

HB

89

<TARGET><BILL>HB 89</BILL><SUBJECT>HB
89</SUBJECT><COMM>HFSH28</COMM></TARGET>

Alaska State Legislature

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REPRESENTATIVE Paul Seaton

District 30

Sponsor Statement

HB 89

Didemnum vexillum (Dvex), also known as Sea Vomit, is an aggressive tunicate invader that grows rapidly and has few known natural predators. It creates metabolic toxins that help it smother substrates and other organisms to create monoculture infestations from intertidal, subtidal to deep sea habitats. As demonstrated in a recent infestation in Whiting Harbor near Sitka, the rapid spread of Dvex is a threat to the mariculture industry, commercial fisheries and ecosystem integrity.

HB 89 provides the Alaska Department of Fish and Game (ADF&G) with the statutory authority, and a fund, to swiftly address outbreaks of aquatic invasive species such as Dvex.

HB 89 requires ADF&G, in coordination with the Department of Environmental Conservation, the Department of Natural Resources, and other applicable agencies, to establish and carry out a rapid response plan to an incipient aquatic invasive species.

HB 89 gives ADF&G the authority to use chemical, biological, mechanical, or physical methods to deal with the outbreak. It allows for expedited review of plans for dealing with invasive species, and directs ADF&G staff to prioritize eradication of the invasive species over other management issues for a specific area.

HB 89 specifies that affected private property owners shall be considered, but still allows responding agencies to be held harmless for damages caused by their invasive species treatment. Impacts to native species shall be minimized if possible.

Sea Vomit and other aquatic invasive species have the potential to seriously impact our lucrative commercial fishing, mariculture, and recreational fishing industries. HB 89 gives Alaska the tools to rapidly combat this threat.

HB 89: Rapid Response Aquatic Invasive Species

Important issue that is threatening our aquatic resources

- Elodea – Southcentral lakes/Fairbanks, overruns salmon habitat
- Pike – Southcentral, dramatically increases juvenile salmon mortality
- D.Vex – Whiting Harbor, smothers everything, may close herring
- Threats – European Green Crab, Quagga/Zebra Mussels

Invasive species cost the US \$120 billion in damages per year – US F&W Service

\$29 million on invasive management in Alaska for government and non-profit groups between 2007-2011 according to ISER

Once established, continual control is often the only option.

Currently no rapid response – takes years to even plan

- Problem can get out of hand
- Increases costs massively
- Reduces effectiveness, may not be able to eliminate established populations

HB 89: rapid response to INCIPIENT populations

- Gives state agencies authority to act, prioritizes action
- Provides a Rapid Response fund
- Considers private property
- Protects subsistence, recreational, and commercial opportunities before it's too late

- **HB 89 gives ADF&G and other state agencies the authority and the tools to rapidly respond to incipient outbreaks of aquatic invasive species, in both fresh water and salt water.**
- **HB 89 requires ADF&G, in coordination with the Department of Environmental Conservation and the Department of Natural Resources, to establish a plan of coordination and response to an aquatic invasive species outbreak.**
- **HB 89 gives ADF&G the authority to use chemical, biological, mechanical, or physical methods to deal with the outbreak. It allows for expedited review of plans for dealing with invasive species, and directs ADF&G staff to prioritize eradication of the invasive species over other management issues for a specific area.**
- **HB 89 specifies that state agencies shall consider impact to native fish species, and give due consideration to private property in taking action to eradicate aquatic invasive species.**
- **State agencies are held harmless agencies harmless for impacts to private property in the process of responding to an aquatic invasive species.**
- **Rapid Response Fund is Established**

A M E N D M E N T

OFFERED IN THE HOUSE
TO: CSHB 89(FSH)

BY REPRESENTATIVE SEATON

- 1 Page 2, line 19, following "section":
- 2 Insert ", unless the act constitutes gross negligence or intentional misconduct"

AMENDMENT

OFFERED IN THE HOUSE

BY REPRESENTATIVE SEATON

TO: HB 89

- 1 Page 2, line 18:
- 2 Delete "department"
- 3 Insert "state and the officers, employees, and agents of the state"

Louie Flora

Subject: FW: Follow Up on HB 89 Request

From: Mulligan, Ben (DFG) [<mailto:ben.mulligan@alaska.gov>]

Sent: Wednesday, February 06, 2013 10:34 AM

To: Louie Flora

Subject: Follow Up on HB 89 Request

Louie,

In yesterday's hearing on HB 89 Rep. Seaton asked Charlie Swanton, our Sport Fish Director, if the hold harmless language in AS 16.05.093(f) is adequate to protect the state and requested that he check with the Dept. of Law. After consulting with the Dept. of Law they suggest that the language found on page 2, line 18 "department" should be replaced with "State, its employees and agents" because the language is limiting in that it may not just be ADF&G who is doing the work under AS 16.05.093(b) to control and eradicate the invasive species.

If you have any additional questions, just let me know.

Thanks,

Ben Mulligan
Legislative Liaison
ADF&G
(907) 465-6137

Fiscal Note

State of Alaska
2013 Legislative Session

Bill Version: HB 89 (U)
Fiscal Note Number: _____
() Publish Date: _____

Identifier: HB 89-DFG-SFD-02-01-13
Title: AQUATIC INVASIVE SPECIES
Sponsor: SEATON
Requester: House Special Committee on Fisheries

Department: Department of Fish and Game
Appropriation: Sport Fisheries
Allocation: Sport Fisheries
OMB Component Number: 464

Expenditures/Revenues

Note: Amounts do not include inflation unless otherwise noted below. (Thousands of Dollars)

	FY2014 Appropriation Requested	Included in Governor's FY2014 Request	Out-Year Cost Estimates				
			FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
OPERATING EXPENDITURES	FY 2014	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Personal Services	137.1		68.6	***	***	***	***
Travel	28.4		14.8				
Services	102.5		56.5				
Commodities	3.0		1.0				
Capital Outlay							
Grants & Benefits							
Miscellaneous							
Total Operating	271.0	0.0	140.9	***	***	***	***

Fund Source (Operating Only)

1004 Gen Fund	271.0		140.9				
Total	271.0	0.0	140.9	***	***	***	***

Positions

Full-time							
Part-time							
Temporary	3.0		3.0				

Change in Revenues							
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Estimated SUPPLEMENTAL (FY2013) cost: 0.0

Estimated CAPITAL (FY2014) cost: 0.0

ASSOCIATED REGULATIONS

Does the bill direct, or will the bill result in, regulation changes adopted by your agency? No
If yes, by what date are the regulations to be adopted, amended or repealed?

Why this fiscal note differs from previous version:

This is the initial fiscal note.

Prepared By: Charles O. Swanton, Director
Division: Sport Fish
Approved By: Kevin Brooks, Deputy Commissioner
Alaska Department of Fish and Game

Phone: (907)465-6184
Date: 02/01/2013 05:20 PM
Date: 02/01/13

FISCAL NOTE ANALYSIS

STATE OF ALASKA
2013 LEGISLATIVE SESSION

BILL NO. HB 89

Analysis

House Bill 89 would require:

- 1) Review and update the Alaska Aquatic Nuisance Species Management Plan.
- 2) Develop an Invasive Species Action Plan that outlines key agency contacts and communication trees; roles, responsibilities, and jurisdictional boundaries; species or habitats of concern and potential economic impacts; defines early detection methods; and will serve as the foundation from which response plans could be written focusing on specific species or pathways.
- 3) Develop rapid response plans for each of the 5 identified invasive species (northern pike, D.vexillum-tunicates, European green crab, spartina cordgrass, crayfish) that threaten aquatic ecosystems across the state. A template for a rapid response plan would be developed specific to each species which would include vectors of transmission, synthesis of background knowledge, documented or perceived distribution, and identified threat to specific areas or locations, as well as effective control or eradication methods.

