

**V(A). Planned Program (Summary)**

**Program # 1**

**1. Name of the Planned Program**

Natural Resources

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			1%	
111	Conservation and Efficient Use of Water			4%	
112	Watershed Protection and Management			4%	
123	Management and Sustainability of Forest Resources			6%	
133	Pollution Prevention and Mitigation			6%	
134	Outdoor Recreation			3%	
135	Aquatic and Terrestrial Wildlife			47%	
136	Conservation of Biological Diversity			2%	
201	Plant Genome, Genetics, and Genetic Mechanisms			5%	
206	Basic Plant Biology			9%	
402	Engineering Systems and Equipment			9%	
608	Community Resource Planning and Development			4%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	9.0	0.0
Actual	0.0	0.0	7.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	361485	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	685259	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Conduct research on Maine's ground water and surface water resources. Conduct research on Maine native animal and plant species and their habitats. Investigate soil-landscape relationship in coastal ecosystems. Publish peer-reviewed journal articles and other publications concerning research. Present findings at professional meetings and at other venues.

**2. Brief description of the target audience**

Other scientists in plant biology, marine biology, animal biology, evolutionary biology, aquaculture, phycology, molecular biology; teachers at all levels; directors of aquariums and museums, exhibit halls, etc.; cancer biologists and pharmaceutical companies; endangered species biologists/managers; policy makers; state regulatory agencies; environmental consultants

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	0	0	0	0
<b>Actual</b>	0	0	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year: 2010  
 Plan: 0  
 Actual: 2

**Patents listed**

Xinfeng Xie and Barry Goodell. 2010. Preparation of Algal Cells for Bio-Oil Extraction. Provisional application. Serial No: 61/381590.

Xinfeng Xie and Barry Goodell. 2010. Highly Ordered Mesoporous Carbon from Lignocellulosic Materials. Provisional application. Serial No: 61/381562.

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2010	Extension	Research	Total
Plan	0	16	
Actual	0	29	29

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- # of other types of publications

Year	Target	Actual
2010	14	15

**Output #2**

**Output Measure**

- # of papers presented at professional meetings

Year	Target	Actual
2010	38	70

**Output #3**

**Output Measure**

- # of research projects completed

Year	Target	Actual
2010	3	3

**Output #4**

**Output Measure**

- # of computer program to simulate borehole flow in a well intersected by discrete zones with different far-field hydraulic heads and transmissivities

Year	Target	Actual
2010	{No Data Entered}	1

**Output #5**

**Output Measure**

- New techniques for culturing kleptoplastic sea slugs in the laboratory

Year	Target	Actual
2010	{No Data Entered}	0

**Output #6**

**Output Measure**

- # of vernal pool assessment protocol for loggers

Year	Target	Actual
2010	{No Data Entered}	1

**Output #7**

**Output Measure**

- # of Maine towns for which MAFES scientists conducted vernal pool assessments in 2010, assessing hundreds of vernal pools

Year	Target	Actual
2010	{No Data Entered}	5

**Output #8**

**Output Measure**

- # of training and informational workshops in 8 Maine towns in 2010--vernal pool training workshops to land trusts, tax assessors, and foresters. Trainings are both indoor and field based.

Year	Target	Actual
2010	{No Data Entered}	14

**Output #9**

**Output Measure**

- Educational materials on vernal pools for the US Army Corps of Engineers available on their website

Year	Target	Actual
2010	{No Data Entered}	0

**Output #10**

**Output Measure**

- Genomic and transcriptomic sequence data from Elysia chlorotica

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2010	{No Data Entered}	0

**Output #11**

**Output Measure**

- Amount of extramural funding awarded to faculty working in this program area during university fiscal year 2010

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2010	{No Data Entered}	1525528

