
Picnic Island
TRAIL
CRA-56
CRA-55
POA-21
PHA-11
Suzys Cave
COL-19
RAR-38
CLE-28
POT-5
RAR-28
CBU-35
RAR-32
CBU-33
CBU-34
CLE-27
CBU-13
HARBOR
ANATOLIA
ROYAL
GREENSTONE RIDGE
LOUGHTON LAKE
Footbridge
POISON IVY
LANE
RIDGE
TRAIL
COVE


47' 30"
5295
328
17' 30"
329
1 440000 FEET
330
331
R 39 W
89°15'
47° 53'
5305565.175
331781.063
TRI VIB 1998
TRI (1998)
5294
5305
POL-53 TRI 1998
52' 30"
10
Washington Island
T 63 N
PIN-70 POL-52 CTS TRI VIB 1998
9
768
5293
5304 000mN
Bottle Island
TRI (1998)
North Rock
Whitewash
South Rock
RIB-59 (1998)
1 130 000 FEET
5292
8
5302328.75
331686.62
328
17' 30"
329
330
331 000mE
89°15'
47° 51' 15"
5291 000mN
Ages
se

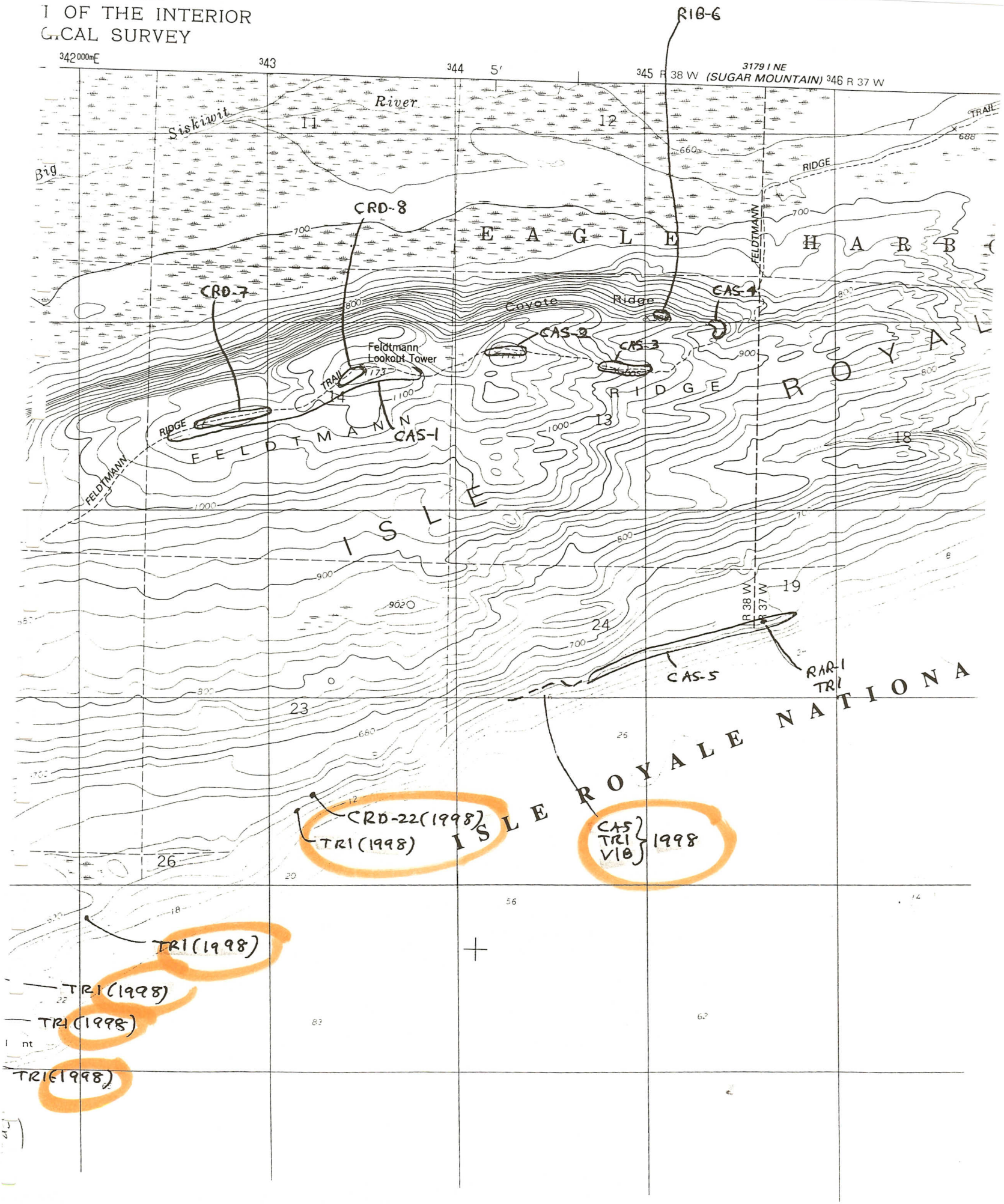

RD-1
RAINBOW
X 607
760
700
Rainbow Point
640
30
TRI (1998)
750
X 787
29
28
27
620
TRI (1998)
VIB (1998)
TRI (1998)
The Head
LAKE SUPERIOR
APPROXIMATE MEAN LAKE ELEVATION 601
(FELDTMANN RIDGE)
3179 I SE
5300
50'
5299
5298
5297
5296

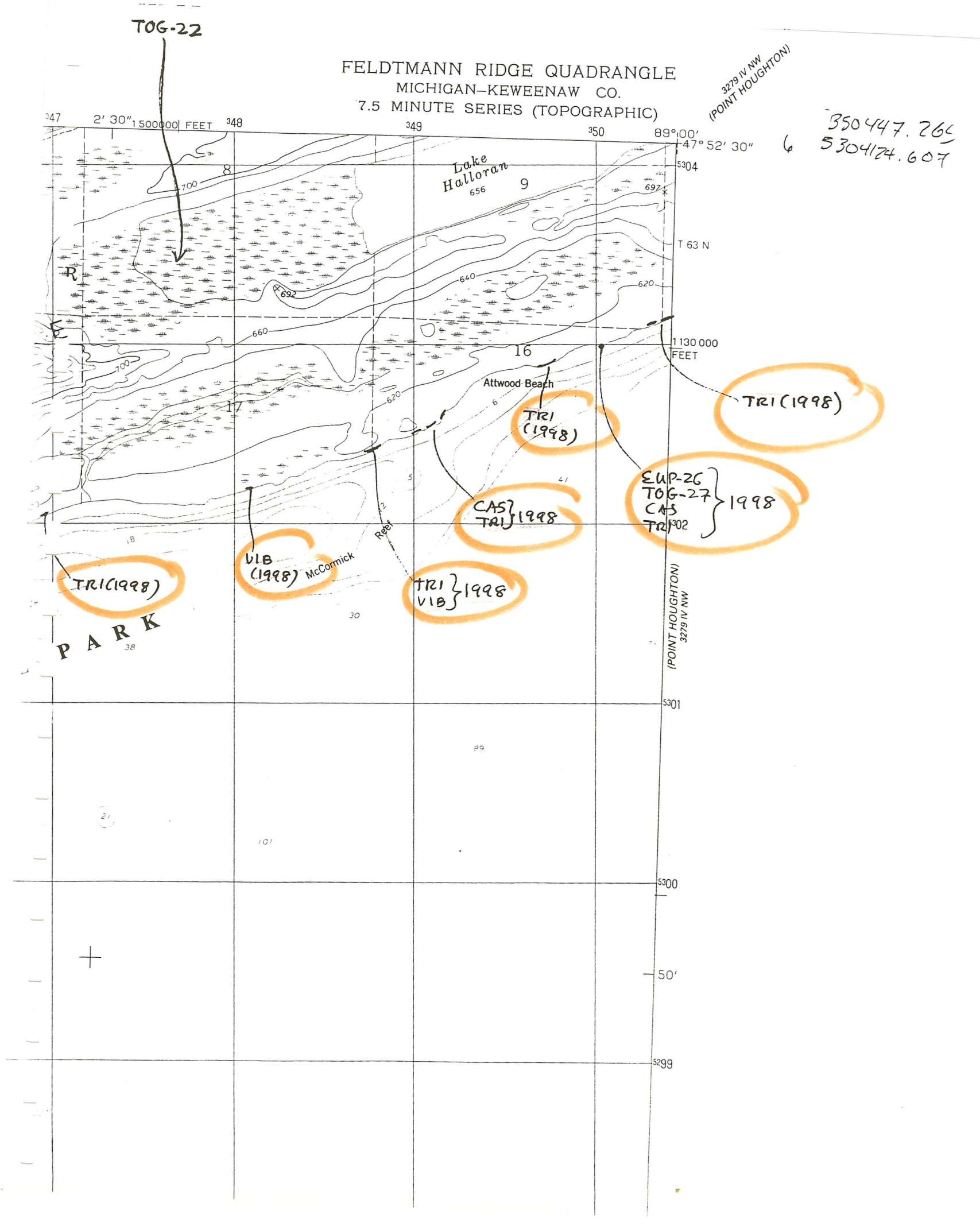

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
POL-53
TRI
1998
331754
17
88°15'
332000mE
333
334
12' 30"
R 39 W
336
47°52'30"
10
Washington Island
620
9
Bottle Island
DRY-21
VIB
1998
TRI (1998)
HARBOR
DRY-1
POL-2
RAM-1
TRI (1998)
11
Middle Point
VIB
(1998)
12
660
700
GRACE
48
680
RIB-59 (1998)
ISLE ROYA
DIN-70
POL-52
CAS
TRI
VIB
1998
14
13
56
620
Δ3 Grace
607
FELDTMANN
LAKE
TRAIL
Cumberland Point
Cumberland Reef
5302000mN
T 63 N
23
620
TRI-1 (1998)
DRY-20 (1998)
24
CRD-4
Rainbow
LIS-1
68
74
R 39 W
R 38 W
Cove
CRD-6
RAINBOW
607