Upon completion, a series of facilitated meetings would take place between identified state, federal, and municipal agencies, along with other stakeholder organizations to catalog authorities and available resources specific to rapid response. In addition, a series of facilitated public meetings would be held to receive and document public input and knowledge to be incorporated into a draft plan. Each hired staff member would be specifically assigned to a species and become the subject matter expert for that species for the purposes of preparing the response plan. The final task would be compiling all of the pertinent information and publishing a final rapid response plan to be implemented by all of the affected parties, on a case by case basis, as needed.

We anticipate that these three tasks will take 18 months to complete and the full year cost is shown in FY14 and a 1/2 year cost is shown in FY15. Because of the duration of the project, the division would utilize three non permanent staff: 1) Fishery Biologist III (18 months), 2) Fishery Biologist IV (9 months), 3) Education Associate II (9 months).

Each species would have a series of meetings which would be facilitated by an outside contractor who would also be required to provide input toward plan development following each meeting. We anticipate the facilitator to meet with staff in preparation, facilitation, and input for final response plans.

This fiscal note does not reflect the costs associated with implementing any of the plans this legislation directs ADF&G to develop. It would be extremely difficult to estimate those costs at this time resulting in an indeterminate cost for FY15 and beyond.

Fiscal Note

State of Alaska
2013 Legislative Session

Bill Version: HB 89 (U)
Fiscal Note Number: _____
() Publish Date: _____

Identifier: HB089-DNR-PMC-2-2-13
Title: AQUATIC INVASIVE SPECIES
Sponsor: SEATON
Requester: House Special Committee on Fisheries

Department: Department of Natural Resources
Appropriation: Agriculture
Allocation: North Latitude Plant Material Center
OMB Component Number: 2204

Expenditures/Revenues

Note: Amounts do not include inflation unless otherwise noted below. (Thousands of Dollars)

	FY2014 Appropriation Requested	Included in Governor's FY2014 Request	Out-Year Cost Estimates				
			FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
OPERATING EXPENDITURES	FY 2014	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Personal Services	77.0		***	***	***	***	***
Travel	5.0						
Services	5.0						
Commodities	5.0						
Capital Outlay							
Grants & Benefits							
Miscellaneous							
Total Operating	92.0	0.0	***	***	***	***	***

Fund Source (Operating Only)

1004 Gen Fund	92.0						
Total	92.0	0.0	***	***	***	***	***

Positions

Full-time							
Part-time							
Temporary	1.0						

Change in Revenues							
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Estimated SUPPLEMENTAL (FY2013) cost: 0.0

Estimated CAPITAL (FY2014) cost: 0.0

ASSOCIATED REGULATIONS

Does the bill direct, or will the bill result in, regulation changes adopted by your agency? No
If yes, by what date are the regulations to be adopted, amended or repealed? N/A

Why this fiscal note differs from previous version:

Initial Version

Prepared By:	Franci Havemeister, Director	Phone:	(907)761-3867
Division	Division of Agriculture	Date:	02/01/2013 04:05 PM
Approved By:	Daniel S. Sullivan, Commissioner	Date:	02/02/13
	Department of Natural Resources		

FISCAL NOTE ANALYSIS

STATE OF ALASKA
2013 LEGISLATIVE SESSION

BILL NO. HB089

Analysis

HB89 establishes a new section in AS 16.05 that directs the Department of Fish & Game (DF&G), the Department of Environmental Conservation (DEC), the Department of Natural Resources (DNR), and other state, federal, public and private entities to establish a rapid response and management plan for addressing incipient populations of aquatic invasive species.

This fiscal note covers the estimated costs associated with DNR's participation in developing a rapid response plan in FY2014.

It is anticipated that in order to help develop the plan, the Division of Agriculture will need a long-term, non-perm Natural Resource Specialist II, Range 16, plus funds to cover travel and computer equipment. It is estimated the development of the rapid response and management plan would take up to one year and that some travel would be required in order to coordinate with the other agencies and entities.

DNR, in a memorandum of understanding with both DF&G and DEC, is the management and coordinative authority for submersed and partially emerged freshwater invasive aquatic plants.

This fiscal note does not include costs for plan implementation, rapid response to and management of an aquatic invasive species and therefore results in an indeterminate cost for FY2015 and beyond.

Currently, there are some eradication efforts in planning stages for freshwater invasive aquatic plants in Alaska--specifically for Elodea. The removal of Elodea would be carried out in the following methods: manual removal by divers, suction dredging, or chemical application.

Examples of potential costs for eradication include estimates done in both Fairbanks and Anchorage areas for removal of Elodea. Eradication of freshwater aquatic invasive plants are multi-year processes. An initial estimate for removal of Elodea in Sand Lake in Anchorage was \$210.0 over three years using herbicides. The Fairbanks Soil and Water Conservation District estimated that over a five-year period it would cost about \$322.4 for mechanical control in Chena Slough.

Fiscal Note

State of Alaska
2013 Legislative Session

Bill Version: HB 89 (U)
Fiscal Note Number: _____
() Publish Date: _____

Identifier: HB089-DOR-TRS-2-1-13
Title: AQUATIC INVASIVE SPECIES
Sponsor: SEATON
Requester: Rep Seaton, Kerttula, Kreiss-Tomkins, Nageak

Department: Department of Revenue
Appropriation: Taxation and Treasury
Allocation: Treasury Division
OMB Component Number: 121

Expenditures/Revenues

Note: Amounts do not include inflation unless otherwise noted below. (Thousands of Dollars)

	FY2014	Included in	Out-Year Cost Estimates				
	Appropriation Requested	Governor's FY2014 Request	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
OPERATING EXPENDITURES	FY 2014	FY 2014					
Personal Services							
Travel							
Services							
Commodities							
Capital Outlay							
Grants & Benefits							
Miscellaneous							
Total Operating	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Fund Source (Operating Only)

None							
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Positions

Full-time							
Part-time							
Temporary							

Change in Revenues

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Estimated SUPPLEMENTAL (FY2013) cost: 0.0

Estimated CAPITAL (FY2014) cost: 0.0

ASSOCIATED REGULATIONS

Does the bill direct, or will the bill result in, regulation changes adopted by your agency? No
If yes, by what date are the regulations to be adopted, amended or repealed?

Why this fiscal note differs from previous version:

Initial version.

Prepared By:	Pamela Leary, Comptroller	Phone:	(907)465-3751
Division	Treasury Division	Date:	02/01/2013 10:00 AM
Approved By:	Angela Rodell, Deputy Commissioner	Date:	02/02/13
	Department of Revenue		

FISCAL NOTE ANALYSIS

STATE OF ALASKA
2013 LEGISLATIVE SESSION

BILL NO. HB 89

Analysis

This bill would create an Aquatic Invasive Species Response fund in the general fund. This fund would be one of many non-segregated funds that are invested alongside other funds in the GeFonsi and no additional costs would be incurred by Treasury.

