

# CLAYTON'S COPPER ASSESSMENT

Draft

Last Updated February 11, 2001

Dr. Mark McCollough

Marcia Siebenmann

Beth I. Swartz

MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE

WILDLIFE DIVISION

RESOURCE ASSESSMENT SECTION

ENDANGERED AND THREATENED SPECIES PROGRAM

## TABLE OF CONTENTS

	Page
INTRODUCTION.....	4
NATURAL HISTORY.....	5
Description.....	5
Distribution.....	7
Life History.....	8
MANAGEMENT .....	12
Regulatory Authority .....	12
Protection of Maine's Invertebrates .....	12
Protection of Endangered and Threatened Invertebrates .....	13
Habitat Protection .....	15
Section 404 Clean Water Act.....	15
The Maine Endangered Species Act.....	17
Natural Resource Protection Act of 1988 .....	18
Mandatory Shoreland Zoning.....	19
Zoning in Unorganized Townships .....	20
Past Goals and Objectives .....	20
Past Management .....	21
Current Research and Management .....	22
HABITAT ASSESSMENT.....	24
Past Habitat.....	24
Current Habitat .....	25
Habitat Projection .....	27
POPULATION ASSESSMENT.....	29
Past Populations.....	29
Current Populations .....	29
Population Projections.....	30
Limiting Factors .....	31
USE AND DEMAND ASSESSMENT .....	32
SUMMARY AND CONCLUSIONS .....	34
LITERATURE CITED .....	36
APPENDIX I .....	38
Sites surveyed for Clayton's copper in Maine	

## LIST OF FIGURES

FIGURE	PAGE
1. Clayton's copper ( <i>Lycaena dorcas claytoni</i> ) butterfly .....	6
2. Current worldwide distribution of Clayton's copper.....	9
3. Shrubby Cinquefoil ( <i>Potentilla fruticosa</i> ) .....	10
4. Clayton's copper ( <i>Lycaena dorcas claytoni</i> ) egg .....	10

## INTRODUCTION

Since 1968, the Maine Department of Inland Fisheries and Wildlife (MDIFW) has developed and refined wildlife species assessments to formulate management goals, objectives, and strategic plans. Assessments are based upon available information and the judgments of professional wildlife biologists responsible for individual species or groups of species. This document represents the first planning effort undertaken by MDIFW for the Clayton's copper (*Lycaena dorcas claytoni*), a butterfly listed as endangered in Maine.

Assessments provide the background for species planning initiatives. A "Natural History" section reviews biological characteristics of the species useful to understanding its status. The "Management" section recaps previous actions, strategic plans, relevant rules, and regulatory authority. Historic, current, and projected future conditions for the species are discussed individually for "Habitat", "Population", and "Use and Demand" analyses. The major points of an assessment appear in "Summary and Conclusions".

The Clayton's copper, a subspecies first described from specimens collected in Springfield, Maine by A. E. Brower in 1937, is known from only ten sites worldwide — nine of which are in Maine. This assessment draws heavily from surveys and research conducted by John Albright, formerly of the Maine Natural Heritage Program (MNHP). Marcia Siebenmann (formerly of the University of Maine) and Dr. Mark McCollough (MDIFW) prepared a draft Clayton's copper assessment for MDIFW in 1995; this document was updated in 2000 with additional information, including recent research and management efforts.

## NATURAL HISTORY

### Description

The Clayton's copper butterfly (*Lycaena dorcas claytoni* Brower) was first discovered in Maine and described as a distinct subspecies by A.E. Brower (1940). It is named for Walter J. Clayton, one of Maine's able field naturalists, from specimens collected in a restricted area around Springfield and Lee, Penobscot County, Maine. Much of our early understanding of this butterfly is gratefully attributed to the late L. Paul Grey of Lincoln, a widely recognized amateur lepidopterist and protégé of Clayton.

Clayton's copper is one of five subspecies currently described for the nominate species Dorcas copper (*Lycaena dorcas*). Except for Scott (1986), lepidopterists have generally accepted Clayton's copper as a distinct taxon — disjunct and separated from the nominate subspecies, Dorcas copper (*Lycaena dorcas dorcas* Kirby), by large blocks of unsuitable habitat. While the Dorcas copper is widespread across northern and western North America, except for Clayton's copper it is not known to occur in the United States east of Michigan and the Indiana/Ohio border (NatureServe 2000, Opler et al. 1995), and no records exist to connect Maine's populations with the nearest Dorcas copper populations in Quebec. Minor, yet apparently distinct and consistent morphological differences also distinguish the two subspecies — Clayton's copper is smaller and much darker and duller in color, with a reduction in the size and number of wing spots, especially on the dorsal surface (Brower 1940). However, the taxonomic distinction between *L. d. claytoni* and *L. d. dorcas* has never been quantified, neither morphologically or by DNA analysis.

Clayton's copper (Figure 1) is a small butterfly with males measuring 24-26 mm across and the females 25-28 mm. The upper wing surface is mainly brown in color, with small black spots scattered throughout and a few faint, red-orange spots near the anal angle of the hindwing. Males have a distinguishing purplish iridescence over the upper surface. The under side is orange-brown, also with scattered black spots, and with light orange markings along the outer margin of the hindwing. The eggs are pale green to nearly white (personal observation, B. Swartz); and larvae are a pale green with short hairs, faint white dashes on each segment, a dark green middorsal line, and a tan head (based on description of *Lycaena d. dorcas* in Opler and Malikul 1992). Pupae can be green, black, brown, or even purplish (Scott 1986). Guides to the identification of this butterfly can be found in Brower (1940), Klots (1951), Howe (1975), Opler and Krizek (1984), Scott (1986), Opler and Malikul (1992), and Layberry et al. (1998).



Figure 1. Clayton's copper (*Lycaena dorcas claytoni*) butterfly

## Distribution

Clayton's copper is evidently a geographically restricted, disjunct subspecies, occupying a very small area centered on eastern Penobscot County, Maine. The nominate subspecies, *Lycaena d. dorcas*, ranges across northern North America from Newfoundland and Labrador to the southern Northwest Territories, but apparently extends no further south than the northern Great Lake states and the St. Lawrence River/Gaspe region of Quebec. Subspecies *florus* occurs in Alberta and British Columbia north in the Mackenzie Mountains to the Arctic Ocean; subspecies *arcticus* occurs in western Yukon and Alaska; and subspecies *castro* is found in the Rocky Mountains of Colorado (Layberry et al. 1998, Nature Serve 2000, Opler and Malikul 1992). Other than Clayton's copper, none of the subspecies are listed as endangered or threatened by other states or provinces within their ranges. However, the nominate subspecies, *Lycaena d. dorcas*, is listed as special concern in Wisconsin (Wisconsin Department of Natural Resources web site).