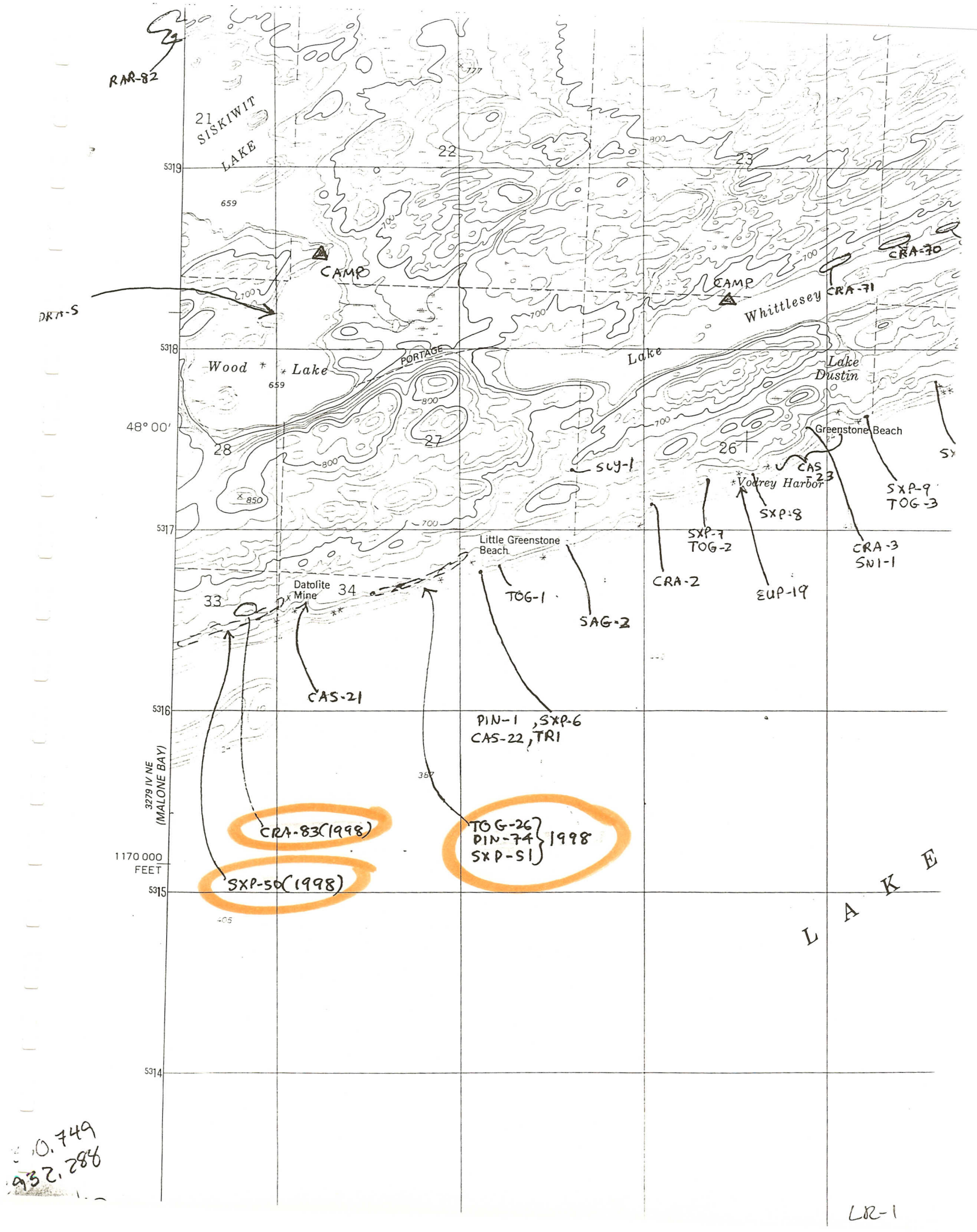

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
342000mE
343
344
345
346
3179 I NE
(SUGAR MOUNTAIN)
38 W
River
Siskiwit
Big
CRD-8
CRD-7
CAS-4
CAS-2
CAS-3
CAS-1
CAS-5
RAR-1
TRI
Feldtmann
Lookout Tower
TRAIL
RIDGE
FELDTMANN
Coyote
Ridge
EAGLE
RIDGE
ISLE
ROYALE
NAT
CRD-22(1998)
TRI(1998)
CAS
TRI
VIB
1998
TRI(1998)
TRI(1998)
TRI(1998)
Long Point
608
FIR-2


FELDTMANN RIDGE QUADRANGLE
MICHIGAN–KEWEENAW CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
3279 IV NW
(POINT HOUGHTON)
347
2' 30"
1500000 FEET
348
349
350
89°00'
47° 52' 30"
TRAIL
688
700
8
Lake
Halloran
656
9
697
5304
T 63 N
692
640
620
660
16
1130000
FEET
Attwood Beach
TRI (1998)
TRI (199
EUP-26
TOG-27
CAS
TRI
1998
CAS
TRI
1998
VIB
(1998)
McCormick
TRI (1998)
TRI
VIB
1998
Reef
5302
(POINT HOUGHTON)
3279 IV NW
5301
5300
50'
5299
5298
B O R
Y A L E
I J N A L P A R K

TED STATES
I OF THE INTERIOR
GICAL SURVEY

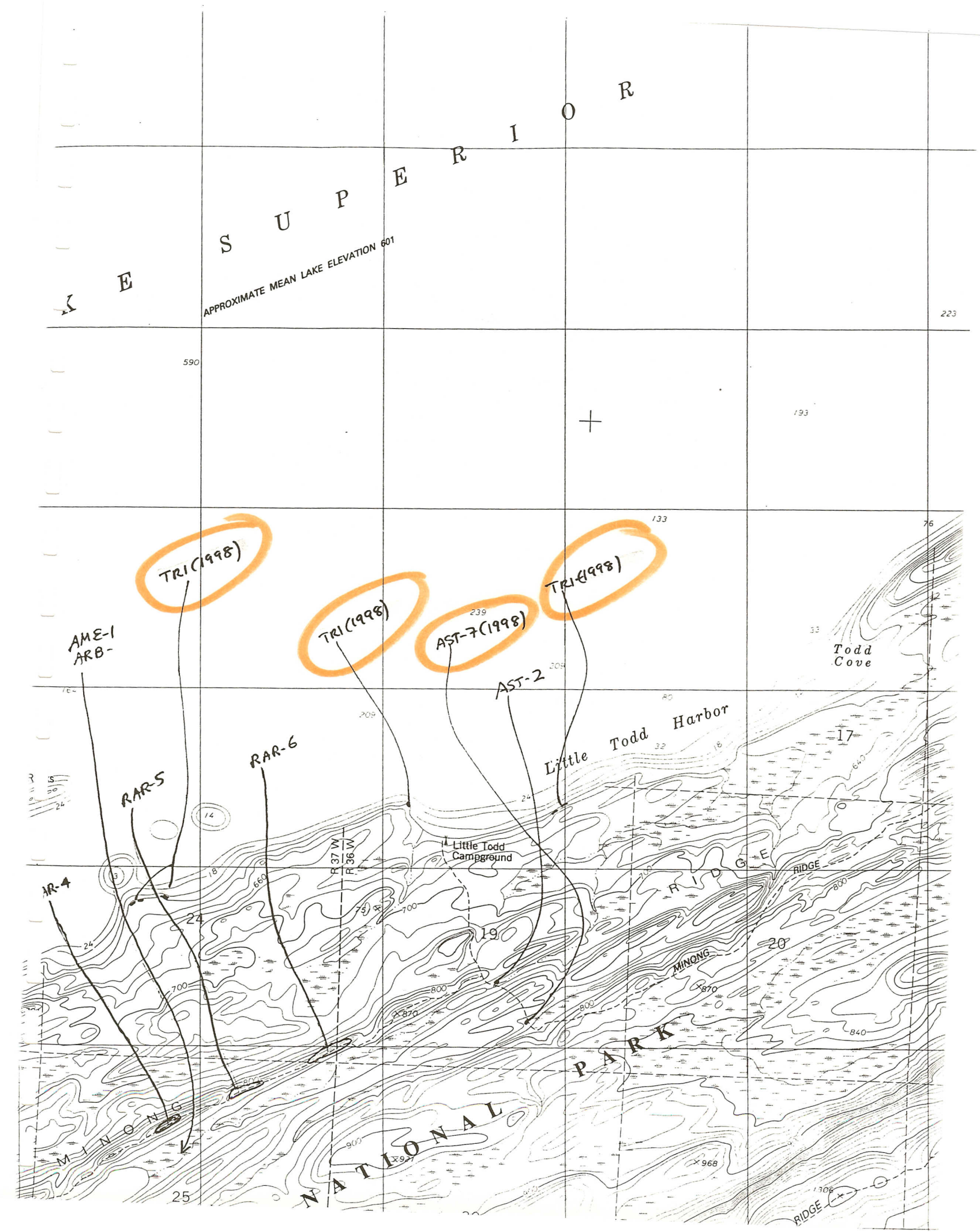



TOG-22
FELDTMANN RIDGE QUADRANGLE
MICHIGAN–KEWEENAW CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
3279 IV NW (POINT HOUGHTON)
350447.766
5304124.607
6
347
2' 30"
1500000 FEET
348
349
350
89°00'
47° 52' 30"
5304
Lake Halloran
656
8
9
16
17
T 63 N
1130000 FEET
Attwood Beach
TRI (1998)
TRI (1998)
EUP-26
TOG-27
CAS
TRI
1998
CAS
TRI
1998
VIB (1998) McCormick
TRI
VIB
1998
TRI (1998)
Ref
PARK
(POINT HOUGHTON) 3279 IV NW
5302
5301
5300
50'
5299