Fiscal Note

State of Alaska
2013 Legislative Session

Bill Version: HB 89 (U)
Fiscal Note Number: _____
() Publish Date: _____

Identifier: HB089-DEC-SWM-01-30-13
Title: AQUATIC INVASIVE SPECIES
Sponsor: SEATON
Requester: House Fisheries Committee

Department: Department of Environmental Conservation
Appropriation: Environmental Health
Allocation: Solid Waste Management
OMB Component Number: 2344

Expenditures/Revenues

Note: Amounts do not include inflation unless otherwise noted below. (Thousands of Dollars)

	FY2014 Appropriation Requested	Included in Governor's FY2014 Request	Out-Year Cost Estimates				
			FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
OPERATING EXPENDITURES							
Personal Services							
Travel							
Services							
Commodities							
Capital Outlay							
Grants & Benefits							
Miscellaneous							
Total Operating	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Fund Source (Operating Only)

None							
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Positions

Full-time							
Part-time							
Temporary							

Change in Revenues							
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Estimated SUPPLEMENTAL (FY2013) cost: 0.0

Estimated CAPITAL (FY2014) cost: 0.0

ASSOCIATED REGULATIONS

Does the bill direct, or will the bill result in, regulation changes adopted by your agency? No
If yes, by what date are the regulations to be adopted, amended or repealed?

Why this fiscal note differs from previous version:

Not applicable, initial version.

Prepared By: Elaine Busse Floyd, Acting Director
Division: Environmental Health
Approved By: Lynn Kent, Deputy Commissioner
Department of Environmental Conservation

Phone: (907)269-7645
Date: 01/30/2013 02:30 PM
Date: 02/02/13

FISCAL NOTE ANALYSIS

**STATE OF ALASKA
2013 LEGISLATIVE SESSION**

BILL NO. HB 89

Analysis

Analysis/Assumptions:

HB 89 has no fiscal impact to the Department of Environmental Conservation, Division of Environmental Health. If passed, additional work requirements that this bill may create would be handled by current division staff as part of our existing working relationship with ADF&G.

Fiscal Note

State of Alaska
2013 Legislative Session

Bill Version: HB 89 (U)
Fiscal Note Number: _____
() Publish Date: _____

Identifier: HB089-DEC-WQ-01-31-13
Title: AQUATIC INVASIVE SPECIES
Sponsor: SEATON
Requester: House Fisheries Committee

Department: Department of Environmental Conservation
Appropriation: Water
Allocation: Water Quality
OMB Component Number: 2062

Expenditures/Revenues

Note: Amounts do not include inflation unless otherwise noted below. (Thousands of Dollars)

	FY2014 Appropriation Requested	Included in Governor's FY2014 Request	Out-Year Cost Estimates				
			FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
OPERATING EXPENDITURES	FY 2014	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Personal Services							
Travel							
Services							
Commodities							
Capital Outlay							
Grants & Benefits							
Miscellaneous							
Total Operating	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Fund Source (Operating Only)

None							
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Positions

Full-time							
Part-time							
Temporary							

Change in Revenues							
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Estimated SUPPLEMENTAL (FY2013) cost: 0.0

Estimated CAPITAL (FY2014) cost: 0.0

ASSOCIATED REGULATIONS

Does the bill direct, or will the bill result in, regulation changes adopted by your agency? No
If yes, by what date are the regulations to be adopted, amended or repealed?

Why this fiscal note differs from previous version:

Not applicable, initial version.

Prepared By:	Michelle Bonnet Hale, Director	Phone:	(907)269-7599
Division	Water	Date:	01/31/2013 10:00 AM
Approved By:	Lynn Kent, Deputy Commissioner	Date:	02/02/13
	Department of Environmental Conservation		

FISCAL NOTE ANALYSIS

**STATE OF ALASKA
2013 LEGISLATIVE SESSION**

BILL NO. HB 89

Analysis

Analysis/Assumptions:

HB 89 has no fiscal impact to the Department of Environmental Conservation. Current Division of Water staff could absorb the amount of time required to cooperate with the Department of Fish and Game in establishing the plan and responding to invasive species.

**Memorandum of Understanding
between
The Alaska Department of Natural Resources,
Alaska Department of Fish and Game, and
Alaska Department of Environmental Conservation**

With Regard to Invasive Freshwater Aquatic Plants

January 15, 2013

Memorandum of Understanding between the Alaska Department of Natural Resources (hereinafter "DNR"), the Alaska Department of Fish & Game (hereinafter "DF&G"), and the Alaska Department of Environmental Conservation (hereinafter "DEC") (jointly referred to herein as the "Parties");

WHEREAS, the Parties recognize that *Elodea spp.* is an aquatic plant that is a noxious weed in Alaska, which is degrading fish habitat and displacing native flora and fauna. *Elodea spp.* alters freshwater habitats by decreasing the flow of water and increasing sedimentation;

WHEREAS, DNR oversees the Division of Agriculture ("DoA"), Soil and Water Conservation Districts ("SWCDs") and the Division of Mining, Land and Water ("DMLW"). The Invasive Weeds Program within the DoA manages invasive weeds and agricultural pests through its strategic plan that identifies the goals and action strategies needed to accomplish objectives that would be reviewed on an annual basis. The SWCDs are one of the cooperative entities that assist in invasive weeds and agricultural pest management, education, outreach, and removal. DMLW is the land manager who is responsible for permitting the use of mechanical methods of removal in state waters;

WHEREAS, the Division of Sport Fish within DF&G is tasked with managing the threat invasive species pose to the aquatic ecosystems of the state. In 2002 ADF&G developed a statewide management plan for aquatic species wherein it identified aquatic species considered to be the highest threat, pathways for introduction, and management actions;

WHEREAS, the Pesticide Control Program within DEC is responsible for protecting public health and the environment through regulation of pesticide use, sale and distribution in Alaska;

WHEREAS, there are different methods for eradication of invasive aquatic plants including manual or mechanical removal, herbicide application, and use of biological control organisms. Each method has its advantages and disadvantages with regard to efficacy, permitting, effect on surrounding ecosystem, and costs;

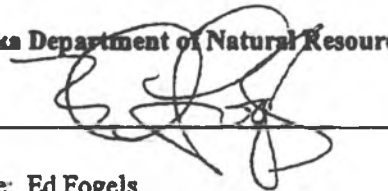
WHEREAS, the Parties wish to cooperate in the undertaking of eradicating *Elodea spp.* in Alaska;

NOW, THEREFORE, the Parties agree as follows:

1. Management and coordinative authority for submersed and partially emerged freshwater invasive aquatic plants, is the responsibility of DNR with assistance provided as needed by DF&G and DEC.
2. DNR will work with DF&G and DEC to conduct an examination of existing management methods for aquatic invasive plants and chart a strategic plan that prioritizes critical areas, provides permitting requirements, and addresses advantages and disadvantages of eradication methods.
3. The Parties will develop a coordinated and efficient permitting process for all methods of control by providing the end-users a list of permits required along with corresponding points of contact. This coordination may also include an examination of one or more general permits related to invasive aquatic plants in freshwater.
4. The Parties will provide each other with quarterly summary information on aquatic invasive plant issues so that each agency is fully aware and adequately informed.
5. The Parties will conduct a statewide dialogue with regard to permits needed to eradicate freshwater aquatic invasive plant species and expand public outreach and education programs on freshwater aquatic invasive plants and the need for and methods of eradication.
6. The Parties agree to develop a plan to better coordinate an effective interagency response, in the case of a detected invasive aquatic plant population that has not dispersed widely, to verify, delineate, contain, and when feasible, implement the plan to eradicate freshwater invasive aquatic plants.
7. The Parties will initiate efforts to examine the most effective and least costly method to eliminate further introduction of *Elodea* to the State, including education, outreach, and even prohibition of sales or distribution of *Elodea* in the State of Alaska.