Historically, documented occurrences of Clayton's copper were limited to the immediate vicinity of Lee and Springfield, where seven or more collection sites were recorded (Albright 1993). By the early 1980s, only three small populations were known to have persisted: Bog Brook fen, Pickle Ridge Road, and Gott Brook — all in Springfield. In 1984, a large population of the butterfly was discovered by John Albright and Barry Burgason (formerly with MDIFW) at Dwinal Pond flowage in Lee and Winn. Subsequent surveys by Albright in 1985-1992 yielded five additional sites (Albright 1993), two of which were closely related to existing locations: Mattagodus Meadow (Webster Plt.) where a relatively large population was found, and Mattagodus Stream

(Prentiss Plt.) where only a single individual was observed in limited habitat. The remaining new occurrences were Soper Pond (Soper Mountain Twp., Piscataquis County), Pillsbury Pond (T8R11 WELS, Piscataquis County), and Little Crystal Bog (Crystal, Aroostook County), which significantly extended the known range of Clayton's copper to the north and northwest. In 1991, a small population of Clayton's copper was also discovered just across the Maine border in Woodstock, New Brunswick (Thomas 1991), extending the butterfly's recorded range to the east.

Clayton's copper is currently known from only ten sites worldwide (Figure 2). Nine sites are located in Maine, with six of these concentrated within a ten square mile area in the Springfield/Lee/Winn vicinity. Although it is possible additional sites may be located, this butterfly relies on an uncommon host plant and is not known to occur everywhere that suitable habitat exists.

### Life History

Clayton's copper is found only in association with its single larval host plant, the shrubby cinquefoil (*Potentilla fruticosa*) (Figure 3). This uncommon calciphile (ie. thrives on calcium salts) requires limestone-derived soils and has a scattered distribution in Maine (McMahon et al. 1990). Although not considered rare, and ranging throughout all but extreme southern portions of the state, it occurs in relatively few stands large enough to support viable Clayton's copper populations. Shrubby cinquefoil is a transitional species and is intolerant of shade. It typically occurs in the upland-wetland edge of calcareous wetlands. It can also be found in purely upland, old field situations, but these stands are generally short-lived as a result of forest



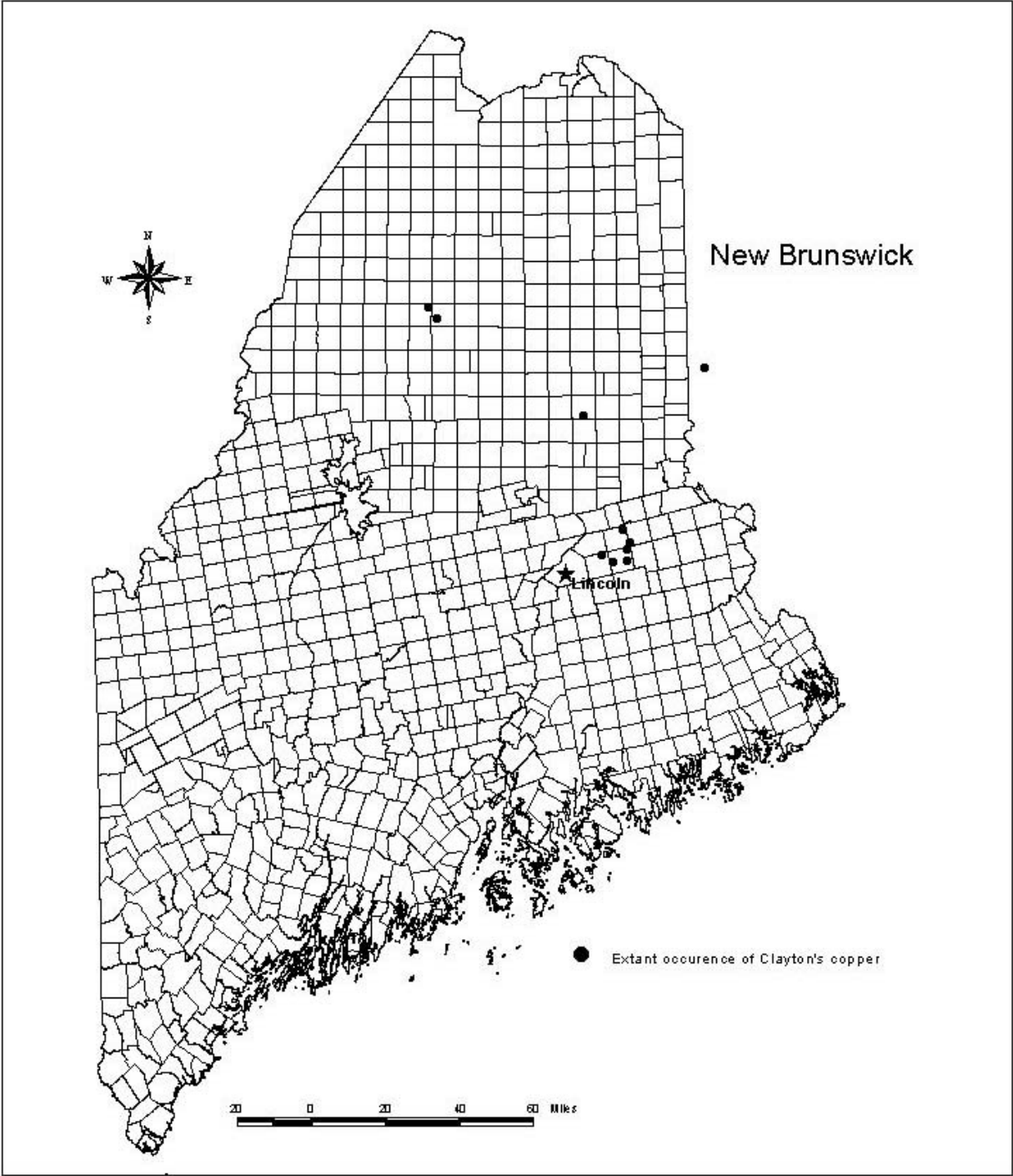


Figure 2. Current worldwide distribution of Clayton's copper (*Lycaena dorcas claytoni*).

succession. All ten of the currently known occurrences for Clayton's copper are circumneutral fens and bogs, or streamside shrublands and meadows. The butterfly will use host plant populations in drier habitats, however, and the original type locations for Clayton's copper were upland old fields where shrubby cinquefoil had invaded (Albright 1993).