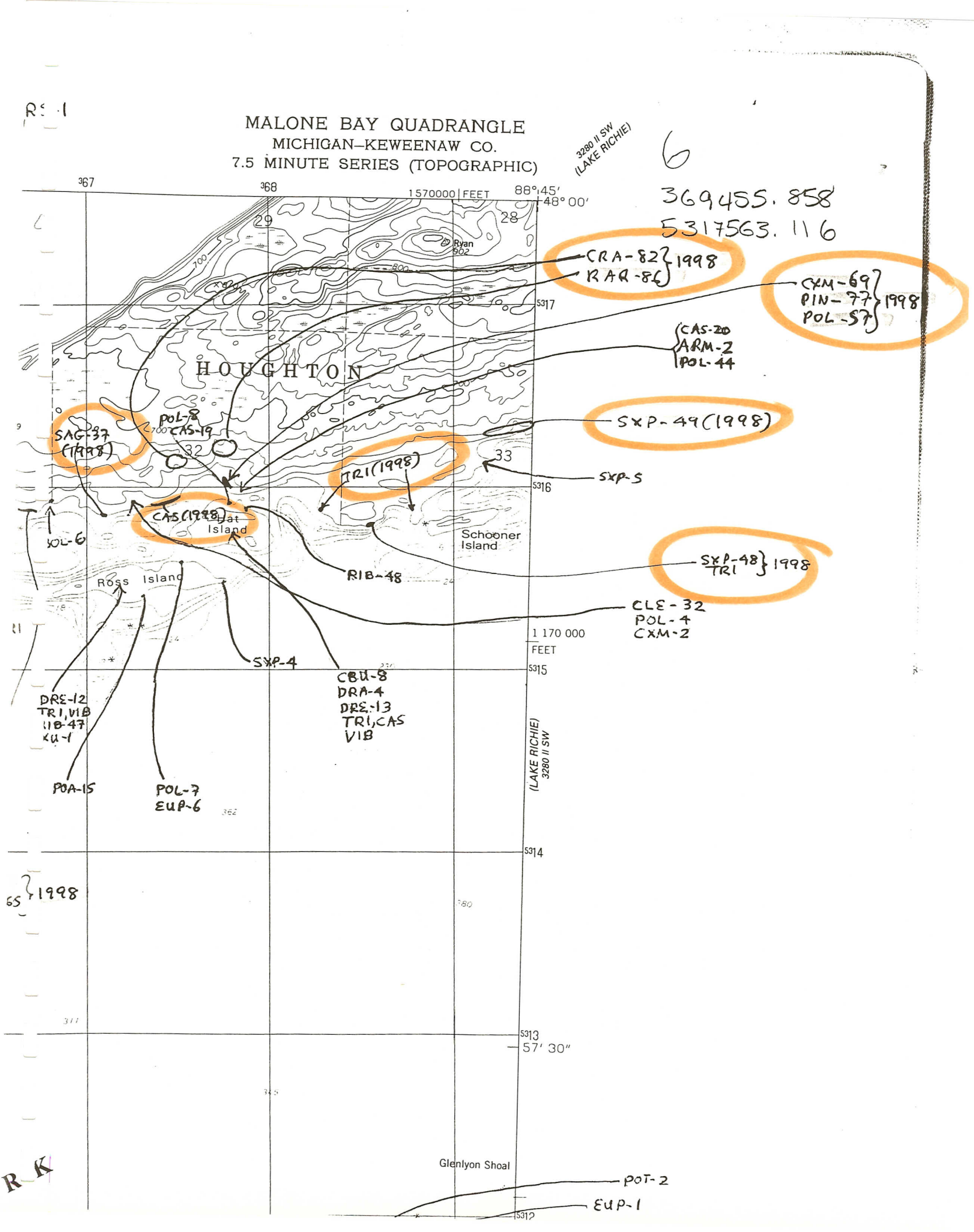


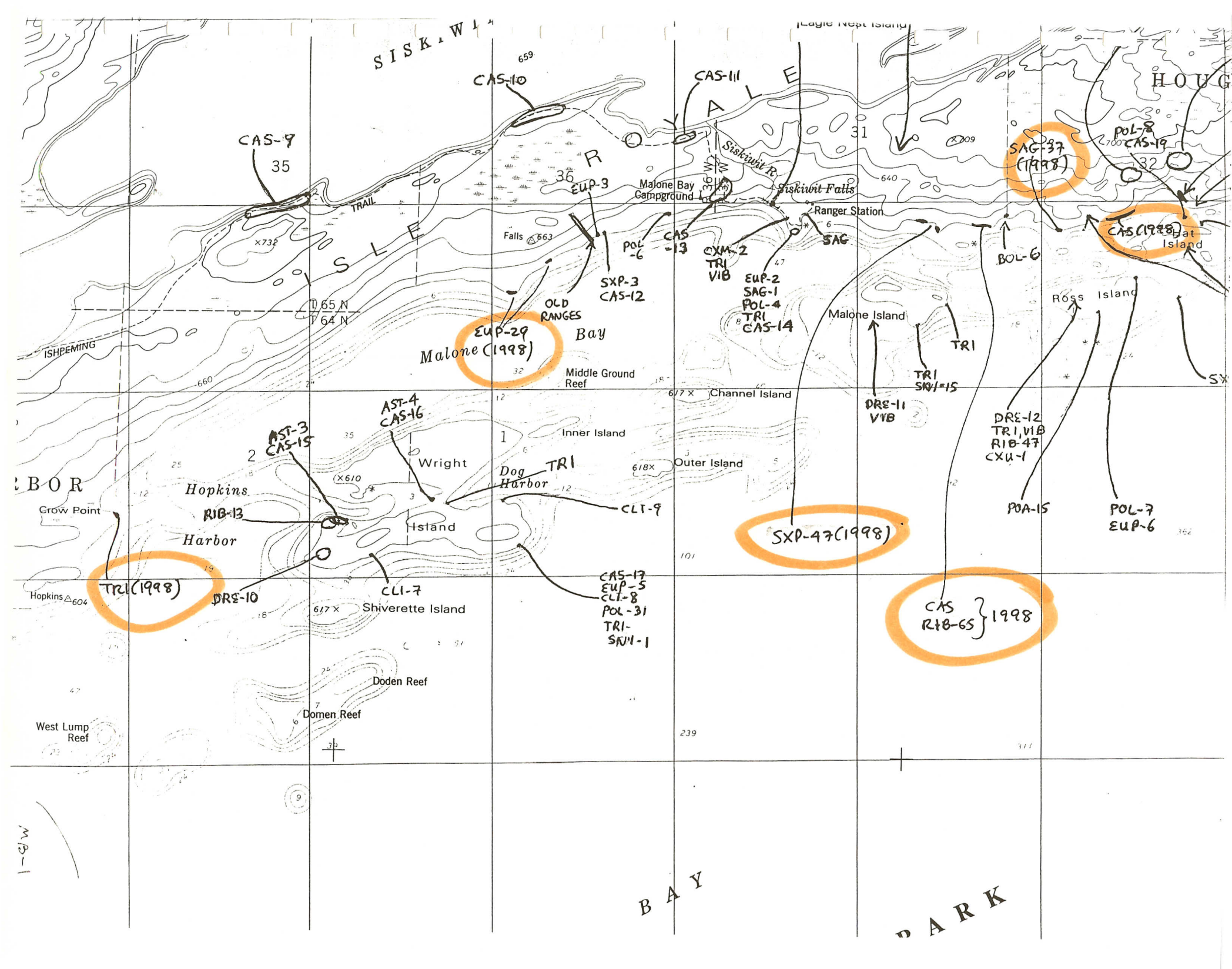

0.749
932,286

LR-1

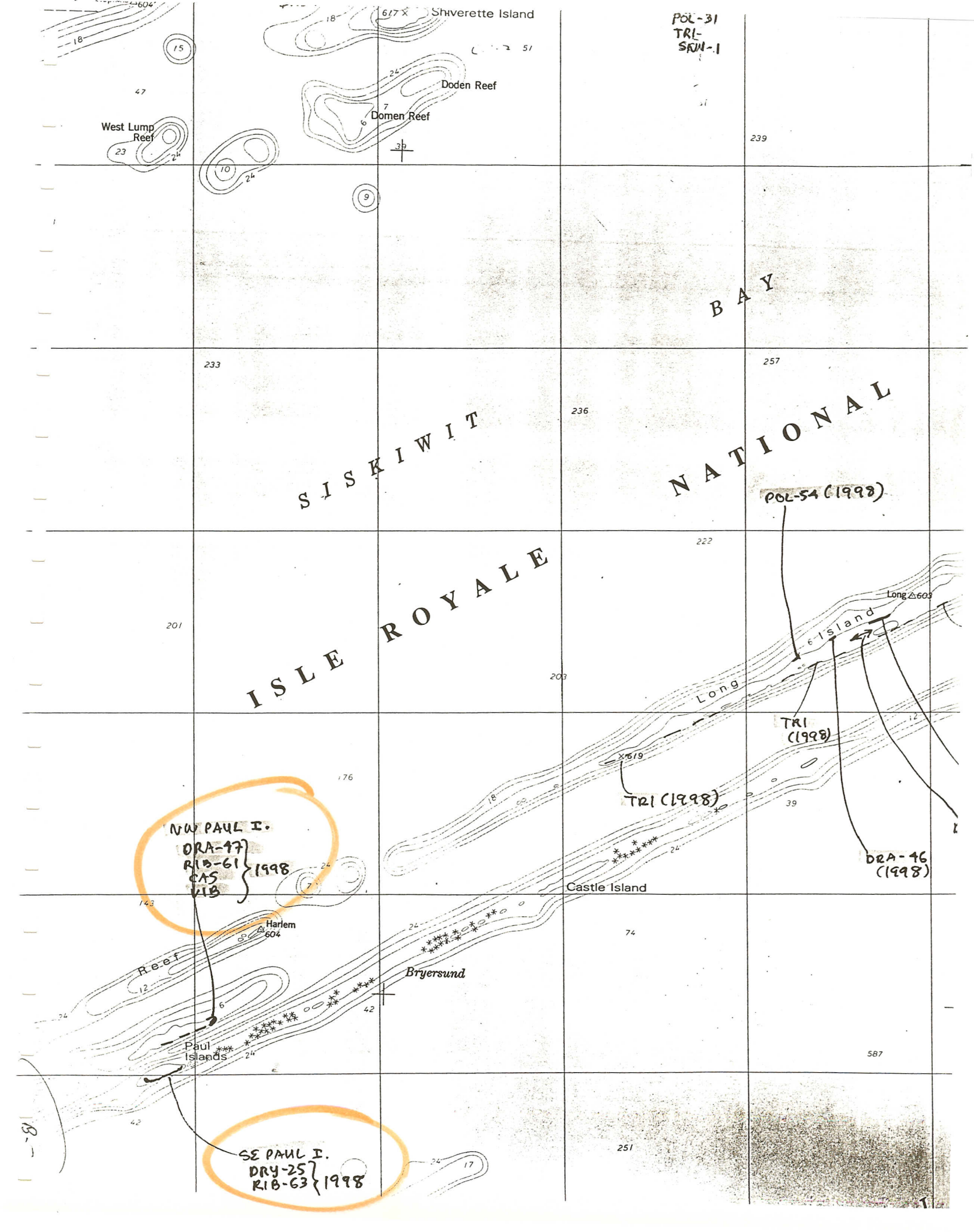

L E S U P E R I O R
APPROXIMATE MEAN LAKE ELEVATION 601
TRI(1998)
TRI(1998)
AST-7(1998)
TRI(1998)
AME-1
ARB-
AST-2
RAR-6
RAR-5
AR-4
Little Todd Harbor
Todd Cove
Little Todd Campground
R 37 W
R 36 W
RIDGE
MINONG
MINONG RIDGE
NATIONAL PARK
17
19
20
24
25
X870
X968
X937