The Parties have caused this Memorandum of Understanding to be executed as of the date of the last signature below.

Alaska Department of Natural Resources

By: 

Name: Ed Fogels

Title: Deputy Commissioner

Alaska Department of Fish & Game

By: Cora Campbell

Name: Cora Campbell

Title: Commissioner

Alaska Department of Environmental Conservation

By: Larry Hartig 1/16/13

Name: Larry Hartig

Title: Commissioner

Title 11 Natural Resources
Part 4 Agriculture
Chapter 34 Plant Health And Quarantine
Article 2 Pest Control

11 AAC 34.100. Expense of treatments

Any treatment which may be required under the provisions of this chapter shall be at the risk and at the expense of the owner or persons in charge or in possession thereof at the time of treatment unless otherwise provided.

Operator's findings. If the results of the State's tests conflict with the Operator's Environmental Site Assessment, the Operator and the State will negotiate in good faith to add to the Environmental Baseline.

3. If, after the Environmental Baseline for any portion of the Premises is established, it is discovered that the presence of Hazardous Substance identified in the Environmental Baseline was caused or Materially Contributed to by the Operator or its operations, the Environmental Baseline may be amended to delete that portion of the contamination that is attributed to the Operator or its operations. The State will have the burden of proof in establishing that the Operator caused or contributed to this contamination.
4. If Hazardous Substance not attributed to the Operator is discovered, or if it is discovered that Hazardous Substance identified in the Environmental Baseline is attributed to the Operator, the parties will agree upon a supplement to the Environmental Baseline within a reasonable time.

C. RELEASE OF OPERATOR

The State releases the Operator from liability to the State for contamination and the presence of Hazardous Substance identified by the Environmental Baseline.

D. ORDERED REMEDIATION

The State is under no obligation to remediate contamination identified in the Environmental Site Assessment(s); except, the State agrees to remediate, or have responsible parties remediate, the contamination identified in the Environmental Baseline if the Operator or State is ordered to remediate by an agency with such authority. In the event of such ordered remediation, the State will make a reasonable effort to coordinate the remediation with the Operator to minimize disruption of the Operator's operations and damage to the Operator's improvements and property. The Operator releases and holds the State harmless for all costs associated with the damage to, relocation and removal of, and the repair of Operator's improvements and property, and loss of income of the Operator or third parties that results from this remediation and the disruption of Operator's operations.

E. ACTION AGAINST POTENTIALLY RESPONSIBLE PARTIES

This article shall not restrict the State or the Operator from seeking and obtaining cleanup efforts, costs, or damages from potentially responsible parties for contamination identified in the Environmental Baseline.

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

ANCHORAGE INTERNATIONAL AIRPORT

MAINTENANCE AGREEMENT ADA-30469

January 27, 1995

thefreedictionary.com

in·cip·i·ent ^ˈɪn·sɪp'ɪ-ənt

adj.

Beginning to exist or appear: *detecting incipient tumors; an incipient personnel problem.*

[Latin *incipiēns*, *incipient-*, present participle of *incipere*, *to begin*; see **inception**.]

in·cip'i·en·cy, **in·cip'i·ence** *n.*

in·cip'i·ent·ly *adv.*

The American Heritage® Dictionary of the English Language, Fourth Edition copyright ©2000 by Houghton Mifflin Company. Updated in 2009. Published by Houghton Mifflin Company. All rights reserved.

incipient [ɪn'sɪpiənt]

adj

just starting to be or happen; beginning

[from Latin *incipiēns*, from *incipere* to begin, take in hand, from *in-*² + *capere* to take]

incipience, **incipiency** *n*

incipiently *adv*

Collins English Dictionary – Complete and Unabridged © HarperCollins Publishers 1991, 1994, 1998, 2000, 2003

Thesaurus Legend: |Synonyms |Related Words |Antonyms

Adj. 1. incipient - only partly in existence; imperfectly formed; "incipient civil disorder"; "an incipient tumor"; "a vague inchoate idea"

|inchoate

|early - being or occurring at an early stage of development; "in an early stage"; "early forms of life"; "early man"; "an early computer"

Based on WordNet 3.0, Farlex clipart collection. © 2003-2012 Princeton University, Farlex Inc.

incipient

adjective |beginning, starting, developing, originating, commencing, embryonic, nascent, inchoate, inceptive *There were signs of incipient panic.*

Collins Thesaurus of the English Language – Complete and Unabridged 2nd Edition. 2002 © HarperCollins Publishers 1995, 2002

Translations

Select a language: -----

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The Cost of No Action

What would *not doing anything* about the infestation of an invasive aquatic plant in the Fairbanks area cost Alaska?

T. Wurtz and N. Lisuzzo, US Forest Service, Alaska Region, 1/27/2011

In late August 2010, a significant infestation of an invasive aquatic plant, *Elodea canadensis*, was discovered in the Fairbanks area. This is the first time an invasive aquatic plant has been found in Alaska.

Elodea canadensis has a long and well-documented history as an invasive species. It was originally introduced to Scotland and Great Britain more than a century ago, as an aquatic ornamental. Since then, it spread throughout the British Isles, much of Scandinavia and all the way across Russia to Lake Baikal, crossing two continental divides along the way. It grows aggressively in slow-moving waters and lakes. It grows well in cold climates, surviving the winters under lake and river ice. Once introduced to a new area, it spreads in two ways: by breaking up and re-rooting after it is washed downstream, or by being carried to new waterbodies inadvertently by people, e.g. caught in boat trailers or on float plane floats.

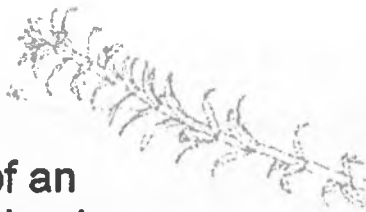
Elodea can "fill up" slow-moving waterways with dense growths of plant material. In other places around the world that it has invaded, *Elodea* has dramatically impeded the navigability of slow-moving waters and of lakes¹. The dense plant material can make fishing problematic or impossible. Invasion by *Elodea* has been shown to negatively impact salmon spawning habitat². When *Elodea* and other aquatic plants colonized a Chinook spawning area of a river in northern California, both water velocities and spawning activity declined rapidly and dramatically. It's likely that *Elodea* also degrades the habitat of other species of sport fish.



"...we can easily remove 20+ tons to the acre (of *Elodea canadensis*) from the water." - Mike Stretton, Aquatic Solutions UK

At present, the *Elodea* infestation in interior Alaska appears to be confined primarily to a slow-moving stream called Chena Slough. But individual plants and small patches were observed in the Chena River itself just prior to freeze-up in fall, 2010. Our best estimate is that this infestation is very recent; it likely has been developing for only five to seven years.

If Alaskans don't respond to the *Elodea* infestation in Chena Slough, it will spread. It could spread via flowing water to any point downstream of the mouth of the slough. Fast-flowing river systems, or those carrying silt, are unlikely to be colonized, but will still serve to spread plant propagules. In time, it could colonize slow-moving reaches of the Chena, and sloughs and oxbows of the Tanana and Yukon drainages. If unchecked, it could colonize the mouths of slow-moving rivers that empty into the lower Yukon. It could be spread by float planes and boats to lakes all over the state, from Homer to the North Slope. Once *Elodea* becomes widely dispersed in Alaska, there will be nothing we can do about it.



Brazilian elodea, a related species, in a lake in Oregon. Photo: OR Statesman Journal.