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	# of new software programs created to evaluate borehole flow profile data collected using borehole geophysics
2	# of new ground-water-modeling programs created to simulate ground-water flow
3	# of people developing a better understanding of patterns of adaptive divergence in wild fish populations and the relevance of evolution in fish conservation management, annually
4	Develop industry understanding of the use of Near-IR information in the processing of woody biomass (%)
5	Industry demonstrations of the operation of NIRS on processing woody biomass (%)
6	Industry modifications of current (2007) processing lines to adopt to new NIRS-based technologies (%)
7	# of streams identified as promising or critical candidates for native salmonine conservation, based on potential perturbation from invasive species and/or riparian zone management
8	# of natural resource managers or biologists incorporating research results on conservation of native fishes into official policy and management plans
9	# of people improving their knowledge about the role of nutrients in stream health
10	Number of management agencies using empirical data and model systems to draft recommendation on fish management and conservation
11	Percentage savings for the U.S. government in the cost of estimating the number of harbor seals after a new protocol for estimating the number of harbor seals has been adopted as a standard for the Northeast.
12	Recovery actions will be implemented to conserve the endemic Clayton's copper butterfly and its habitat
13	# of local, state or federal agencies implementing management plans for Atlantic salmon
14	Increase in the distribution and abundance of migratory fish in Maine
15	Population monitoring plan will be instituted for the long-term use of the Maine Dept. of Inland Fisheries & Wildlife biologists to ensure the conservation and recovery of Clayton's copper butterfly
16	Identifying partial genes for plant nuclear-encoded photosynthesis proteins
17	Effect of dam removals on fish populations

18	Number of people developing a better understanding of population boundaries of harbor seals in the western North Atlantic
19	Number of management agencies using information on assessment of population abundance, movement and habitat of shortnose and Atlantic sturgeon in the Penobscot River System
20	Number of NGOs using information on assessment of population abundance, movement and habitat of shortnose and Atlantic sturgeon in the Penobscot River System
21	Increased understanding of how migratory bird populations are regulated throughout the annual cycle
22	Protection of key migratory flyways and associated stopover sites along the Maine coastal and offshore islands

**Outcome #1**

**1. Outcome Measures**

# of new software programs created to evaluate borehole flow profile data collected using borehole geophysics

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2010	1	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Domestic wells typically penetrate into the bedrock and extract ground water from fractures. These wells are threatened by a variety of human activities. Once contaminated, a detailed understanding the ground-water hydraulics of fractured bedrock aquifers is required to predict ground-water flow direction and identify potential receptors. This project will focus on several Maine DOT facilities where deicing salts appear to have contaminated the fractured bedrock aquifer. Borehole geophysics will be used to characterize the ground-water flow and distribution of road deicing salt within boreholes at these sites. Computer programs will be used to simulate the ground-water flow and solute transport within a borehole and within a fracture network and compared to the hydrologic and chemical data to create conceptualized ground-water flow and solute transport computer models of these sites.

**What has been done**

MAFES scientists developed a computer program to simulate borehole flow in a well intersected by fractures with different far-field hydraulic heads and transmissivities.

**Results**

Results from the Jonesboro, Maine, study area, the location of a deicing salt release, illustrate the extreme heterogeneity in fractured bedrock systems.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
133	Pollution Prevention and Mitigation

**Outcome #2**

**1. Outcome Measures**

# of new ground-water-modeling programs created to simulate ground-water flow

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2010	1	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Transmissivity and far-field hydraulic head for individual fractures can be quantified by calibrating a model of a borehole to measured flow profiles by varying these two hydraulic properties.

**What has been done**

To verify the borehole flow model is working properly, MAFES scientists analyzed published borehole flow data using this model and compared the results were to published estimates of fracture transmissivity and far-field hydraulic head. The scientists interfaced the calibration process, previously completed through a trial-and-error process, with optimization routines that automate this process.

**Results**

Initial efforts to optimize borehole flow models required computing times ranging from about 12 hours to several days. Recently, new nonlinear optimization routines have been utilized that are much more efficient, reducing the time required to optimize a borehole flow model to about 2

hours.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
133	Pollution Prevention and Mitigation

#### Outcome #3

##### 1. Outcome Measures

# of people developing a better understanding of patterns of adaptive divergence in wild fish populations and the relevance of evolution in fish conservation management, annually

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	200	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Preservation of adaptive variation within and among populations is an important element of many conservation and management programs. However, little is generally known about adaptive diversity in many species of practical concern or the best approaches to maintain such diversity. Indeed, the implications of most conservation and management schemes for adaptive variation are largely untested. This work characterizes potential adaptive variation in Maine salmonids and employs simulation and biological model systems to understand management implications for preserving adaptive variation in Maine fishes and other species in general.

###### **What has been done**

MAFES fishery biologists have examined the adaptive trait variation in Maine fishes of conservation or recreational concern, and on the use of model systems for exploring evolutionary implications of management and conservation strategies.