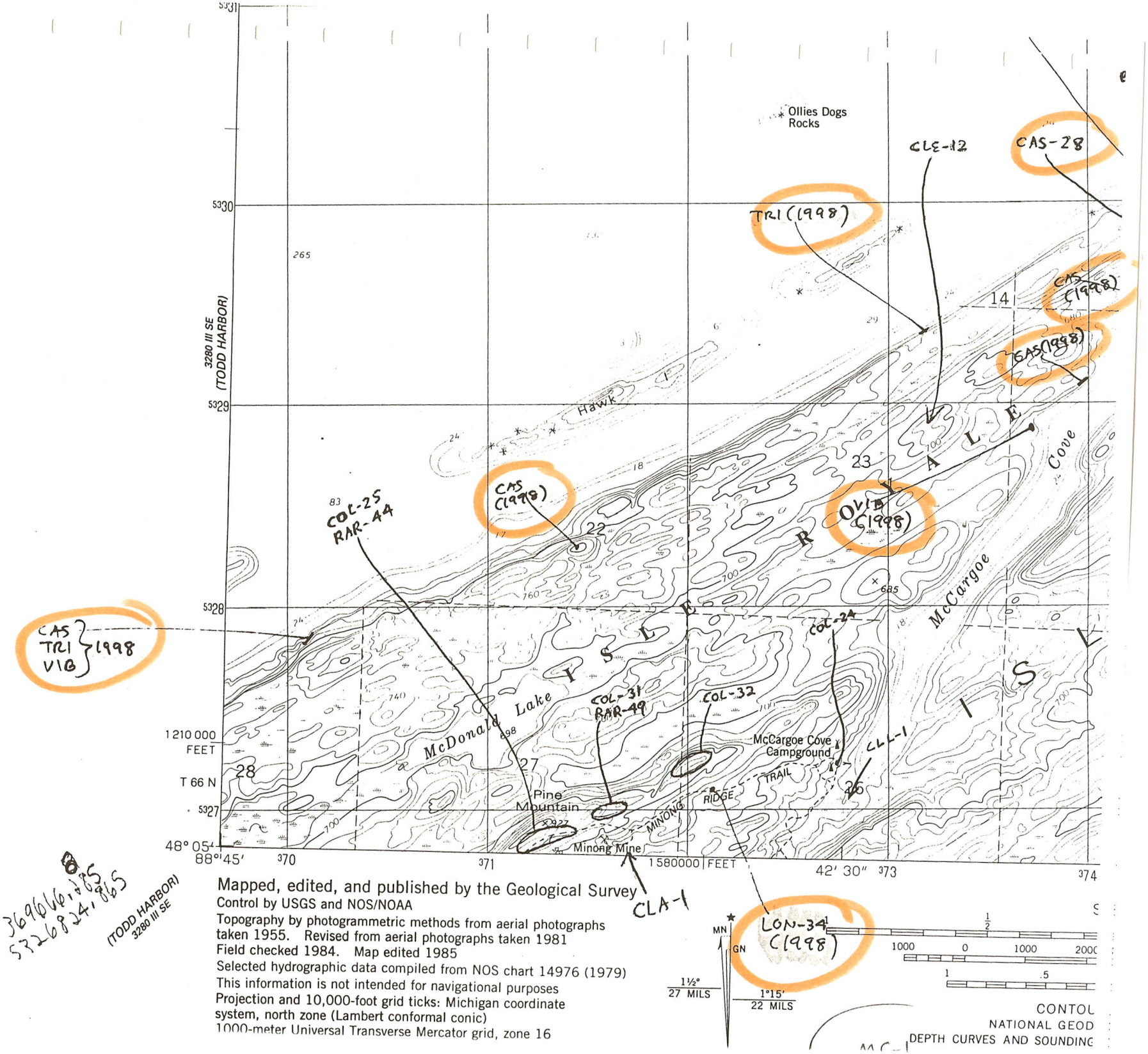

1 200000
FEET
5324
(TODD HARBOR)
3280 III SE
223
5323
DRF-17 (1998)
2' 30"
43
9
6
5322
76
700
16
5321
TRAIL
CLE-33
5320
900
905
800
21
900
840
RAR-83
5319
1228
TRAIL
1200
1218
5318


MALONE BAY QUADRANGLE
MICHIGAN–KEWEENAW CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
3280 II SW (LAKE RICHIE)
6
369455.858
5317563.116
367
368
1570000 FEET
88°45'
48°00'
29
28
Ryan
902
CRA-82
RAR-86
1998
CXM-69
PIN-77
POL-57
1998
5317
CAS-20
ARM-2
POL-44
HOUGHTON
SXP-49 (1998)
POL-8
CAS-19
SAG-37 (1998)
32
33
TRI (1998)
SXP-5
5316
POL-6
CAS (1998)
Hat Island
Schooner Island
SXP-48
TRI
1998
RIB-48
Ross Island
CLE-32
POL-4
CXM-2
1 170 000 FEET
SXP-4
5315
CBU-8
DRA-4
DRE-13
TRI, CAS
VIB
DRE-12
TRI, VIB
UB-47
KU-1
POA-15
POL-7
EUP-6
(LAKE RICHIE) 3280 II SW
5314
1998
5313
57' 30"
Glenlyon Shoal
POT-2
EUP-1
5312


CAS-10
CAS-11
CAS-9
35
36
31
32
TRAIL
EUP-3
Malone Bay Campground
Siskiwit R
Siskiwit Falls
Ranger Station
SAG-37 (1998)
POL-8
CAS-19
CAS (1998)
Flat Island
Falls
POL -6
CAS -13
CXM-2
TRI
VIB
SAG
EUP-2
SAG-1
POL-4
TRI
CAS-14
BOL-6
SXP-3
CAS-12
OLD RANGES
EUP-29
Malone (1998)
Bay
Middle Ground Reef
ISHPEMING
Malone Island
Ross Island
TRI
TRI
SNI-15
DRE-11
VIB
Channel Island
Inner Island
Outer Island
AST-4
CAS-16
AST-3
CAS-15
Wright
Dog Harbor
TRI
Hopkins
RIB-13
Harbor
Island
CLI-9
DRE-12
TRI, VIB
RIB-47
CXU-1
POA-15
POL-7
EUP-6
Grow Point
SXP-47 (1998)
TRI (1998)
DRE-10
CLI-7
Hopkins 604
Shiverette Island
CAS-17
EUP-5
CLI-8
POL-31
TRI-
SNI-1
CAS
RIB-65
1998
Doden Reef
Domen Reef
West Lump Reef
BAY


CLI-7
Shiverette Island
CAS-11
EUP-5
CLI-8
POL-31
TRI-
SAN-1
CAS
RIB-65
1998
Doden Reef
Domen Reef
BAY
PARK
NATIONAL
ROYALE
RIB-62(1998)
POL-54(1998)
Stone House Island
TRI(1998)
TRI(1998)
Long Island
Taylor Reef
TRI
(1998)
TRI(1998)
EUP-27(1998)
CXM-65(1998)
DRY-24
(1998)
VIB(1998)
DRA-46
(1998)
Castle Island
Bryersund
1998


POL-31
TRI-
SNM-1
Shiverette Island
Doden Reef
Domen Reef
West Lump
Reef
BAY
SISKIWIT
NATIONAL
ISLE ROYALE
POL-54 (1998)
Long
Island
TRI
(1998)
TRI (1998)
DRA-46
(1998)
Castle Island
NW PAUL I.
DRA-47
RIB-61
CAS
VIB
1998
Harlem
604
Reef
Bryersund
Paul
Islands
SE PAUL I.
DRY-25
RIB-63
1998




Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1955. Revised from aerial photographs taken 1981

Field checked 1984. Map edited 1985

Selected hydrographic data compiled from NOS chart 14976 (1979)

This information is not intended for navigational purposes

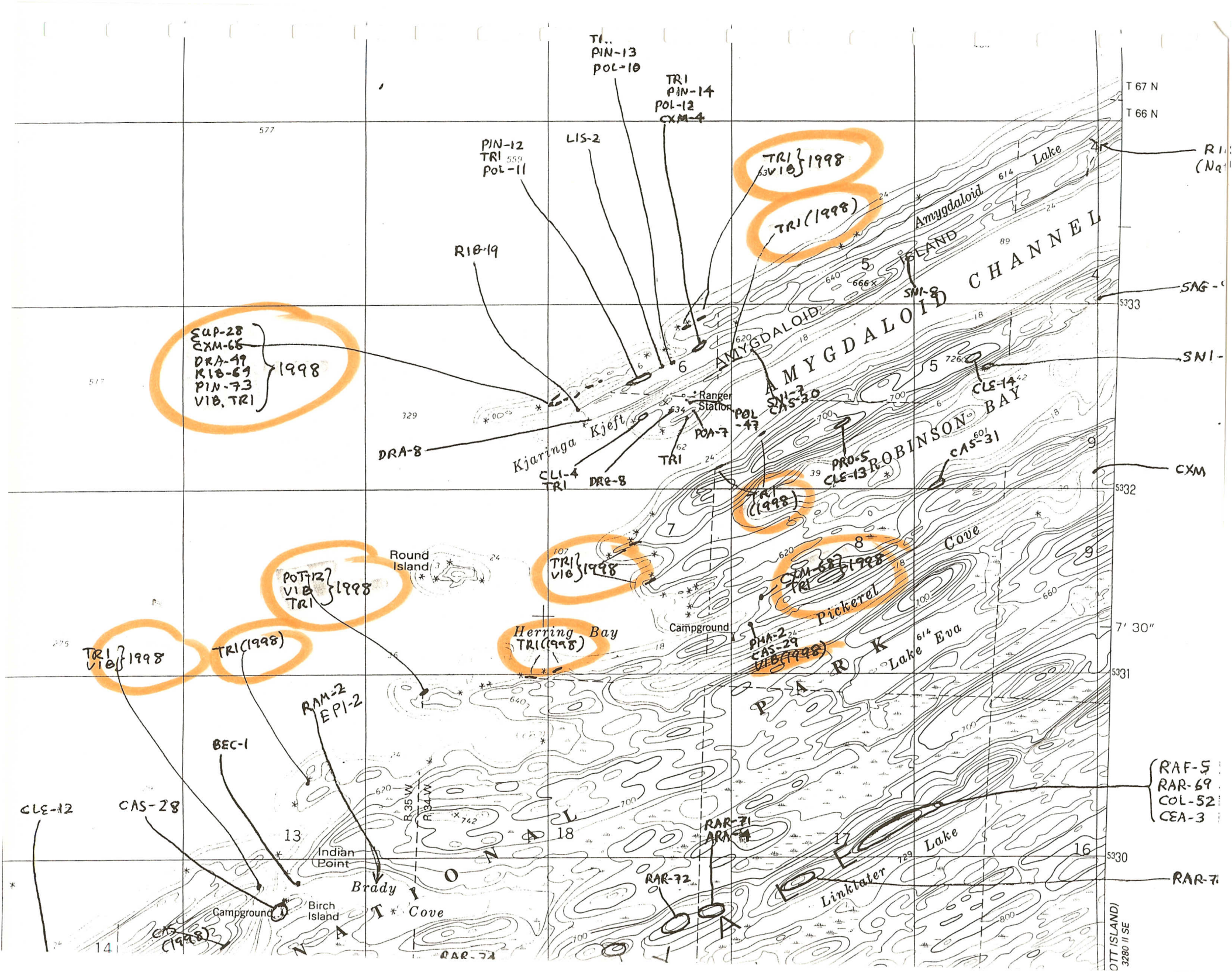
Projection and 10,000-foot grid ticks: Michigan coordinate system, north zone (Lambert conformal conic)