Elodea canadensis has dramatically impacted lakes in England. "...Over here, an infestation can and does make fishing impossible. Rowing boats can't row, jet skis can get blocked and speed boats have problems as well."

Mike Stretton, Aquatic Solutions UK



Float plane rudder with aquatic plants. Float planes are one way that *Elodea* may be spread to Alaskan lakes. Photo: D. Lessuy

What will this cost Alaska?

It is impossible to know precisely how much damage the unchecked spread of *Elodea* could cause in Alaska. But based on what it has done in other places around the world, two industries likely to be affected are sport fishing and commercial salmon harvest. Although it would be very difficult to estimate how much *Elodea canadensis* could cost our state, even a small change that affects either of these industries could result in a substantial economic loss:

Commercial salmon harvest:

The average annual value of Alaska's commercial salmon harvest is \$230 million.¹

If potential future habitat degradation from *Elodea* resulted in a reduction in salmon populations by 1/10th of 1%, then

$0.001 * \$230,000,000/\text{yr} = \$230,000/\text{yr}$ future loss in revenues in commercial salmon harvest

Sport fishing:

The Alaskan sport fish industry is valued at \$1.4 billion a year, 7% of which (\$98 million) is from Interior Alaska.² *Elodea* could colonize the streams and freshwater lakes in some of the prime fishing areas of our state, damaging fish habitat and reducing angling opportunities.

If widespread *Elodea* infestation in Alaska resulted in a future reduction in sport fishing opportunities by 1/10th of 1%, then

$0.001 * 1,400,000,000/\text{yr} = \$1,400,000/\text{yr}$ future loss in sport fish revenues

$0.001 * 98,000,000 = \$98,000/\text{yr}$ future loss in sport fish revenues in Interior Alaska alone



A dense bed of *Elodea* growing in Chena Slough. In this area the plant material was several feet thick, extended from the slough bottom up to within a few inches of the water surface.

What can Alaskans do?

Projects to stop the spread of invasive aquatic plants are going on all over the country. Several successful examples began with situations similar to ours: an *Elodea* infestation in a river system. Alaskans need to mobilize: leadership, initiative, cooperation, funding and fast action are all needed. From the Governor's Office to boy scout troops, everyone's help is needed. Get involved today. Contact Darcy Etcheverry at the Fairbanks Soil and Water Conservation District at FCWMA.tech@gmail.com or visit http://www.fairbankssoilwater.org/resources/Chena_Slough_Invasive.html

¹ Simpson, D.A. 1984. A short history of the introduction and spread of *Elodea* Michx in the British Isles. *Watsonia*, 15:1-9

² Merz, J.E., Smith, J.R., Workman, M.L., Setka J.D., and B. Mulchaey. 2008. Aquatic Macrophyte Encroachment in Chinook Salmon Spawning Beds: Lessons Learned from Gravel Enhancement Monitoring in the Lower Mokelumne River, California. *North American Journal of Fisheries Management*. 28: 1568-1577

³ ADF&G. 2005. Commercial fisheries of Alaska. Special Report 05-09. www.alaska.gov/adfg

⁴ ADF&G. 2007. Economic impacts and contributions of sportfishing in Alaska. www.alaska.gov/adfg

Managing Invasive Species: How Much Do We Spend?

Tobias Schwörer, ISER – Rebekka Federer and Howard Fersen, Alaska SeaLife Center

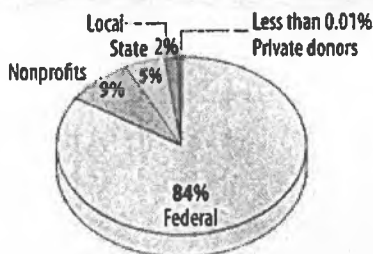
Institute of Social and Economic Research • University of Alaska Anchorage

July 2012

Invasive species: they're along roadways and up mountain trails; they're in lakes and along the coast; chances are they're in your yard. You might not recognize them for what they are—plants or animals not native to Alaska, brought here accidentally or intentionally, crowding out local species. This problem is in the early stages here, compared with what has happened in other parts of the country. But a number of invasive species are already here, and scientists think more are on the way. These species can damage ecosystems and economies—so it's important to understand their potential economic and other effects now, when it's more feasible to remove or contain them.

Here we summarize our analysis of what public and private groups spent to manage invasive species in Alaska from 2007 through 2011. This publication is a joint product of ISER and the Alaska SeaLife Center, and it provides the first look at economic effects of invasive species here. Our findings are based on a broad survey of agencies and organizations that deal with invasive species.¹ The idea for the research came out of a working group formed to help minimize the effects of invasive species in Alaska.² Several federal and state agencies and organizations funded the work (see back page).

Figure 1. Who Pays to Manage Invasive Species in Alaska?
Total Spending, 2007-2011: \$29 Million • Average Annual Spending: \$5.8 Million



Source: ISER/Alaska SeaLife Center survey, 2011-2012

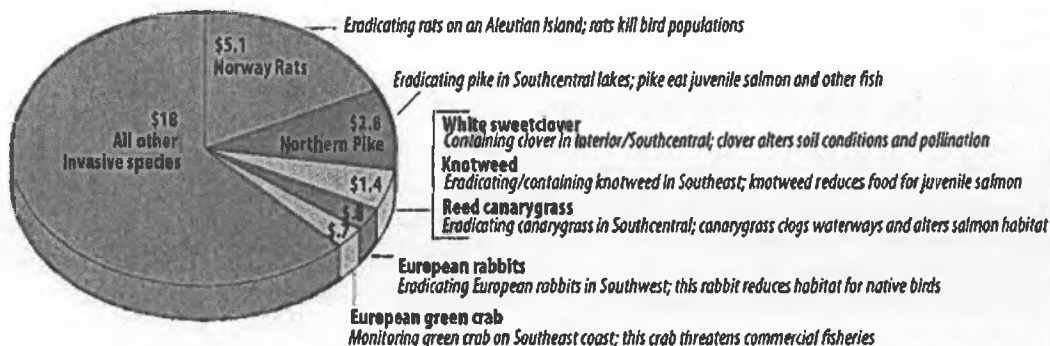
Who Paid?

Governments, nonprofits, and private donors spent about \$29 million to manage invasive species in Alaska from 2007 through 2011, with an annual average of \$5.8 million. The federal government put up most of the money—84%. Nonprofits and state and local governments supplied almost all the rest (Figure 1).

Which Were the Costliest Species?

The biggest expenses were \$5 million for eradicating Norway rats on an Aleutian Island where they had destroyed bird populations, and \$2.8 million for killing Northern pike in Southcentral lakes; pike are voracious eaters of juvenile salmon and other fish. Nearly \$1.5 million went for controlling a few damaging invasive plants. About \$700,000 went for monitoring the European green crab, which is moving toward Southeast and threatening commercial fisheries (Figure 2).

Figure 2. What Were the Most Expensive Species to Manage, 2007 - 2011?
(In Millions of Dollars)



Source: ISER/Alaska SeaLife Center survey, 2011-2012

What are Invasive Species?

Invasive species are non-native species that establish themselves, dominate habitats, and cause or are likely to cause economic loss, environmental damage, or harm to human health. These are primarily plants or animals that come from outside the state, but some—like Northern pike—are native in parts of the state but invasive when introduced elsewhere in Alaska.