Clayton's copper is univoltine, producing one brood per year. The tiny, pale green to nearly white eggs are laid singly in August on the underside of the cinquefoil leaves (Figure 4),

usually near the top of smaller plants (Scott 1986). Leaves and eggs drop to the ground



Figure 3. Shrubby cinquefoil (*Potentilla fruticosa*)

in autumn, and eggs overwinter.

The pale green larvae emerge in spring and crawl back up the plant to feed on the leaves. There are five instars, or molts, from larva to pupa. Adults emerge during a flight period when shrubby cinquefoil is flowering, typically late July through August. During hotter, drier years, flowering and emergence may occur



Figure 4. Clayton's copper (*Lycaena dorcas claytoni*) egg

earlier. In cooler years, flowering, emergence and egg-laying may extend through mid-September. Occasionally, a few worn adults can be observed as late as the end of September (personal observation, B. Swartz), by which time the life cycle is completed. Throughout the flight period, adults remain fairly local to their cinquefoil stands (Layberry et al. 1998), where the abundant yellow blooms provide their primary nectar source.

## MANAGEMENT

### Regulatory Authority

#### *Protection of Maine's Invertebrates*

The Maine Department of Inland Fisheries and Wildlife is charged to “preserve, protect and enhance the inland fisheries and wildlife resources of the state; to encourage the wise use of these resources; to ensure coordinated planning for the future use and preservation of these resources; and to provide for the effective management of these resources” (12 MRSA, Chpt. 702, Section 7011). “Wildlife” is defined as “any species of the animal kingdom, except fish, which is wild by nature, whether or not bred in captivity, and includes any part, egg or offspring thereof, or the dead body parts thereof” (Section 7001).

Unless listed as endangered or threatened, however, invertebrates are currently provided only minimal protection under Maine law. The laws which govern hunting, trapping, and possession of Maine's wildlife (Sections 7401, 7406) pertain solely to “wild birds” and “wild animals”. By definition, “wild animals” includes only mammals (Section 7001) - thus excluding invertebrates from any closed season or general possession coverage. Except for listed species, invertebrates are also excluded from scientific collection permit requirements by the same definition (Section 7242). Permits are required, however, to possess for exhibition purposes (Section 7231), import or introduce into the state (Section 7237), or take or transport within the state for breeding and advertising purposes (Section 7241), because these laws refer to all “wildlife”, which includes invertebrates.

### *Protection of Endangered and Threatened Invertebrates*

The Maine Endangered Species Act of 1975 prohibits the take, exportation, hunting, trapping, possession, processing, offering for sale, selling, transporting, feeding, baiting or harassing of any endangered or threatened species of fish and wildlife, including invertebrates (12 MRSA, Section 7756). Because Clayton's copper was officially listed as an endangered species in Maine in 1997, it is fully protected from these activities. Prohibitions do not apply to acts that affect the quality and quantity of habitat available to the species. Furthermore, state law, as written, contains inconsistencies regarding deliberate harassment, harassment, and take.

Concern has been raised about "deliberate harassment" (Section 7756, subsection 1, paragraph D) of endangered or threatened invertebrates. "Harass", as defined in Section 7001 (Definitions), means "an intentional or **negligent** (emphasis added) act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns". After reviewing the statute (MRSA 12, Section 7756. Prohibited Acts) in December, 1994, the Attorney General's Office determined that the words "deliberately" and "harasses" shall be interpreted to mean intentionally (with forethought) kills, torments, troubles, or worries a listed species. This prohibition was interpreted to apply to acts that are **deliberately** directed at individuals or groups of individuals of a listed species and result in the death of individuals, alteration or disruption of normal behavior patterns, or adversely impact normal life processes. In an attempt to remedy this shortcoming, Section 7756 was amended in 1999 to read:

“For the purposes of this section, “to take, take and taking” means the intentional **or negligent** (emphasis added) act or omission that results in the death of any endangered or threatened species.”

The prohibition on “harassing” endangered or threatened wildlife is now somewhat less ambiguous with regard to intent, when “harassing” results in the death (i.e. taking) of an individual or group of individuals of a listed species. However, the prohibition of harassment may not be interpreted to include *non-lethal* acts (e.g. torments, troubles, or worries) that predispose to injury one or more individuals of a listed species. A first violation of the intentional harassment prohibition is punishable by a mandatory warning; the second violation is punishable as a Class E crime.

In 1999, the legislature also amended Section 7756 to allow the Commissioner to permit the “incidental” take of any endangered or threatened species. There are three provisions of the Incidental Take Permit (Section 7756, subsection 2, paragraph C):

- 1) such taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity;
- 2) the taking will not impair the recovery of any endangered species or threatened species; and
- 3) the person develops and implements an incidental take plan approved by the Commissioner to take an endangered species or threatened species pursuant to paragraph D;

However, because of the narrow definition of “take” (i.e. act or omission that results in death) adopted by the legislature, prohibited acts that are *non-lethal* in nature may not be permissible under an Incidental Take Permit.

Current law also prohibits collection (scientific, hobby) of endangered or threatened invertebrates. Exemptions for educational or scientific purposes are currently granted through Scientific Collecting Permits on an annual basis (Section

7756). The transplantation, introduction, or reintroduction of an endangered or threatened invertebrate may be enabled pursuant to the Commissioner of MDIFW developing a recovery plan for that species, which is then approved through both a public and legislative hearing process (Section 7754).