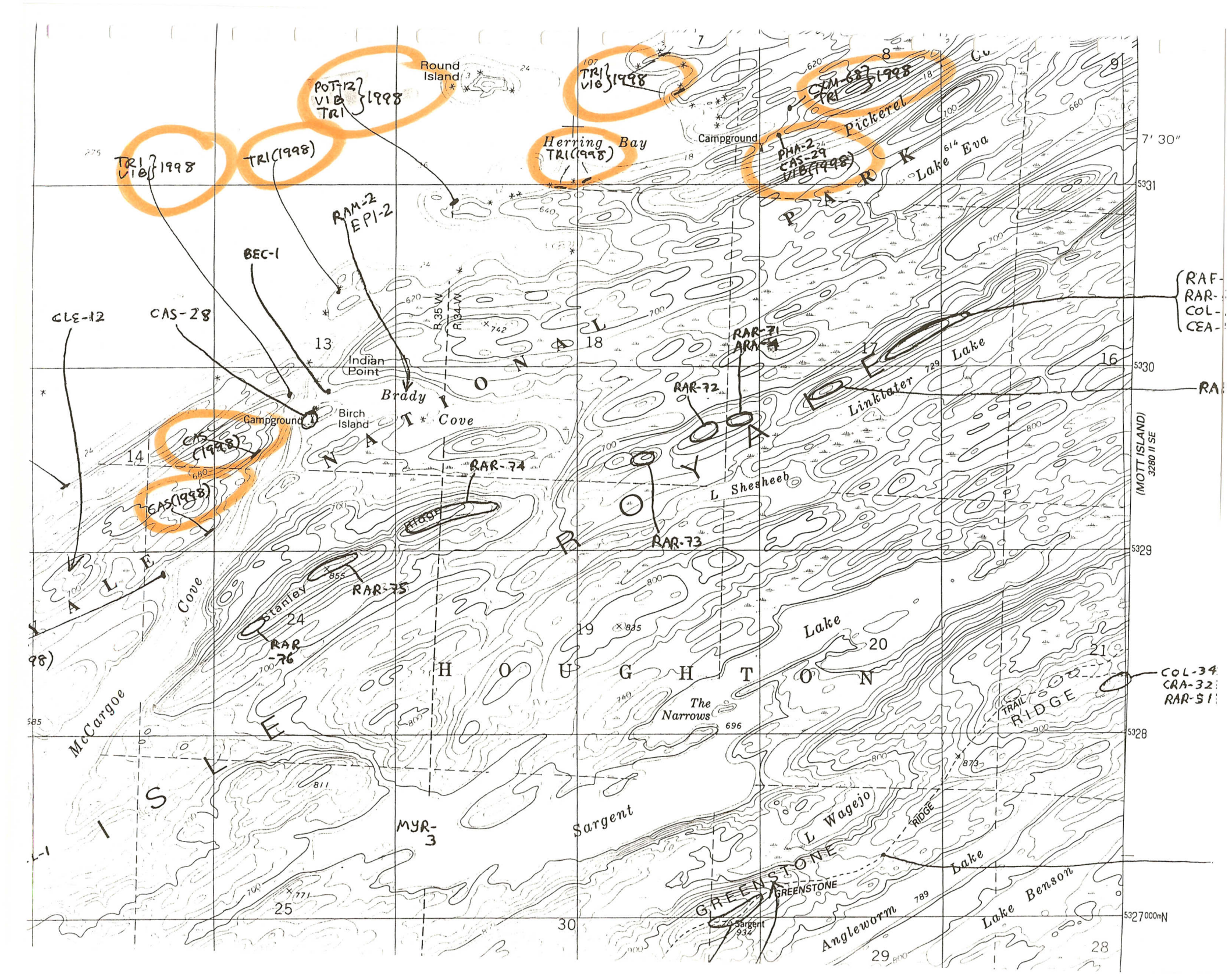
1000-meter Universal Transverse Mercator grid, zone 16