###### **Results**

In 2009 the scientists published a paper showing that harvest by humans drives faster rates of evolution than found in nature or other contexts involving human disturbance. This paper has already been cited 27 times, hinting at the impact it is currently having on the minds developing

harvest policy worldwide. Recent findings from their guppy model system suggest that genetic diversity within species can have profound effects on population and ecosystem function. In total, this theoretical and model work, particularly the eco-evolutionary frameworks that they have developed, have begun to gather significant attention within the applied fields of conservation, resource management and beyond. Indeed, in the last year the scientists have been invited to present their insights in keynote talks, and summits in the U.S. and abroad.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

#### Outcome #4

##### 1. Outcome Measures

Develop industry understanding of the use of Near-IR information in the processing of woody biomass (%)

Not Reporting on this Outcome Measure

#### Outcome #5

##### 1. Outcome Measures

Industry demonstrations of the operation of NIRS on processing woody biomass (%)

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	20	20

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Rapid near real-time capabilities using in-process-line sensors are needed to replace slower off-line wet chemistry methods. Near-infrared spectroscopy (NIRS) offers one option for consideration.

###### **What has been done**

MAFES researchers have developed NIR techniques to successfully determine concentrations of useful sugars such as Xylan and Glucomannan, as well as components that may be harmful to the bio-refinery process, like lignin.

**Results**

Knowing the concentration of these components is fundamental to in-line decision making and full use of the extracts.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
402	Engineering Systems and Equipment

**Outcome #6**

**1. Outcome Measures**

Industry modifications of current (2007) processing lines to adopt to new NIRS-based technologies (%)

Not Reporting on this Outcome Measure

**Outcome #7**

**1. Outcome Measures**

# of streams identified as promising or critical candidates for native salmonine conservation, based on potential perturbation from invasive species and/or riparian zone management

Not Reporting on this Outcome Measure

**Outcome #8**

**1. Outcome Measures**

# of natural resource managers or biologists incorporating research results on conservation of native fishes into official policy and management plans

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2010	1	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Maine harbors the only wild Atlantic salmon and is the last stronghold for wild brook trout in the U.S. Both fish are important to anglers; securing healthy, fishable populations is a top management goal and sound economic policy. Sportfishing in Maine provides \$250 million in economic output, \$18 million in tax revenue, and 3,200 jobs; 279,000 people hold Maine fishing licenses. The persistence of these, and other, fishes is threatened by many factors, including habitat alteration and competition from exotic species, such as small-mouth bass. While the spread of exotic small-mouth bass throughout Maine waters is alarming, this fish is popular with

#### What has been done

MAFES scientists have designed a project to provide fisheries managers with the information required to improve native fisheries while balancing conflicting objectives of varied resource users.

#### Results

To answer questions about the species' coexistence, the researchers have learned about the interactions between exotic small-mouth bass and native Atlantic salmon in nursery streams. They've found that small-mouth bass compete for habitat with Atlantic salmon, but only at certain life stages and seasons. This competition, however, is likely to occur during the summer when Atlantic salmon face stress from limited habitat and high temperatures already. State fisheries managers can use these results in planning stocking, regulations, habitat improvement, and mitigation measures.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

#### Outcome #9

##### 1. Outcome Measures

# of people improving their knowledge about the role of nutrients in stream health

Not Reporting on this Outcome Measure

#### Outcome #10

##### 1. Outcome Measures

Number of management agencies using empirical data and model systems to draft recommendation on fish management and conservation

Not Reporting on this Outcome Measure

**Outcome #11**

**1. Outcome Measures**

Percentage savings for the U.S. government in the cost of estimating the number of harbor seals after a new protocol for estimating the number of harbor seals has been adopted as a standard for the Northeast.

Not Reporting on this Outcome Measure

**Outcome #12**

**1. Outcome Measures**

Recovery actions will be implemented to conserve the endemic Clayton's copper butterfly and its habitat

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2010	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**  
{No Data Entered}

**What has been done**  
{No Data Entered}

**Results**  
{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**Outcome #13**

**1. Outcome Measures**

# of local, state or federal agencies implementing management plans for Atlantic salmon

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2010	0	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**Outcome #14**

**1. Outcome Measures**

Increase in the distribution and abundance of migratory fish in Maine

Not Reporting on this Outcome Measure

## **Outcome #15**

### **1. Outcome Measures**

Population monitoring plan will be instituted for the long-term use of the Maine Dept. of Inland Fisheries & Wildlife biologists to ensure the conservation and recovery of Clayton's copper butterfly

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2010	0	2

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Clayton's copper butterfly is listed as endangered in Maine and is known from only 13 sites globally (in Maine and New Brunswick, Canada). The population size has only been estimated at one of these sites in Maine. The taxonomic distinctiveness of Clayton's copper butterfly from the nominate species, Dorcas copper, is controversial which affects its status at the global level.