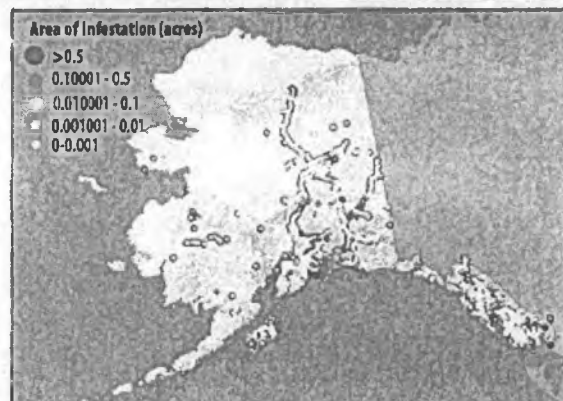
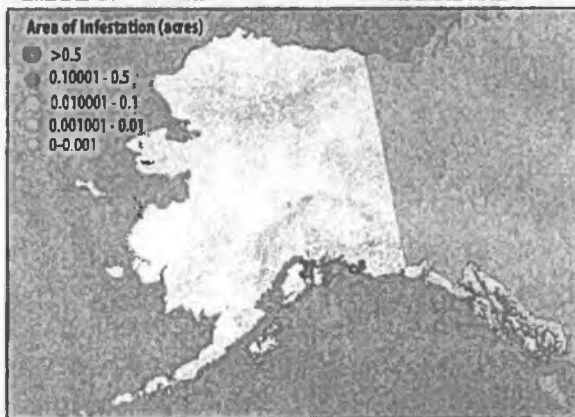
Some invasive species pose much bigger risks than others. Also, some non-native species aren't invasive and in fact benefit people. For example, non-native crops and livestock support the agricultural industry in Alaska and elsewhere.

In 2007, there were 283 known non-native plant species and 116 non-native animals species (fish, amphibians, birds, mammals, invertebrates, parasites, and pathogens) in Alaska. Between 1968 and 2007, the number of known non-native plant species in the state nearly doubled. That means more than 10% of Alaska's 2,100 known plant species are non-native.³

Invasive plants have just recently begun to take hold in much of Alaska. Maps from the Alaska Exotic Plant Information Clearinghouse at the University of Alaska Anchorage (below) show how invasive plants spread just from 2000 to 2011. In 2000, known invasive plants were mostly confined to limited areas of Southeast and Southcentral Alaska. Ten years later, invasive plants were far more widespread in those regions and had reached into Interior and Southwest Alaska.

But in recent years there's also been more funding available for those who study invasive plants, so part of the reason for the sharp increase may simply be that the extra funding has allowed more observations of plants in more places. It's certainly likely that invasive plants are also in more remote areas of the state where they have yet to be observed.

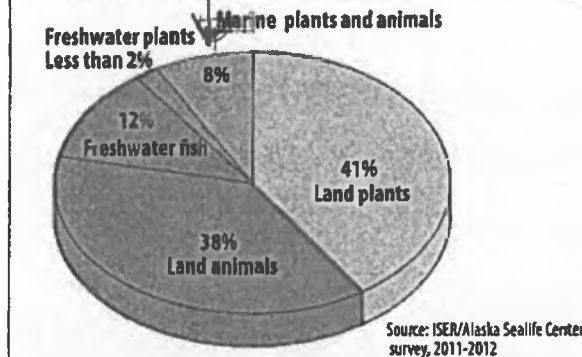
Spread of Invasive Plants, 2000 to 2011



Source: Alaska Exotic Plant Information Clearinghouse, UAA

22% water

Figure 3: Distribution of Spending for Invasive Species in Alaska, By Type, 2007-2011



Where Did the Money Go?

Figure 3 shows the distribution of spending for managing invasive species in Alaska, by type, from 2007 through 2011. More than 40% went for managing invasive land plants and another 38% for invasive land animals. As we discussed earlier, the biggest single expense for animals was for eradicating Norway rats.

Managing invasive freshwater fish accounted for another 12% of spending, but most was for eradicating a single species—Northern pike—in Southcentral Alaska, where it is invasive. In the Interior and the Arctic it is native.

Only about 8% of spending was for invasive marine life from 2007 through 2011. But big potential threats to Alaska's commercial fisheries have recently been identified, and spending to manage invasive marine plants and animals is likely to be up in the coming years. Those species include a dangerous marine animal called the glove leather tunicate (adjacent page) recently found in Sitka. It encrusts marine infrastructure and non-mobile marine animals like oysters and mussels, killing them. Another is the European green crab (adjacent page), which biologists fear could soon reach the Southeast coast of Alaska, threatening Dungeness and other native crabs.

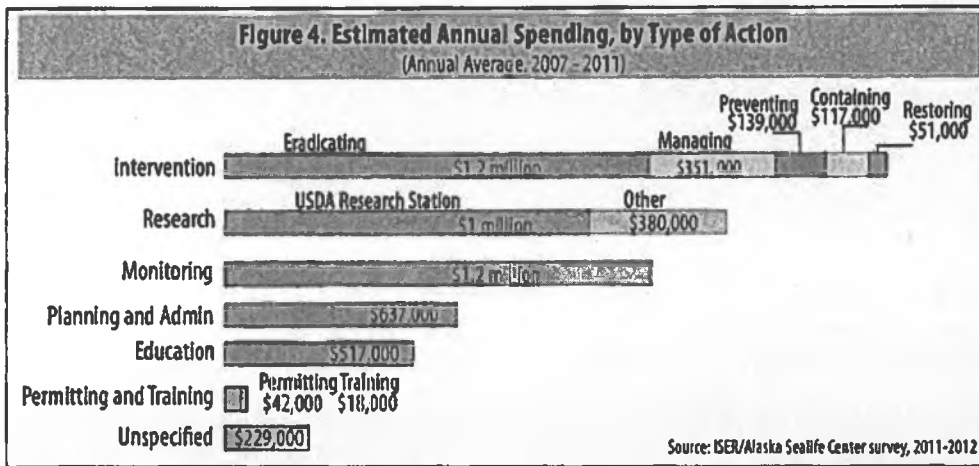


Northern pike (*Esox lucius*)
Photo courtesy of Alaska Department of Fish and Game

What Are the Management Actions?

There are a number of possible management actions for government agencies and nonprofits dealing with invasive species in Alaska. Figure 4 shows average annual spending for various management actions from 2007 to 2011.

• **Intervention.** About \$1.9 million went to intervention activities annually. That included eradicating species considered very dangerous; managing them

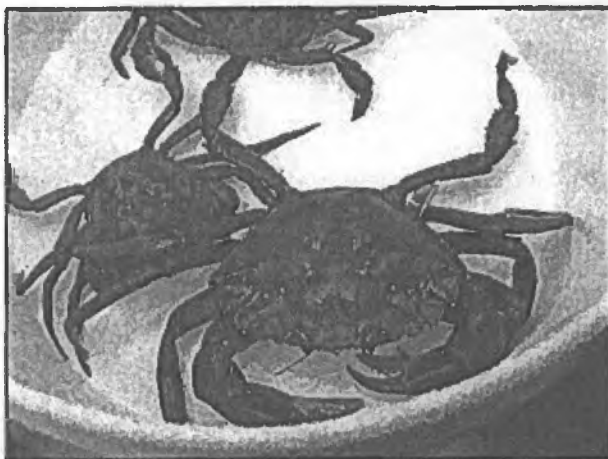


to keep established invasions from spreading; *preventing* them from reaching the state; *containing* new invasions when they reached Alaska; and *restoring* ecosystems to their original state, after invasive species were removed.