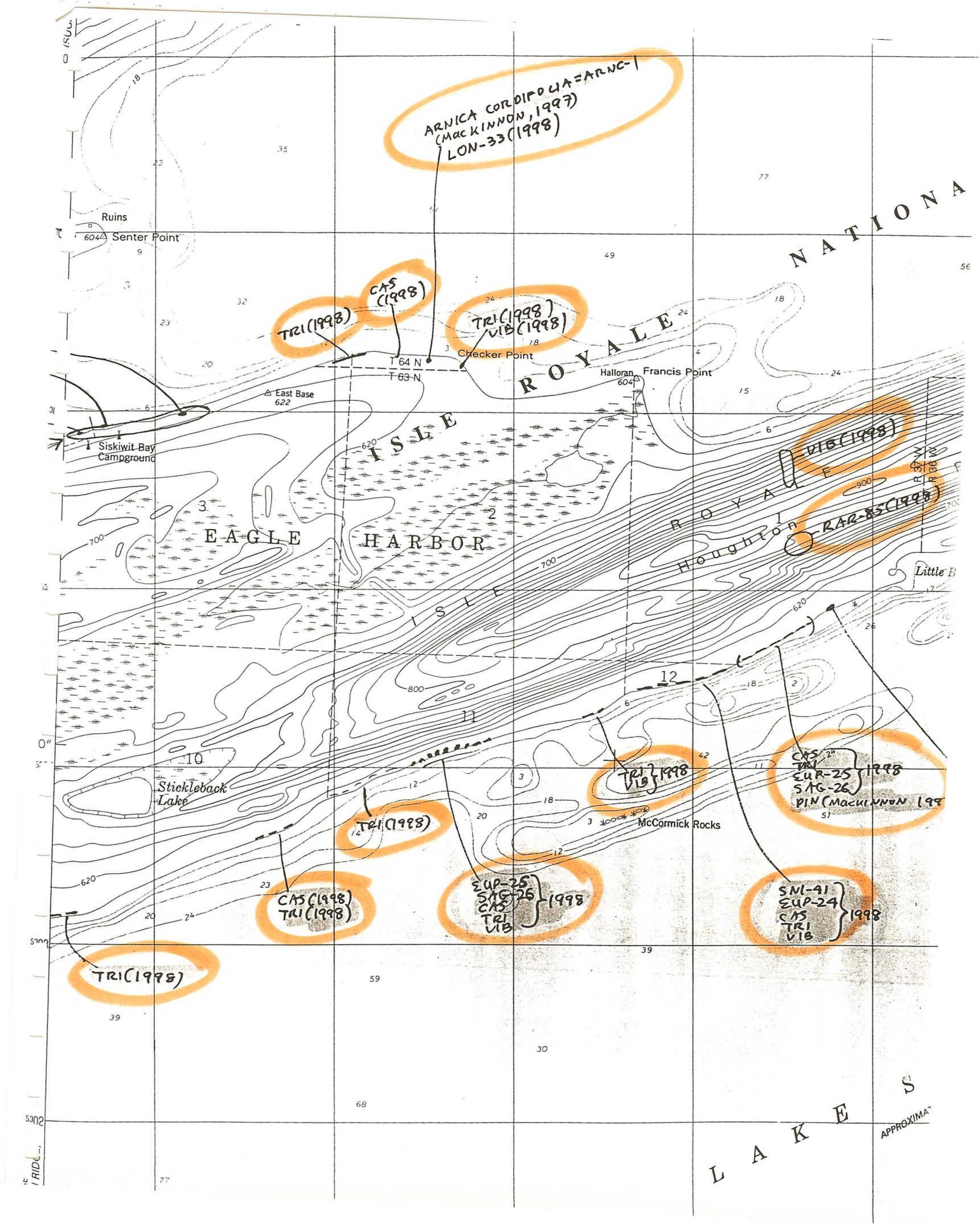
CONTOL

NATIONAL GEOD

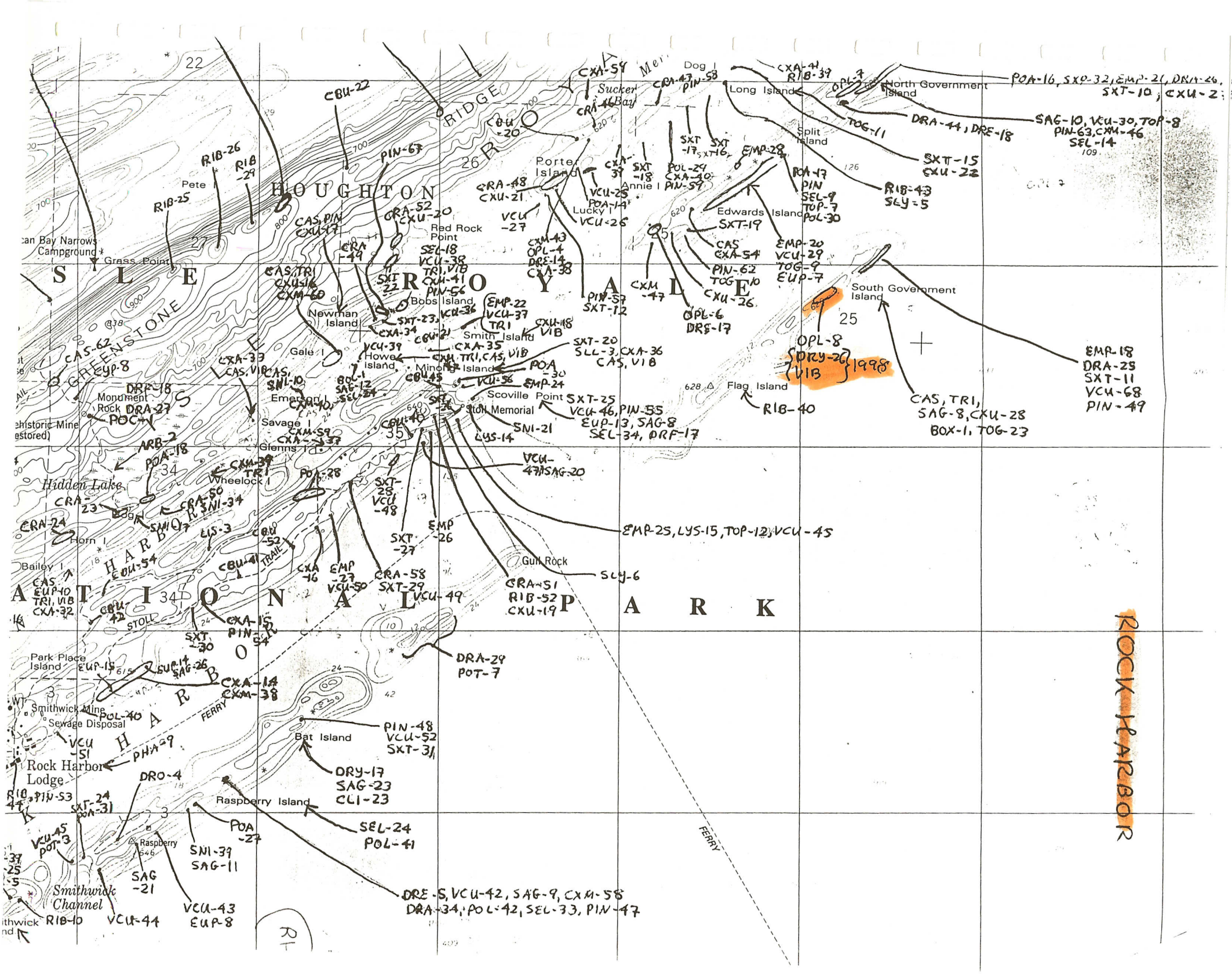
DEPTH CURVES AND SOUNDING

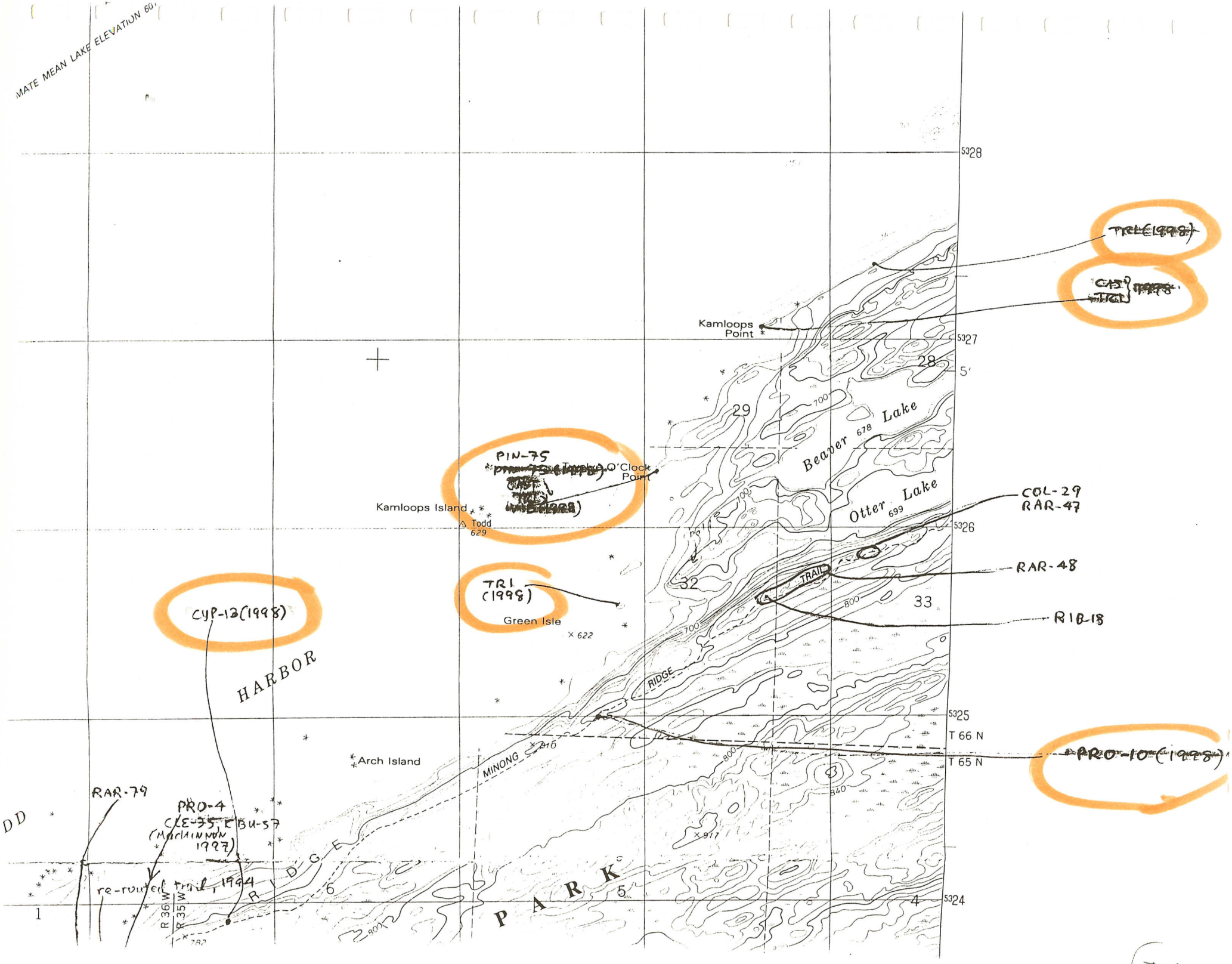

TI..
PIN-13
POL-10
TRI
PIN-14
POL-12
CXM-4
PIN-12
TRI
POL-11
LIS-2
TRI 1998
TRI (1998)
R1B-19
SUP-28
CXM-66
DRA-49
R1B-69
PIN-73
VIB, TRI
1998
DRA-8
Kjaringa
Kjeft
CLI-4
TRI
DRE-8
TRI
POA-7
Ranger Station
POL -47
SNI-7
CAS-30
PRO-5
CLE-13
CAS-31
TRI (1998)
Amygdaloid
ISLAND
AMYGDALOID CHANNEL
ROBINSON BAY
Lake
SNI-8
CLE-14
SAG-
SNI-
CXM
R1
(Na
T 67 N
T 66 N
Round Island
POT-12
VIB
TRI
1998
TRI
VIB
1998
Herring Bay
TRI (1998)
Campground
CXM-68
TRI
1998
PHA-2
CAS-29
VIB (1998)
Pickerel
Cove
Lake Eva
PARK
7' 30"
TRI
VIB
1998
TRI (1998)
RAM-2
EPI-2
BEC-1
CLE-12
CAS-28
CAS
(1998)
Indian Point
Brady
Cove
Campground
Birch Island
R35W
R34W
RAR-71
ARA-1
RAR-72
Linklater
Lake
RAF-5
RAR-69
COL-52
CEA-3
RAR-7
5333
5332
5331
5330
OTT ISLAND)
3280 II SE

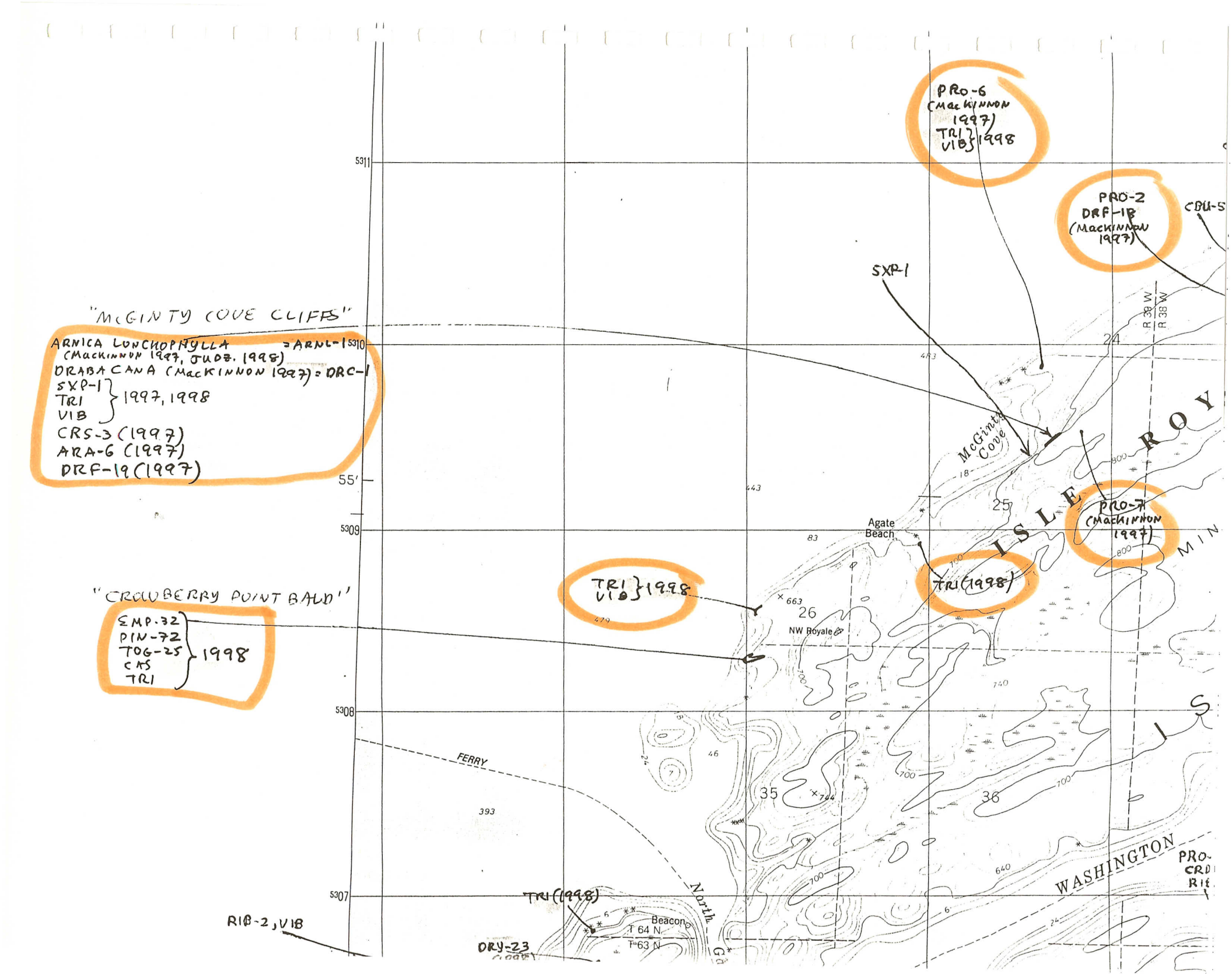

Round Island
POT-12
VIB
TRI
1998
TRI
VIB
1998
TRI(1998)
Herring Bay
TRI(1998)
Campground
CAM-6?
TRI
1998
PHA-2
CAS-29
VIB(1998)
Pickerel Lake
Eva Lake
PARK
7' 30"
5331
RAM-2
EPI-2
BEC-1
CLE-12
CAS-28
13
Indian Point
R.35 W.
R.34 W.
742
18
RAR-71
ARA-4
RAR-72
17
16
5330
Linklater Lake
729
RAF-
RAR-
COL-
CEA-
RA
Brady
Campground
Birch Island
Cove
CAS
(1998)
CAS(1998)
14
RAR-74
Shesheeb
RAR-73
(MOTT ISLAND)
3280 II SE
5329
Cove
Stanley
855
RAR-75
24
RAR-76
19
835
20
21
Lake
COL-34
CRA-32
RAR-51
McCargoe
The Narrows
696
TRAIL
RIDGE
5328
811
MYR-3
Sargent
L Wagejo
RIDGE
Lake
GREENSTONE
GREENSTONE
Angleworm
789
Lake Benson
5327000mN
Sargent
932
25
30
29
28