#### **What has been done**

MAFES scientists are working to clarify its taxonomic status, develop a statewide monitoring plan and baseline population estimate, determine the population structure of the butterfly and its host plant in Maine, and analyze the wetland habitat dynamics.

#### **Results**

Their ongoing analysis of habitat characteristics required by the state-endangered Clayton's copper butterfly is being used to modify the approach to habitat management by the Maine Department of Inland Fisheries and Wildlife at two state Wildlife Management Areas, and by The Nature Conservancy and the U.S. Fish & Wildlife Service at two important Nature Conservancy sites, one of which is also crucial for a federally endangered species of orchid.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife

## **Outcome #16**

### **1. Outcome Measures**

Identifying partial genes for plant nuclear-encoded photosynthesis proteins

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2010	{No Data Entered}	2

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Photosynthesis is the primary determinant of crop productivity. It is the single process on earth that converts sunlight into biomass, sequesters atmospheric CO<sub>2</sub> into carbohydrates, and liberates O<sub>2</sub>. Photosynthesis and the formation of food, fiber, and biomass are dramatically limited by environmental, biochemical, and genetic constraints. Alleviation of some or all of these constraints could lead to substantial increases in plant productivity. As part of Multistate Project NC1168: Regulation of photosynthetic processes, MAFES scientists are working with highly productive photosynthesis investigators from across the country in an integrated effort to broaden our understanding of this critically important process.

#### **What has been done**

The scientists have been working to identify regulatory pathways by which plastid biogenesis and photosynthetic functions are modulated and studying direct signaling pathways and photosynthetic protein transfer between chloroplasts and the nucleus.

#### **Results**

: MAFES scientists have recently identified two partial genes for plant nuclear-encoded photosynthesis proteins, the photosystem II Mn-stabilizing protein (psbO) and the Calvin Cycle enzyme phosphoribulokinase (prk), in the sea slug's DNA. Further identification of DNA elements that have been horizontally transferred to the sea slug is one component to understanding the host cell nuclear contribution to maintaining the engulfed plastids. Another key component is to identify and characterize the chloroplast proteome in the sea slug over the entire life-cycle to better understand the role of the nucleus in chloroplast gene expression and the stability of chloroplast proteins. Kleptoplastic sea slugs potentially have a direct bearing on human health, through their production of anti-cancer/tumor compounds, as models for immuno-therapy and drug delivery, and for their glaring absence of an immune-rejection response. All of these properties may be related to additional symbiotic associations the sea slug forms with various

bacterial species that we have identified through next generation sequencing.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology

**Outcome #17**

**1. Outcome Measures**

Effect of dam removals on fish populations

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2010	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Maine harbors the only wild Atlantic salmon and is the last stronghold for wild brook trout in the U.S. Both fish are important to anglers; securing healthy, fishable populations is a top management goal and sound economic policy. Sportfishing in Maine provides \$250 million in economic output, \$18 million in tax revenue, and 3,200 jobs; 279,000 people hold Maine fishing licenses. Maine citizens derive sociological and aesthetic benefits from healthy, intact waters that support wild Atlantic salmon, brook trout, and other native species. Historically, Atlantic salmon and brook trout have been harmed by forest clearing and dam-building, but now there is interest in reforestation and dam removal.

**What has been done**

MAFES researchers have been monitoring the effect of dam removals on resident fishes in Sedgeunkedunk Stream in Brewer, Maine.