In summary, the Maine Endangered Species Act protects the Clayton's copper from take, export, possession, etc. The Act does not protect the Clayton's copper from activities that affect the quality and quantity of its habitat. It is unclear whether a court would find unintentional harassment of an endangered or threatened species to be an offense, unless the harassment directly resulted in the deaths of one or more individuals. Similarly, it is unclear whether prohibited acts that have non-lethal effects on an endangered or threatened species are permissible under an Incidental Take Permit. Collection of this species (e.g. for scientific purposes) is currently prohibited without a Scientific Collecting Permit. Transplantation or reintroduction would require an approved recovery plan.

### *Habitat Protection*

Federal, state, and municipal regulations exist for protecting wetlands used by the Clayton's copper. At present, these are the most important management tools for protecting Clayton's copper habitat.

#### Section 404, Clean Water Act

Section 404 of the federal Clean Water Act provides the Army Corps of Engineers (Corps) with regulatory authority to control filling of waters and wetlands.

The 404 Program is administered jointly by the Corps (which has permit authority) and the Environmental Protection Agency (EPA). Guidelines, as defined by EPA, prohibit projects that would adversely affect endangered or threatened species (federally listed), violate water quality standards, or involve toxic discharges. The guidelines also require mitigation of unavoidable impacts.

The Corps has three categories of permits enabling filling of wetlands. In New England, certain projects affecting isolated wetlands less than one acre are permitted by *Nationwide Permit #26* authorization. *General Permits* may be issued by the Corps for certain activities in small geographic areas. Such permits are in effect for five years and may be modified or revoked if adverse environmental impacts increase. *Individual Permits* are required for projects that do not qualify for Nationwide and General permits. These permits are generally needed for larger projects affecting wetlands; they have a 30-day public comment period and provide for input on fish and wildlife values.

In most cases, the EPA, Corps, and other federal review agencies (including the U.S. Fish and Wildlife Service) attempt to reach a consensus decision on project applications. In general, the Corps makes most decisions, but the EPA may veto Corps-issued permits based on a determination of unacceptable adverse effects on wildlife areas and other criterion. This authority may be exercised by EPA to designate areas in advance of discharge or filling. This planning process of Section 404, labeled "Advanced Identification of Disposal Sites," allows EPA and the Corps to work in cooperation with state and local authorities to identify sites unsuitable for filling. In New England, it is expected that Advance Identification will be more actively used as a planning tool for increased wetland protection (Widoff 1988).



Potential exists for closer cooperation and communication between MDIFW and the Corps to intensify wetland protection. Potential also exists to prepare lists of Clayton's copper sites or habitats that merit protection through Advanced Identification. These wetlands could be added to an EPA list of priority wetlands already developed for Maine (EPA 1987 in Widoff 1988). This list is updated periodically and recommendations for additions may be proposed at any time.

*The Maine Endangered Species Act*

A 1988 amendment of the Maine Endangered Species Act (12 MRSA, Section 7754) enables the Commissioner of Inland Fisheries and Wildlife to designate areas currently or historically providing physical or biological features essential to the conservation of an endangered or threatened species as "Essential Habitat." Under the Act, state agencies and municipal governments may not permit, license, fund, or carry out projects that would significantly alter an Essential Habitat or violate protection guidelines adopted for the habitat. Essential Wildlife Habitats are implemented as "consultation zones" to flag development projects within endangered and threatened species habitat and allow MDIFW to work with landowners and project applicants to minimize or avoid potential conflicts before a project begins.

Essential Habitat was first designated to protect bald eagle (*Haliaeetus leucocephalus*) nest sites in Maine in 1989. Since then, piping plover (*Charadrius melodus*) and least tern (*Sterna albifrons*) nesting, feeding, and brood-rearing areas, and roseate tern (*Sterna dougallii*) nesting areas have also been protected via Essential

Habitat designation. Essential Wildlife Habitat designation could also be used to protect Clayton's copper habitat.

*The Natural Resource Protection Act of 1988*

The Natural Resource Protection Act of 1988 (NRPA) provides for designation of "Significant Wildlife Habitat" for state and federally listed endangered and threatened species and certain other wildlife, and contains provisions for protecting freshwater wetlands. The NRPA prohibits dredging; bulldozing; removing soil, sand, or vegetation; draining; filling; or construction, repair or alterations of permanent structures without a permit in areas designated as Significant Wildlife Habitat. Significant Wildlife Habitat for species on the Maine or federal lists of endangered or threatened species is to be identified and mapped by MDIFW and adopted by the Maine Department of Environmental Protection (DEP) through rulemaking. Habitat protection guidelines and permit review criteria would be developed by MDIFW for these areas and may include acceptable types of development, recommended setbacks or buffers, and recommendations for timing of development activities. These guidelines are also adopted as part of DEP regulations.

Maine's Comprehensive Growth Management Act similarly enables Significant Wildlife Habitats of rare species to be identified and submitted to the Department of Economic and Community Development for use by towns for comprehensive planning purposes. MDIFW reviews town comprehensive plans and all permit applications within Significant Wildlife Habitats. To date, Significant Wildlife Habitat has only been

designated for seabird nesting islands. This habitat protection tool could also be used to protect Clayton's copper habitat.

The NRPA also contains provisions for protection of some freshwater wetlands, which could also benefit Clayton's copper habitat. The Act provides that a permit is needed for development activities that may fill or alter wetlands. Generally, wetland impacts of <4,300 ft<sup>2</sup> require no review and are exempt from permitting requirements. Three tiers of review are employed depending on the amount of area altered in the wetland (4,300 ft<sup>2</sup> - 15,000 ft<sup>2</sup>, 15,000 ft<sup>2</sup> - 1 acre, >1 acre). The Maine Department of Environmental Protection reviews freshwater wetlands permits (in many instances in consultation with MDIFW) for activities in organized towns.

#### *Mandatory Shoreland Zoning*

Organized towns and municipalities are required by the Mandatory Shoreland Zoning Law to pass ordinances that establish a shoreland zone in all districts within 250 feet of the upland edge of freshwater wetlands >10 acres, and designate resource protection in those areas that are rated "moderate" or "high" value by MDIFW (Jones 1986). Within resource protection districts, agriculture, new buildings, campsites, road construction, and parking facilities are prohibited, and other development activities require permit applications for approval. MDIFW generally does not review town permit applications but occasionally is consulted by towns. Towns are permitted to adopt wetland protection guidelines more stringent than those mandated by the Mandatory Shoreland Zoning Law.