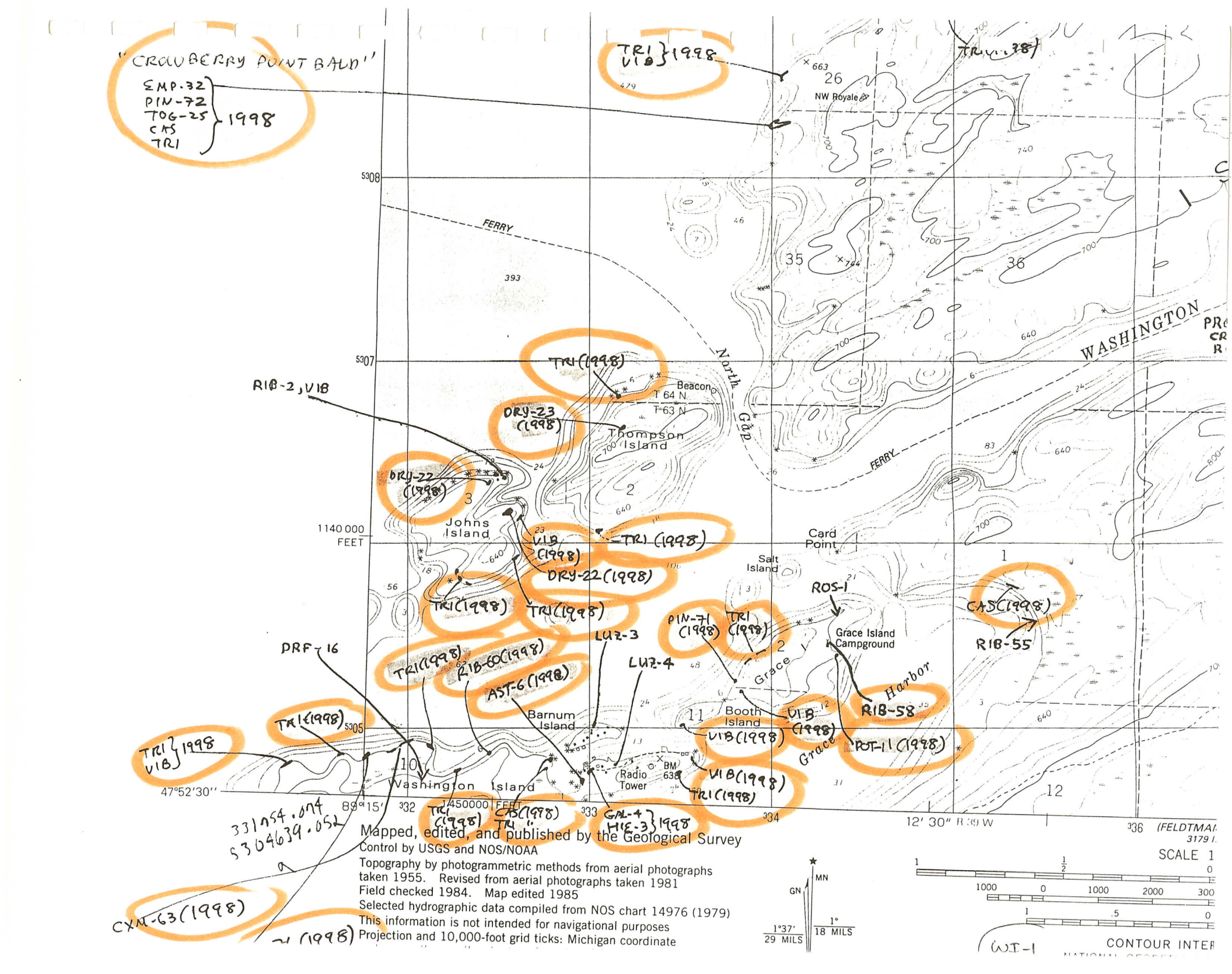

ARNICA CORDIFOLIA=ARNC-1
(MacKINNON, 1997)
LON-33(1998)
Ruins
604 Senter Point
TRI(1998)
CAS (1998)
TRI(1998)
VIB(1998)
Checker Point
T 64 N
T 63 N
Halloran Francis Point
604
East Base
622
Siskiwit Bay
Campground
ROYALE
NATIONA
ISLE
ROYALE
VIB(1998)
RAR-85(1998)
Houghton
EAGLE HARBOR
ISLE
Little B
Stickleback
Lake
TRI(1998)
TRI(1998)
VIB 1998
CAS
TRI
EUP-25
SAG-26
PIN (MacKINNON 199
McCormick Rocks
CAS(1998)
TRI(1998)
EUP-25
SAG-26
CAS
TRI
VIB
1998
SMI-41
EUP-24
CAS
TRI
VIB
1998
TRI(1998)
LAKE
APPROXIMA


NATIONAL
POL-19
CXM-62
1998
VIB(1998)
Houghton
606
Point Houghton
Brandsford
Reef
Houghton Point P
EUP-20
TRI
1998
TRI(1998)
CAS(1998)
T.64 N
T.63 N
VIB(1998)
CAS(1998)
Fishermans Home
POL-50
VIB
1998
VIB(1998)
RAR-85(1998)
Ridge
R.33W
R.34W
TRI
CAS
EUP
1998
EUP-21
CAS
TRI
1998
Little Boat Harbor
CAS
TRI
1998
EUP-22
CAS
TRI
1998
POL-51
EUP-27
CAS
VIB
DIN
SAG
1998
MACHINNON
1997
CAS
TRI
EUP-25
SAG-26
1998
DIN (MACHINNON (1997)
PIN-69(1998)
TRI (1998)
SNI-40
SXP-26
MACHINNON
(1997)
SNI-41
EUP-24
CAS
TRI
VIB
1998
SUPERIOR
APPROXIMATE MEAN LAKE ELEVATION 601


HOUGHTON
SLEEPY EYE
RIDGE
GREENSTONE
HARBOR
ATIONAL PARK
ROCK HARBOR
Sucker Bay
Long Island
Dog I
North Government Island
South Government Island
Split Island
Porter Island
Annie I
Lucky I
Edwards Island
Red Rock Point
Bobs Island
Newman Island
Smith Island
Howe Island
Gale I
Minong Island
Emerson I
Savage I
Glenns I
Wheelock I
Hidden Lake
Monument Rock
Historic Mine (restored)
Scoville Point
Stoll Memorial
Flag Island
Gull Rock
Bat Island
Raspberry Island
Raspberry
Park Place Island
Smithwick Mine
Sewage Disposal
Rock Harbor Lodge
Smithwick Channel
Bailey I
Horn I
Grass Point
Pete
Campground
FERRY
TRAIL
STOLL
1998
CBU-22
CBU-20
PIN-67
RIB-26
RIB-29
RIB-25
CAS,PIN CXU-17
CRA-52 CXU-20
CRA-49
CAS,TRI CXU-16 CXM-60
SXT-22
CXA-34
VCU-39
CAS-62 EUP-8
DRA-18
DRA-27 POC-1
CXA-33 CAS,VIB
CAS, SNI-10
BOL-1 SAG-12 SEL-24
CXA-10
CXM-59 CXA-37
ARB-2
POA-18
CXM-39 TRI
CRA-23
CRA-50 SNI-34
CRA-24
LYS-3
CBU-52
CBU-41
EMP-27 VCU-50
CXA-16
CXA-15 PIN-54
SXT-30
CAS EUP-10 TRI, VIB CXA-32
CBU-42
EUP-15
EUP-14 SAG-26
CXA-14 CXM-38
POL-40
VCU-51
PHA-9
DRO-4
SXT-24 CXM-31
VCU-45 POT-3
SAG-21
VCU-44
RIB-10
SNI-39 SAG-11
POA-27
VCU-43 EUP-8
SEL-24 POL-41
DRE-5, VCU-42, SAG-9, CXM-58 DRA-34, POL-42, SEL-33, PIN-47
DRY-17 SAG-23 CCI-23
PIN-48 VCU-52 SXT-31
DRA-29 POT-7
CRA-58 SXT-29
SXT-28 VCU-48
SXT-27
EMP-26
CRA-51 RIB-52 CXU-19
VCU-49
SCY-6
EMP-25, LYS-15, TOP-12, VCU-45
VCU-47, SAG-20
LYS-14
SNI-21
SXT-25 VCU-46, PIN-55 EUP-13, SAG-8 SEL-34, DRF-17
RIB-40
CAS, TRI, SAG-8, CXU-28 BOX-1, TOG-23
EMP-18 DRA-25 SXT-11 VCU-68 PIN-49
OPL-8 DRY-26 VIB
SXT-20 SCL-3, CXA-36 CAS, VIB
CXM, TRI, CAS, VIB
POA -30
EMP-24
VCU-36
CBU-45
SXT-26
CBU-40
EMP-22 VCU-37 TRI
CXU-18 VIB
PIN-57 SXT-12
CXM -47
OPL-6 DRF-17
CAS CXA-54 PIN-62 TOG CXU-26
EMP-20 VCU-29 TOG-9 EUP-7
POA-17 PIN SEL-9 TOP-7 POL-30
SXT-19
RIB-43 SCY-5
SXT-15 CXU-22
SAG-10, VCU-30, TOP-8 PIN-63, CXM-46 SEL-14
DRA-44, DRE-18
TOG-11
OPL-7
POA-16, SXP-32, EMP-21, DRA-26, SXT-10, CXU-2
CXA-41 RIB-37
CRA-43 PIN-58
CXA-54
CRA-46
CXA-39
SXT -18
SXT -17
SXT -16
POL-24 CXA-40 PIN-59
EMP-28
CRA-48 CXU-21
VCU-25 POA-14
VCU -27
VCU-26
CXM-43 OPL-4 DRE-14 CXA-38


MATE MEAN LAKE ELEVATION 60'
5328
5327
5326
5325
5324
T 66 N
T 65 N
Kamloops Point
Kamloops Island
Todd 629
O'Clock Point
Beaver Lake 678
Otter Lake 699
Green Isle
Arch Island
HARBOR
RIDGE
MINONG
PARK
TRAIL
29
28
32
33
5
6
1
4
R 36 W
R 35 W
700
800
840
PIN-75
TRI (1998)
CYP-13 (1998)
COL-29
RAR-47
RAR-48
RIB-18
PRO-10 (1998)
RAR-79
PRO-4
CLE-35 CBU-57
(MacLennan 1997)
re-routed trail 1994