**Results**

Their early results show distinct patterns in stream fish metrics over time and space due to the presence of a dam, and immediately after dam removal they saw drastic changes, including sea lamprey, juvenile Atlantic salmon, and alewife moving upstream into previously inaccessible habitat. The consistency in metrics over time and space, coupled with drastic changes after dam

removal, suggest that this study will help scientists predict how other streams will respond to impending dam removal. Fisheries managers can use this information in future planning. This project's partnership with federal, state, and local governments and the public provides a model of how strong community involvement can drive river restoration.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

#### Outcome #18

##### 1. Outcome Measures

Number of people developing a better understanding of population boundaries of harbor seals in the western North Atlantic

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	100

##### 3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

**What has been done**

**Results**

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

## **Outcome #19**

### **1. Outcome Measures**

Number of management agencies using information on assessment of population abundance, movement and habitat of shortnose and Atlantic sturgeon in the Penobscot River System

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2010	{No Data Entered}	1

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

#### **What has been done**

#### **Results**

MAFES research on the abundance and movement patterns of shortnose and Atlantic sturgeon has been extensively used in guiding recent federal permitting and monitoring in association with development and remediation activities in the Penobscot River corridor. The work has revealed unappreciated metapopulation connections among sturgeon in Maine, leading to a much broader conceptualization of conservation units and their critical habitat

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife

## **Outcome #20**

### **1. Outcome Measures**

Number of NGOs using information on assessment of population abundance, movement and habitat of shortnose and Atlantic sturgeon in the Penobscot River System

### **2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2010	{No Data Entered}	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

oMAFES research on the abundance and movement patterns of shortnose and Atlantic sturgeon has been extensively used in guiding recent federal permitting and monitoring in association with development and remediation activities in the Penobscot River corridor. The work has revealed unappreciated metapopulation connections among sturgeon in Maine, leading to a much broader conceptualization of conservation units and their critical habitat.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**Outcome #21**

**1. Outcome Measures**

Increased understanding of how migratory bird populations are regulated throughout the annual cycle

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
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2010      {No Data Entered}      0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Wildlife abundance depends on resource availability and quality. How these factors influence individual growth, breeding success, and survival are largely unknown for many species and difficult to quantify. Physiologic indicators of individual condition are needed to understand how Maine's wildlife are responding to events that occur before and after they arrive in Maine.

**What has been done**

MAFES researchers have focused on behavioral and physiological differences in migratory strategies of a long-distance migrant, the Blackpoll Warbler, and a facultative short-distance migrant, the Yellow-rumped Warbler. The scientists examined the behavioral and endocrine aspects of migration physiology and how variation in these processes may reflect different migration strategies.

**Results**

A significant amount of information collected during this project has been incorporated into the species account for the Blackpoll and Yellow-rumped warblers in the Cornell Lab of Ornithology/American Ornithologists' Union sponsored Birds of North America online (<http://bna.birds.cornell.edu/bna/>) resource for life histories of birds and "Birdlife of the Churchill Region: Status, History, Biology" by JR Jehl, Jr., 2004. Trafford Publ. Co.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife

**Outcome #22**

**1. Outcome Measures**

Protection of key migratory flyways and associated stopover sites along the Maine coastal and offshore islands

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Millions of migratory bird species pass through Maine on their journey between their breeding and wintering grounds. While these birds that travel well beyond the Gulf of Maine are good at what they do, it might not take much more than one thing, such as loss of critical migratory habitat in addition to loss of wintering and breeding areas, to push them over a threshold at which they can no longer sustain their populations. In Maine, they face potential hazards during their migration from land development along the coastline and the development of coastal or near-shore areas for sources of wind energy.

#### What has been done

Faculty and student researchers from UMaine are part of the Northeast Regional Migration Monitoring Network, a cooperative of Canadian and U.S. nonprofit organizations, government agencies and university researchers. The Network has spent the last two years trying to determine how migrating species use the Gulf of Maine's complex network of islands and coastal areas. Using a combination of decades-old monitoring techniques and newer technologies, Network researchers are examining migratory movements made by both large groups of birds and individuals.

#### Results

The researchers now believe they may have discovered a previously unknown, but potentially important flyway that songbirds are using as a shortcut across the Gulf of Maine during fall migration. During a bird banding study on several national wildlife refuge islands last fall, more than 6,000 songbirds representing 75 species were captured, far exceeding the number captured at long-running banding stations elsewhere. The researchers estimate that up to a half million or more songbirds could be using the Metinic Island area on their way from the Canadian Maritimes to the southern Maine mainland. The five most abundant songbird species caught on Metinic, Seal and Petit Manan islands were Myrtle Warbler, Savannah Sparrow, Common Yellowthroat, White-throated Sparrow and Red-eyed Vireo.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (new invasive species)

### **Brief Explanation**

{No Data Entered}

## **V(I). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)
- Comparison between locales where the program operates and sites without program intervention

### **Evaluation Results**

{No Data Entered}

### **Key Items of Evaluation**

{No Data Entered}