### Zoning in Unorganized Townships

In Maine's unorganized townships, development activities in wetlands are regulated by the Land Use Regulation Commission (LURC). LURC wetland protection rules apply to any wetlands (non-forested) delineated on LURC's zoning maps, which essentially are any non-forested wetlands identified on National Wetland Inventory maps. Applicants whose activities will alter  $>15,000 \text{ ft}^2$  of a mapped wetland, or  $\geq 1$  acre ( $\geq 43,560 \text{ ft}^2$ ) of any combination of wetland and upland, are required to delineate all wetlands in the project area; LURC may consider impacts to any newly mapped wetlands in its review of permit applications.

Other state environmental regulations, such as the Site Location of Development Act, may also be applied occasionally to protect endangered species habitat. MDIFW formally reviews and comments on approximately 500 permit applications annually through its regional offices. Hundreds of additional projects are reviewed on an informal and pre-consultation basis. Regional staff consult with the Endangered and Threatened Species Program biologists for permit applications involving listed species. These species and their habitats are granted protection in accordance with pertinent regulations.

### Past Goals and Objectives

There are no past goals and objectives for the Clayton's copper.

## Past Management

The Clayton's copper has received little management attention. MDIFW has management authority at the two largest of the state's nine known occurrences, Dwinal Pond Wildlife Management Area (Lee, Winn) and Mattagodus Meadows Wildlife Management Area (Webster Plt.), but no management activities specific to Clayton's copper have taken place. Since 1988, MDIFW has proposed to rebuild the dam on Mattakeunk Stream with a water control structure in order to stabilize water levels for wildlife management purposes at Dwinal Pond flowage. The existing dam, which was first built in 1851 to run a sawmill, has deteriorated and no longer holds water (Stevens and Burgason 1996). However, these plans have been postponed until potential long-term effects on Clayton's copper and other rare species present at Dwinal can be investigated.

In 1986, MDIFW provided funding from its Endangered and Nongame Wildlife Fund research grants program to the Maine Natural Heritage Program to assess the status of Clayton's copper in Maine. Through this grant, all known sites were visited to verify the butterfly's presence or absence, and a limited mark-recapture study was conducted at Bog Brook fen. In subsequent years (1987-91), with financial support from the Maine Chapter of The Nature Conservancy and the state's Office of Comprehensive Planning, MNHP staff conducted additional surveys for Clayton's copper in other potential habitats (Appendix I). In obligation to the 1986 grant, a final report summarizing the results of these studies was prepared for MDIFW (Albright 1991). About this same time, Clayton's copper was listed as a candidate (Category 2) for the federal Endangered Species List because of concern for its long-term viability given the

scarcity of existing sites, apparent loss of habitat, and minimal potential for discovering additional suitable habitats (Albright 1993).

In 1993, the Natural Heritage Program produced a status survey of Clayton's copper for the U.S. Fish and Wildlife Service (USFWS). MNHP's recommendations were to upgrade the butterfly's federal listing status to Category 1 based on its rarity and degree of threat (Albright 1993). In 1994, MDIFW received \$1,500 in federal funding (Section 6, Endangered Species Act) to address research and management of the Clayton's copper, which at the time remained a Category 2 species. These funds were contracted out for population studies at Dwinal Pond, but the data analysis and final report were never completed. In 1995, Congress abolished the federal candidate conservation lists. Since then, there has been little activity by the USFWS to advance listing proposals for invertebrates.

### Current Research and Management

During the summers of 1998, 1999, and 2000, several of the known occurrences for Clayton's copper were spot-checked for presence/absence of the butterfly, and to quickly assess current status of the habitat (Appendix I). In 1999 and 2000, MDIFW submitted a grant proposal to the Outdoor Heritage Fund (OHF) for moneys to revisit and assess status of the butterfly at all nine sites in Maine; survey potential habitats for new occurrences; foster landowner stewardship at all known occurrences; research the population status and habitat use of Clayton's copper at Dwinal Pond flowage; improve habitat quality at Dwinal by removing encroaching cedar from the wetland; and create additional habitat at Dwinal by managing uplands for the host plant. OHF awarded

partial funding (\$6254) for this proposal in May, 2000. The U.S. Fish and Wildlife Service has contributed an additional \$6500 towards Clayton's copper research and management for 2000-2001. With these resources, MDIFW plans to focus initial conservation and management efforts on the largest occurrence of Clayton's copper. Surveys, population assessments, and habitat management activities were initiated at Dwinal Pond flowage in July, 2000. Also, in anticipation of the need to clarify the subspecies status of Clayton's copper, approximately 40 individuals were collected from Dwinal and frozen for future DNA analysis when funding becomes available.

## HABITAT ASSESSMENT

### Past Habitat

Prior to the early 1980s, Clayton's copper was thought to be restricted to a small region of Maine east of Lincoln in the towns of Lee and Springfield. Historically, only about seven collection sites were known, all in this vicinity, and all characterized by early successional fields where shrubby cinquefoil had invaded. This atypical association with dry, upland habitat led early lepidopterists to presume a distinct subspecies status for this butterfly based solely on its apparent habitat preference, which was in contrast to the nominate subspecies, Dorcas copper, known to occupy bogs and fens. However, the region around Lee and Springfield contains a number of circumneutral wetlands that probably provided the seed source for the host plant to move up out of wetlands into a readily available habitat occurring after farms were left fallow (Albright 1993). The Clayton's copper would have then dispersed into the new cinquefoil stands from its original wetland habitat.

Without management, these old fields were likely able to support viable cinquefoil stands for only a few decades before being shaded out by competing trees and shrubs. By the mid 1980s, nearly all of the originally known locations for Clayton's copper had been lost to forest succession. Local collectors knew of only one remaining population where specimens could be reliably obtained, and a general concern about the long-term viability of the subspecies led to its listing as a Category 2 species by the USFWS.



## Current Habitat

Clayton's copper is currently known from ten sites — nine in Maine and one just over the border in New Brunswick, Canada. Habitat at all of these sites is characterized as circumneutral fen or bog, or streamside shrubland or meadow, which offer unshaded growing conditions for the cinquefoil. Only one site, Dwinal Pond flowage in Lee and Winn, is known to support large populations of both the butterfly and its host plant. Three sites (Mattagodus Meadows, Pickle Ridge, and Little Crystal Bog) may support medium-sized populations.