- **Research.** About \$1.4 million went for research annually. The U.S. Department of Agriculture's Agricultural Research Station in Fairbanks accounted for most research spending from 2007 to 2011. The station studied effects of invasive species on ecosystems, and also advised government agencies about ways to control invasive plants. It will close in 2012, due to federal budget cuts.
- **Monitoring.** About \$1.2 million went to monitoring invasive species every year. Monitoring mostly tracks worrisome invasive species —like the European green crab—that may be finding their way to Alaska. It also includes monitoring species thought to be eradicated in Alaska, to make sure they are entirely gone.
- **Education.** Roughly \$500,000 of annual spending from 2007 to 2011 was to make Alaskans more aware of the dangers invasive species pose.
- **Other Spending.** Several other kinds of spending support management of invasive species. That includes spending for planning and administration; for getting required permits; and training volunteers. Together, spending for those expenses averaged close to \$700,000 annually in recent years.



Glove leather tunicate (*Didemnum vexillum*)
Photo courtesy of Alaska Department of Fish and Game



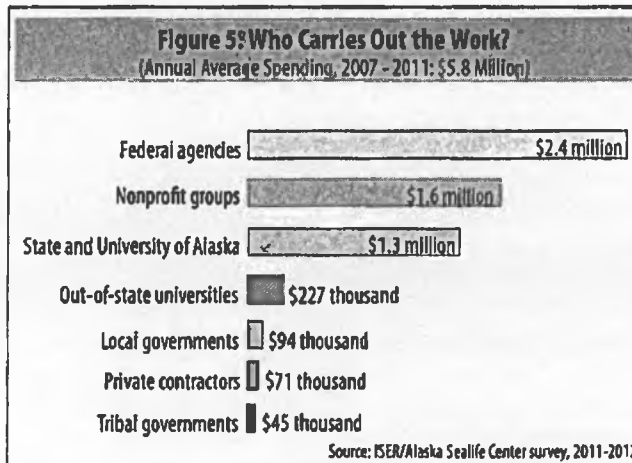
European green crab (*Carcinus maenas*)
Photo courtesy of National Oceanic and Atmospheric Administration

Who Does the Work?

Figure 1 on the front page shows who pays for managing invasive species in Alaska. But the agencies and organizations that put up the money don't always do the management work. Figure 5 shows which entities actually carried out the work and their average annual spending from 2007 through 2011.

Federal agencies spent about \$2.4 million on an annual average. Nonprofit groups were next at \$1.6 million, followed by state entities (including the University of Alaska) at \$1.3 million.

Others—out-of-state universities, local and tribal governments, and private contractors—spent much smaller amounts.



Jobs and Payroll

Managing invasive species in Alaska also generates jobs and payroll, as Figure 6 shows. During the study period, annual numbers ranged from 31 in 2007 to 73 in 2010. Payroll increased as job numbers went up, peaking at \$3 million in 2010.

But job and payroll figures for 2010 and 2011 were boosted by one-time money from the federal American Recovery and Reinvestment Act, which Congress passed to help bring the U.S. economy out of recession. That money has now essentially been spent, so figures for 2012 are likely to be lower.

Volunteers have also become increasingly important in efforts to control invasive species, especially plants. For example, the Alaska Parks Foundation, Mat-Su Conservation Services, and other organizations coordinate volunteer efforts, and the National Park Service hires crews of students (at nominal pay). And it was a community-based monitoring program in Sitka—BioBlitz—that recently discovered one of the more dangerous invasive marine species, the glove leather tunicate (pictured on page 3).

Conclusions

We know that numbers of invasive species are increasing in Alaska, but that's a fairly recent phenomenon, and ways of dealing with the problem are still in their infancy. Because the problem is at an early stage—compared with other areas of the country—Alaska has opportunities to develop cost-effective solutions and create institutions to coordinate a multitude of stakeholders.

But the state government will need to take a bigger role in managing invasive species. We know that in recent years state funds made up only about 5% of spending, with the federal government supplying 84%. Federal spending cuts will close the Agricultural Research Station in 2012, and further cuts in federal money for managing invasive species seem likely.

Also, as the problem becomes increasingly important, coordinating limited resources will become more critical in the future. Yet several attempts in recent years—including proposed legislative action—have failed to establish a formal Alaska Invasive Species Council.

The bulk of funding so far has been targeted toward terrestrial plants and animals, although funds for marine organisms have increased slightly over the last few years. A shift toward more spending for marine plants and animals seems likely, as more species that pose threats to Alaska's commercial fisheries are being identified. Much of the spending to combat invasive species in recent years has been in Southcentral and Southwest Alaska, but spending in Southeast Alaska has steadily increased over the past 5 years, with the arrival of invasive marine species in Alaska waters.

Finally, our study found increased employment, payroll, and volunteer effort in dealing with invasive species—which may suggest that Alaskans are becoming more aware of this important problem.

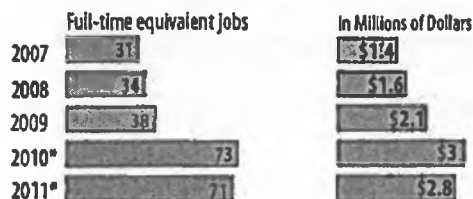
Acknowledgements

Funding for this research was provided by the Prince William Sound Regional Citizens Advisory Council, the U.S. Fish and Wildlife Service, Ocean Alaska Science and Learning Center, Alaska Legislative Council, and Bureau of Land Management. Special thanks to those who contributed data and expertise to this project. We are particularly indebted to Dr. Steve Coit for providing early comments and review of our work. We also thank the Alaska Natural Heritage Program, particularly Lindsey Flagstad, for providing mapping and other help.

About the Authors

Tobias Schwörer is an ecological economist at ISER, focusing on regional economic analysis, ecosystem services valuation, and energy economics. Rebekka Federer and Howard Ferren are with the Alaska SeaLife Center in Seward. Rebekka Federer manages the marine invasive species program and Howard Ferren is the director of conservation. The findings and conclusions of this report are those of the authors. For questions, contact Tobias Schwörer at tschwoerer@alaska.edu.

Figure 6. Jobs and Payroll In Management of Invasive Species in Alaska



*The big jump in both jobs and payroll in these years is probably due largely to one-time money under the federal American Recovery and Reinvestment Act. Figures for 2012 will likely be lower.

Source: ISER/Alaska Sealife Center survey, 2011-2012

Endnotes

1. We e-mailed questionnaires (and followed up with phone calls) to 112 people at 64 organizations: 11 federal, 8 state, 20 nonprofit, 7 private, 6 tribal, 7 university, and 4 local government. We asked for budget information from 2007 to 2011 on spending related to invasive species—employment, personnel cost, hourly effort, expenditures on equipment and supplies, volunteer effort, source and recipient of funds spent, and targeted invasive species. We also asked respondents to provide detailed information by species, action taken, location, and aerial extent of the action. We collected information from 84 of the 112 people we contacted, for a response rate of 75%. We were especially careful to try to avoid double-counting spending in the complex web of agencies and organizations involved in managing invasive species.

2. In 2006, representatives of federal, state, university, and nonprofit organizations that deal with invasive species in Alaska created the Alaska Invasive Species Working Group, an informal organization with a number of goals, including coordinating resources and activities to improve management of invasive species and developing a statewide plan for managing invasive species. Group members hope to establish a formal council, but legislative action hasn't yet succeeded.

3. Carlson, M.L. and Shephard, M. 2007. "Is the Spread of Non-Native Plants in Alaska Accelerating?" In *Meeting the Challenge: Invasive Plants in Pacific Northwest Ecosystems*, General Technical Report GTR-694, U.S. Forest Service Pacific Northwest Research Station; and McClary J. and Gotthardt T. 2008. *Non-Native and Invasive Animals of Alaska: A Comprehensive List and Select Species Status Reports*, Final Report, Alaska Natural Heritage Program, UAA.