PRO-6
(MacKINNON 1997)
TRI } 1998
VIB }
PRO-2
DRF-1B
(MacKINNON 1997)
CBU-5
SXP-1
"McGINTY COVE CLIFFS"
ARNICA LONCHOPHYLLA =ARNL-1
(MacKINNON 1997, JUDS. 1998)
DRABA CANA (MacKINNON 1997) = DRC-1
SXP-1
TRI
VIB
} 1997, 1998
CRS-3 (1997)
ARA-6 (1997)
DRF-1B (1997)
McGinty Cove
ISLE ROYALE
PRO-7
(MacKINNON 1997)
Agate Beach
TRI (1998)
TRI } 1998
VIB }
"CROWBERRY POINT BALD"
EMP-32
PIN-72
TOG-25
CAS
TRI
} 1998
NW Royale
FERRY
WASHINGTON
TRI (1998)
Beacon
T 64 N
T 63 N
RIB-2, V1B
DRY-23
R 39 W
R 38 W
5311
5310
5309
5308
5307
55'
24
25
26
35
36
663
704
700
740
640
800
750
443
479
393
83
46




Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1955. Revised from aerial photographs taken 1981

Field checked 1984. Map edited 1985

Selected hydrographic data compiled from NOS chart 14976 (1979)

This information is not intended for navigational purposes

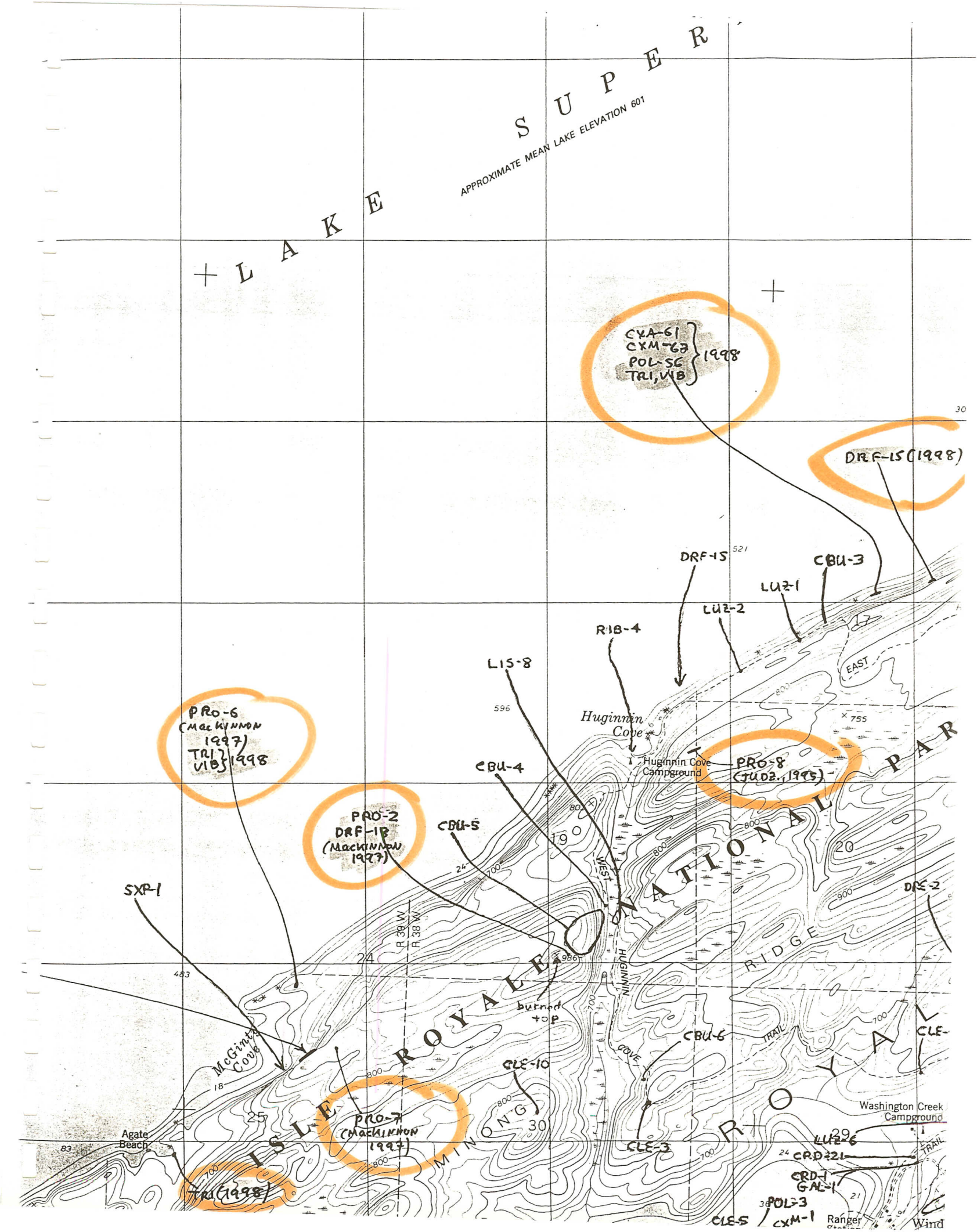
Projection and 10,000-foot grid ticks: Michigan coordinate

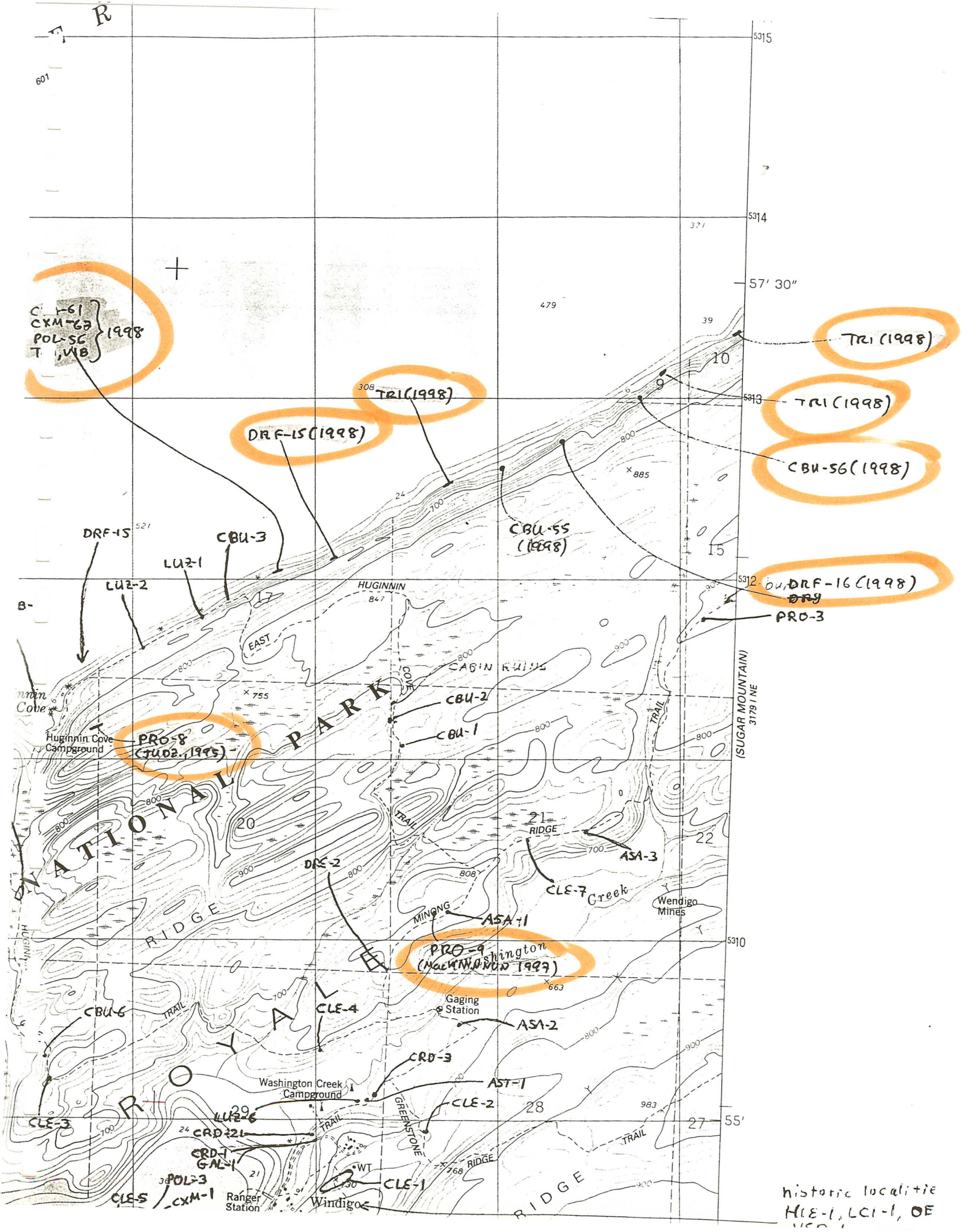
MN
GN
1°37' 29 MILS
1° 18 MILS

SCALE 1

1000 0 1000 2000 300

CONTOUR INTER


LAKE SUPERIOR
APPROXIMATE MEAN LAKE ELEVATION 601
CXA-61
CXM-63
POL-SG
TRI, VIB
1998
DRF-15 (1998)
DRF-15
CBU-3
LUZ-1
LUZ-2
RIB-4
LIS-8
EAST
Huginnin Cove
Huginnin Cove Campground
PRO-8 (JUD2, 1995)
PRO-6 (MacKINNON 1997) TRI, VIB 1998
PRO-2 DRF-18 (MacKINNON 1997)
CBU-4
CBU-5
SXR-1
ISLE ROYALE NATIONAL PARK
RIDGE
WEST
HUGINNIN
COVE
TRAIL
DRE-2
CLE-
McGinty Cove
burned top
CBU-6
CLE-10
PRO-7 (MacKINNON 1997)
MINONG
CLE-3
Agate Beach
TRA (1998)
Washington Creek Campground
LUZ-6
CRD-2
CRD-1
GAL-1
POL-3
CXM-1
CLE-5
Ranger
Wind
R 38 W
R 39 W
T 67 N
T 68 N
596
755
986
483
521


CLE-6
CXM-6?
POL-5C
T ,VIB
1998
TRI (1998)
DRF-15 (1998)
TRI (1998)
TRI (1998)
CBU-56 (1998)
CBU-55 (1998)
DRF-15
CBU-3
LUZ-1
LUZ-2
DRF-16 (1998)
DRY
PRO-3
CBU-2
CBU-1
PRO-8 (JUD2., 1995)
Huginnin Cove Campground
DRF-2
ASA-3
CLE-7
ASA-1
PRO-9 (Washington 1997)
CBU-6
CLE-4
ASA-2
CRD-3
AST-1
CLE-2
LUZ-6
CRD-2L
CRD-1
GNL-1
CLE-3
POL-3
CXM-1
CLE-5
CLE-1
Ranger Station
Windigo
Gaging Station
Washington Creek Campground
Wendigo Mines
Creek
HUGINNIN
CABIN RUINS
EAST COVE
NATIONAL PARK
ROYAL
RIDGE
TRAIL
GREENSTONE
(SUGAR MOUNTAIN)
3179 I NE
57' 30"
55'
historic localitie
HLE-1, LCI-1, OE