The remaining sites are all small (several acres or less) and support fewer Clayton's copper and shrubby cinquefoil. Several of these marginal sites have not been visited since the mid 1980s to early 1990s, and the status of both the habitat and the butterfly is unknown. Two sites are known to have been altered by beaver in the recent past: prior to the mid 1980s, the shrubby cinquefoil stand at Pickle Ridge Road was greatly reduced as a result of flooding from beaver activity (Albright 1993); and in 1997, the single New Brunswick site was also flooded. Although Clayton's copper apparently disappeared from the Pickle Ridge Road wetland after the flooding, water levels later receded enough to allow shrubby cinquefoil to re-invade. By the late 1990s, approximately 5-10 acres of cinquefoil were present and once again supporting a good population of Clayton's copper. The fate of the New Brunswick site is unknown, but it is believed to have persisted (Reggie Webster, personal communication).

The integrity of at least two other sites is potentially compromised by natural succession. At Dwinal Pond flowage, cedar have spread from the wetland perimeter in to the open fen and may ultimately result in a loss of cinquefoil (Rooney and Weber

1994). At Bog Brook fen — an upland sloping fen more susceptible to forest succession — cedar and other woody vegetation have invaded from adjacent abandoned pasture land and already reduced the amount of shrubby cinquefoil available to the butterfly (Albright 1993). Both of these sites would benefit greatly from management efforts to remove competing vegetation.

A portion of the existing habitat at Dwinal Pond flowage — the largest known population of Clayton's copper — would potentially be affected by proposed plans to rebuild a water control structure and stabilize water levels on Mattakeunk Stream for wildlife management purposes. However, MDIFW has postponed these plans until the potential effects of stabilizing the water level and options for habitat mitigation can be investigated. Removal of water for irrigation threatens another site (Gott Brook).

With additional survey effort, it is possible new occurrences of Clayton's copper may be found — particularly in relation to existing sites and in the gaps between occurrences. The use of GIS and other analytical mapping tools could be applied to identify the appropriate soil, vegetative, and hydrological characteristics where new cinquefoil stands might be found. However, large persistent stands of shrubby cinquefoil — as well as the circumneutral fen habitats which often support them — are uncommon in Maine. Only twelve circumneutral fens are currently documented in the state, and shrubby cinquefoil is not present at all of those sites (Andy Cutko, Maine Natural Areas Program, personal communication). Clayton's copper is also not known to occur everywhere its host plant is found. Surveys by Albright during 1986-92 found Clayton's copper present at six of ten sites where shrubby cinquefoil was present (Albright 1993). All but two of these sites were marginal in the population size of both

butterfly and host plant, and three of the six were located in close proximity to existing populations. It is likely there are other as yet unknown factors (i.e. hydrology, topography, watershed area, etc.) besides presence of host plant that determine the suitability of a site for Clayton's copper.

### Habitat Projection

The future of this species and its habitat likely depends on the ability of state wetland statutes to maintain the natural productivity and ecological integrity of existing suitable wetlands. In addition, management efforts to curtail encroachment of woody vegetation before the host plant is out-competed will be necessary to preserve the integrity of some sites. Streamside occurrences are vulnerable to flooding by beaver activity and need to be regularly monitored to ensure shrubby cinquefoil stands are not lost to rising water levels. Drawdowns for irrigation purposes can also alter habitat characteristics and threaten the longevity of host plant stands. Management efforts to both improve existing cinquefoil stands and establish new ones could potentially increase the amount of habitat available to the butterfly at nearly all of the sites. However, our current understanding of the plant's specific life history requirements, as well as management and propagation potential, is limited.

The three best sites for Clayton's copper (Dwinal Pond flowage, Mattagodus Meadows, and Crystal Bog) are under conservation ownership (MDIFW, The Nature Conservancy) and have the greatest potential to be managed to maintain or enhance populations of the butterfly. However, the remaining six sites are on private lands, including several on industrial forest lands. The long-term viability of these sites, and

therefore the butterfly, will be dependent upon cooperative management agreements to successfully conserve this species for the future.

## POPULATION ASSESSMENT

### Past Populations

Past populations of Clayton's copper are largely unknown in Maine. Historically, the butterfly was known only from about seven old field collection sites in a restricted area around Springfield and Lee. In a mid-1980s interview, L. Paul Gray recalled being able to take "hundreds" of specimens from these locations "years ago" (Albright 1993). By the early 1980s, however, all but one of these upland sites had been lost to forest succession. It is likely that early lepidopterists were decoyed away from the more exemplary wetland sites by a presumed upland habitat association.

### Current Populations

Clayton's copper is currently known from only ten sites worldwide — nine in Maine and one in western New Brunswick. All but a few of these populations are believed to be small, both in amount of habitat available and number of butterflies supported. Large stands of the host plant, shrubby cinquefoil, are uncommon in Maine, and it is unlikely that many more — if any — large populations of Clayton's copper will be discovered. Additional survey work is necessary, however, and it is possible that new populations could be found — particularly in relation to existing occurrences, and in gaps between. In July, 2000, MDIFW initiated efforts to assess and monitor the butterfly's population at Dwinal Pond flowage - the largest known occurrence.

## Population Projections

In general, if wetland habitat is protected at each site, it is likely most of the existing populations will remain secure for at least the next decade. However, at least two of the known sites, if not managed in the near future, are in danger of being compromised by or lost to forest succession. Proposed water level stabilization may affect a portion of habitat at the largest Clayton's copper site. Removal of water for irrigation potentially threatens another site. Without dedicated management and monitoring activities, deteriorated water quality, flooding by beaver or artificial dams or impoundments, dredging, draining, or filling of wetlands, and forest succession would all be expected to reduce or extirpate populations of the host plant, and therefore potentially eliminate Clayton's copper at any of the ten known sites.

Management to increase the amount of shrubby cinquefoil present at known sites, or to create new stands in proximity to existing Clayton's copper populations, could be a potential method of expanding the butterfly's numbers. Translocation of individuals to suitable yet previously unoccupied habitats is also a potential method for increasing the numbers and occurrences of Clayton's copper, if warranted under an approved recovery plan. However, limiting factors, as well as natural population fluctuations for this insect, are unknown. It is probable that, within certain distances and under the right conditions, individuals from stable source populations can colonize new habitats or repopulate nearby extirpated habitats once the host plant is reestablished. An investigation of population viability and the dynamics and genetic relationships between existing populations would greatly enhance our understanding of how

Clayton's copper is distributed, its potential for natural population expansion, or its risk of extinction.

### Limiting Factors

Clayton's copper is an obligate larval feeder. Its only known host plant is the shrubby cinquefoil. Threats to the butterfly must also include any threats to its host plant. In addition to pollutants (ie. chemical spills, agricultural runoff, etc.) that might threaten water quality and affect all species, Clayton's copper is vulnerable to activities that alter the water level and eliminate its host plant. Flooding of cinquefoil stands by beaver, artificial impoundment, or other events during the egg, larval, or pupal stages could potentially drown individuals and reduce or eliminate Clayton's copper from a site. Aerial insecticide spraying (i.e. for gypsy moth or spruce budworm) could also directly harm this species. Although collecting is not known to have been an issue, illegal poaching could pose a threat should a demand for specimens arise.

## USE AND DEMAND ASSESSMENT

Prior to its listing as a state-endangered species in 1997, Clayton's copper — like most rare invertebrate species — had largely gone unnoticed by the general public. Until the mid 1980s, when the butterfly's rarity and potential threats to its habitat were recognized by state and federal wildlife agencies, only a handful of amateur lepidopterists who pursued the butterfly for study and their personal collections likely even knew the subspecies existed. Today, even with its endangered species status, Clayton's copper is still unknown to most of Maine's citizens due to its extreme rarity and localized distribution.

Public outreach to increase the awareness and appreciation of Clayton's copper could increase the use and demand for this rare butterfly from a larger segment of the public. An estimated 91% of Maine's adult citizens engaged in some nonconsumptive use of wildlife and expended more than \$50 million in 1988 (Boyle *et al.* 1990). As the popularity of photography and nature study and appreciation grows, and as awareness of the diversity of Maine's wildlife resources grows, the demand for observational and photographic use of rare species, such as endangered or threatened invertebrates, will increase. As interest in these species intensifies, there will likely be increased public demand for interpretive and educational materials to explain and justify species and habitat protection measures. Moderate increases in recreational activity in wetlands will unlikely influence rare invertebrates. Recreational experience of some boaters and anglers will be heightened simply by knowing the Clayton's copper coexists in the same wetlands.



Increasing numbers of U.S. citizens desire preservation of the greatest diversity of species possible, at state, national, and global levels (Kellert 1980). These desires are based on increasing public perception of scientific, utilitarian, and cultural values of biological diversity, as well as ethical arguments for preserving plant and animal species that are endangered by the actions of human society. At the state level, public support for preserving biodiversity in Maine is growing and is reflected in strong state legislation to protect endangered and threatened wildlife and their habitats. Regardless of the appeal and familiarity of an individual species, public demand for the conservation of rare species, especially those listed as endangered or threatened, is unequivocally mandated in the preamble to the Maine Endangered Species Act of 1975:

“The Legislature finds that various species of fish or wildlife have been and are in danger of being rendered extinct within the State of Maine, and that these species are of aesthetic, ecological, educational, historical, recreational, and scientific value to the people of the State. The Legislature, therefore, declares that it is the policy of the State to conserve, by according such protection as is necessary to maintain and enhance their numbers, all species of fish or wildlife found in the State, as well as the ecosystems upon which they depend.”

As such, MDIFW is committed to preserving the diversity of all wildlife in the state and is entrusted with the preservation of Maine's natural heritage for future generations. This responsibility is manifested by an increasing commitment to management and research programs that protect and enhance endangered and threatened species of all taxa. The protection and ecological understanding of inconspicuous species, such as Clayton's copper, are vital to proper ecosystem management and to the preservation of Maine's natural heritage. The Clayton's copper butterfly contributes to the biological diversity of our state, and its presence adds to the ecological value of Maine's wetlands.

## SUMMARY AND CONCLUSIONS

Clayton's copper (*Lycaena dorcas claytoni*) is evidently a geographically restricted, disjunct subspecies, occupying a small area centered in eastern Penobscot County, Maine. It is currently known from only ten sites worldwide — nine in Maine and one in extreme western New Brunswick — and only a few of these sites support relatively large populations. This butterfly is found only in association with its single larval host plant, the shrubby cinquefoil (*Potentilla fruticosa*), an uncommon calciphile with a scattered distribution in Maine. Shrubby cinquefoil is typically found at the upland edge of calcareous wetlands, and relatively few large stands exist in the state.

Because of its near endemic status, limited number of occurrences, and rare habitat association, the Clayton's copper was listed as endangered in Maine in 1997 and is protected by the Maine Endangered Species Act. To date, Clayton's copper has received little management attention. Many of its occurrences have not been visited for more than a decade, and the status of both habitat and butterfly at these sites is unknown. It is possible new populations may be discovered, and additional survey work is necessary to fully document the distribution and status of Clayton's copper.

plant and butterfly. A proposal to rebuild a water control structure and stabilize water levels could potentially affect a portion of Maine's best Clayton's copper site. Research is needed to understand the specific habitat requirements of both Clayton's copper and shrubby cinquefoil, as well as their response to hydrological changes and management actions.

The taxonomic distinctness of Clayton's copper as a subspecies needs to be clarified and documented. Likewise, basic life history information should be investigated for both butterfly and host plant. In particular, the population viability criteria, and dynamics, movements, and genetic relationships between populations of Clayton's copper need to be researched to enhance understanding of distribution, dispersal and exchange, and conservation potential. A long-term monitoring program should be developed at all known occurrences to monitor status and trends. Potential threats and limiting factors need to be identified, and management strategies to improve existing or create new habitat, as well as enhance populations, need to be investigated and implemented.

Public outreach, particularly with landowners, about Clayton's copper is critical to ensuring support for this endangered species. Securing cooperative management agreements with landowners to protect and manage the butterfly's habitat will be essential to assure the future of Clayton's copper as part of Maine's — and the world's — natural heritage.

## LITERATURE CITED

- Albright, J.J. 1991. A survey of selected rare invertebrates of Maine. Unpublished report to the Maine Department of Inland Fisheries and Wildlife, Endangered and Nongame Wildlife Fund Grant Program. 26 pp.
- \_\_\_\_\_. 1993. Status survey of *Lycaena dorcas claytoni* (Brower) Clayton's copper butterfly. Unpublished report to the Maine Natural Heritage Program, Office of Community Development. 25 pp.
- Boyle, K.J., S.D. Reiling, M. Tiesl, and M.L. Phillips. 1990. A study of the economic impact of game and non-game species on Maine's economy. Staff Paper No. 423, Dept. of Agriculture and Resource Economics, University of Maine. 119 pp.
- Brower, A.E. 1940. Descriptions of some new Macrolepidoptera from Eastern America. *Bulletin of the Brooklyn Entomological Society* 35:138.
- Howe, W.H. 1975. *The Butterflies of North America*. Doubleday and Co. Garden City, New York. 633 pp.
- Jones, J. 1986. The cumulative impacts of development in southern Maine: important wildlife habitats. Maine State Planning Office, Augusta, ME 70 pp.
- Kellert, S.R. 1980. Public attitudes towards critical wildlife and natural habitat issues. U.S. Govt. Printing Office, Wash., D.C.
- Klots, A.B. 1951. *A field guide to the butterflies of North America, east of the Great Plains*. Houghton Mifflin Company. Boston. 349 pp.
- Layberry, R.A., P.W. Hall, and J.D. LaFontaine. 1998. *The butterflies of Canada*. University of Toronto Press. Toronto. 280pp.
- McMahon, J.S., G.L. Jacobson, Jr., and F. Hyland. 1990. An atlas of the native woody plants of Maine: a revision of the Hyland maps. *Maine Agr. Exp. Sta. Tech. Bull.* 830. Univ. of Maine. Orono, Maine. 260 pp.
- NatureServe: An online encyclopedia of life. 2000. Version 1.1. Arlington, VA, USA: Association for Biodiversity Information. Available: <http://www.natureserve.org/>.
- Opler, P.A. and G.O. Krizek. 1984. *Butterflies east of the great plains*. John Hopkins University Press. Baltimore. 294 pp.
- \_\_\_\_\_ and V. Malikul. 1992. *A field guide to eastern butterflies*. Peterson Field Guide Series. Houghton Mifflin Company. Boston. 396 pp.

- Opler, P.A., H. Pavulaan, and R. Stanford (coordinators). 1995. Butterflies of North America. Jamestown, ND : Northern Prairie Wildlife Research Center Home Page. <http://www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/bflyusa.htm> (Version 17AUG2000).
- Rooney, S.C. and J.E. Weber. 1994. Botanical assessment of vegetation changes following proposed dam reconstruction at Dwinal Flowage. Unpublished report to Maine Department of Inland Fisheries and Wildlife.
- Scott, J.A. 1986. The butterflies of North America. Stanford University Press. Stanford, California. 583 pp.
- Stevens, K.C. and B.N. Burgason. 1996. Management Plan for Dwinal Pond Wildlife Management Area *in* Planning for Maine's Inland Fish and Wildlife 1996-2001. Vol.1 Wildlife, Part 4.4: p1454-1505. Maine Department of Inland Fisheries and Wildlife, Augusta, ME.
- Thomas, A.W. 1991. Life across the border. *Journal of the Lepidopterists' Society*. 45(2):180.
- Tiesl, M.F. and K.J. Boyle. 1998. The economic impacts of hunting, inland fishing, and wildlife-associated recreation in Maine. Staff Paper No. 479, Department of Resource Economics and Policy, University of Maine. 7pp.
- Widoff, L. 1988. Maine Wetlands Conservation Plan. Maine State Planning Office, Augusta, ME. 91 pp.
- Wisconsin Department of Natural Resources World Wide Web site. Available: <http://www.dnr.state.wi.us/>.

**APPENDIX I. SITES SURVEYED FOR CLAYTON'S COPPER IN MAINE (current as of 9/00)**

SITE	TOWN	COUNTY	DATE	<i>P. fruticosa</i>	<i>L. d. claytoni</i>		COMMENTS
			SURVEYED	PRESENT	PRESENT	ABSENT	
Bog Brook Fen	Springfield	Penobscot	1950	Yes	X		Hundreds Still healthy pop. 106+ ---
			10/07/85	Yes	X		
			8/07/86	Yes	X		
			Summer 1998	Yes	X		
Bog Brook Flowage	Springfield	Penobscot	1986-1990	No		X	---
Carlton Bog	Molunkus Twp	Aroostook	1986-1990	No		X	---
Contrary Brook Bog	Winn	Penobscot	1992	Yes		X	---
Dwinal Pond flowage	Lee/Winn	Penobscot	8/05/87	Yes	X		Abundant
			Summer 1988	Yes	X		Abundant
			Summer 1994	Yes	X		Abundant
			Summer 1998	Yes	X		---
			7-9/2000	Yes	X		Abundant
Gott Brook	Springfield	Penobscot	8/05/86	Yes	X		100 (estimate) only 1 seen, host plant reduced? ---
			Summer 1998	Yes	X		
Greene Field	Greene	Androscoggin	1992	Yes		X	---
Little Crystal Bog	Crystal	Aroostook	1986	Yes		X	--- Several females ---
			8/16/91	Yes	X		
			Summer 2000	Yes	X		
Mattagodus Meadows	Webster Plt	Penobscot	8/28/89	Yes	X		Abundant
			Summer 1999	Yes	X		---
			8/10/2000	Yes	X		---
Mattagodus Stream	Prentiss	Penobscot	8/09/89	Yes	X		Only one (1) seen
Mattawamkeag River	Drew Plt/ Kingman Twp	Penobscot	1986-1990	No		X	---
Pickle Ridge	Springfield	Penobscot	8/07/86	Yes	X		12
			Summer 1999	Yes	X		---
			8/10/2000	Yes	X		---
Pillsbury Pond	T8 R11 WELS	Piscataquis	1985	Yes	X		About 25 12 females
			8/11/91	Yes	X		
Portage Lake	Portage Lake	Aroostook	1991	Yes		X	---
Reed Deadwater	North Yarmouth Academy Grant	Aroostook	1986-1990	No		X	---
St. John River/Ferry Beach	Big Black Rapids	Aroostook	1991	Yes		X	---
Soper Pond	Soper Mtn	Piscataquis	8/06/92	Yes	X		Common
Thompson Deadwater	Reed Plt/Upper Molunkus Twp	Aroostook	1986-1990	No		X	---