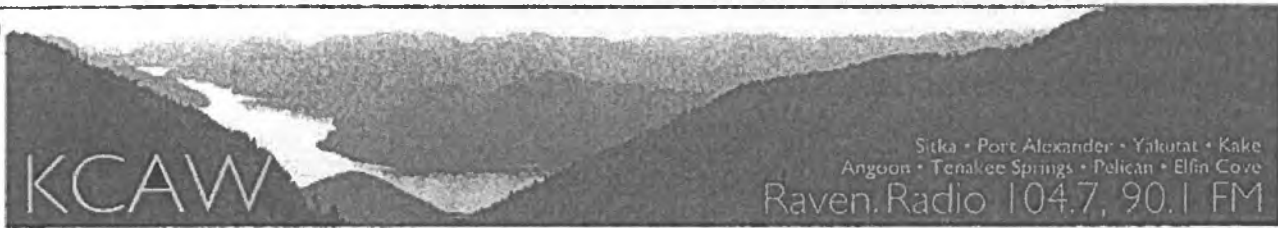


Reed canarygrass (*Phalaris arundinacea*)
Photo courtesy of Alaska Natural Heritage Program, UAA



Alaska SeaLife Center
windows to the sea

 We are currently undergoing a server migration which may cause temporary issues with loading media content.



LOCAL NEWS

Looking for solutions to Sitka's sea squirt invasion

by Robert Woolsey, KCAW

June 30, 2011 4:40 pm

 bert Woolsey - Looking for solutions to Sitka's sea squirt invasion 0:00



SITKA, ALASKA

Dvex (*Didemnum vexillum*) was discovered last summer in Sitka during a citizen-science project called "Bioblitz," a collaboration between the University of Alaska, the Smithsonian Institution, ADF&G, USF&W, the Sitka Tribe, and the Sitka Sound Science Center. This summer, researchers have returned to Sitka to try and learn if Dvex has spread outside of Whiting.

Over the past several days, teams of Bioblitz volunteers placed over 200 test plates in intertidal areas along the road system.

Linda McCann, with the Smithsonian Environmental Research Center, heads the project. KCAW's Robert Woolsey caught up with her on the Samson barge dock. McCann, UAS biology professor Marnie Chapman, and US Fish & Wildlife invasive species specialist Kimberly Holzer, were patiently setting test plates amid the din of rock-loading operations for Sitka's airport expansion.

"So we're out here right now deploying some collecting devices. This is a really high-tech piece of scientific equipment. You can write about it – a piece of plastic attached to a brick. This was designed because we know Dvex and other invasive species commonly settle on artificial, or manmade, substrate. This will fit under a microscope quite easily, we can take it on and off. So it hangs like this at approximately a meter below the surface of the water, and we'll leave it out for three months. We're coming back in September and we'll hopefully find that it's not at any of these other sites. During the Bioblitz we had volunteers out surveying a lot of the sites that we're doing today, and they didn't find it. But, you can only see so far down from a dock. This will allow us to see what's subtidal."

KCAW – "What's the next step for an invasive like this? Is there a strategy for reducing it or eliminating it that anybody is even discussing at this point?"

McCann ‐ "Absolutely. The first step, as we saw it, was to document where it already was, because we can't effectively manage or eradicate anything if we don't know the extent of the infestation. So we've been focused on that this year. And also drafting potential plans and options for any kind of management that we might pursue. The next step is to figure out what we can do to get rid of it. So this trip we initiated an experiment out in Whiting Harbor where we tested different kinds of eradication methods including acetic acid, or vinegar; bleach, or chlorine; low dissolved oxygen, basically starving the animal of oxygen; drying it out, or dessicating it; and fresh water. So a lot of these things have been tried in different parts of the world to varying degrees of success. We're trying to find out where the threshold is: Where is the line where you get 100-percent mortality of Dvex? A lot of the literature suggests that you can kill 80-percent of it, but we want to kill all of it. So we want to find where that line is."

 With over 200 test plates in the water at 11 locations around Sitka, the hanging bricks are not hard to find. Each is also marked with a large, yellow plastic plate identifying it as the property of the Smithsonian. If the test plates are disturbed, scientists could lose valuable information about the spread of Dvex.

Currently, there is no statutory authority for the state to close waters to prevent the spread of invasive marine organisms. The agencies attempting to contain the infestation are asking for the voluntary cooperation of the public to keep vessels out of Whiting Harbor. Dvex easily fragments, and can be spread easily on an anchor, boat hull, or the sole of a boot.

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MADRONE LEAVES

Madrone Audubon Society, Inc., Post Office Box 1911, Santa Rosa, California 95401

VOLUME 46

February/March 2013

Number 4

Invasive Tunicate "Marine Vomit" in Drakes Estero Is Cause for Serious Concern

By Jude Stalker

(Reprinted with permission from *Marin Audubon*)

Recent observations in Drakes Estero of the behavior of the invasive tunicate *Didemnum vexillum* (aka marine vomit) along with the threat that it presents worldwide, are cause for serious concern for such an ecologically valuable, federally protected marine wilderness area.

Didemnum vexillum (Dvex) is a highly invasive non-native colonial tunicate (sea squirt) that has a texture of wet leather. Each colony of Dvex consists of thousands of tiny soft-bodied individuals called zooids embedded in a common membranous matrix. Dvex colonies are unpalatable to most other marine organisms or birds.

Dvex colonies grow subtidally in bays and coastal waters and readily attach to hard surfaces such as rocks, shell, gravel, boulders, and all sorts of artificial structures. Dvex can reproduce sexually, releasing its larvae into the water where it will attach to a hard substrate and form a new colony. New colonies can also be produced through fragmentation. Lobes from a colony can break off, drift to a new site, settle or become entangled in the bottom, and grow out over the substrate.

Because it rapidly overgrows hard surfaces, structures and shellfish, Dvex invasions across the country and the world have caused tremendous problems and concern over the past decade for both natural ecosystems and aquaculture operations. There are populations of Dvex on the East Coast that have infested huge areas of seabed, smothered large numbers of native marine plants and animals, and



Didemnum vexillum
Photo courtesy of Gerald Moore

GENERAL MEETINGS

First United Methodist Church
1551 Montgomery Drive, Santa Rosa

PLEASE NOTE: The February and March General Meetings will be held in the church sanctuary instead of the community room. Please remember to bring your own beverage cup (save paper!) to enjoy tea and coffee.

February Meeting
"Restoration of the Farallon Islands"
Monday February 18, 7:30 PM

Melissa Pitkin, Outreach and Education Group Director for PRBO Conservation Science will give us an update on activities related to the Farallones Islands restoration efforts by US Fish and Wildlife Service (USFWS). The Gulf of the Farallones National Marine Sanctuary hosts the largest breeding seabird colony in the contiguous US, but the islands' ecosystem is under threat from invasive species (particularly the house mouse). The USFWS plan to eradicate the mice over time will restore balance and protect the breeding sites of the Ashy Storm-petrel, a California Species of Special Concern. The project is controversial because this will affect the food supply for over-wintering Burrowing Owls (another Species of Special Concern) that prey on the mice and small seabirds. We will find out how the scientists are dealing with this delicate issue.

March Meeting
"West County Hawk Watch"
Monday March 18, 7:30 PM

Sonoma County raptor specialist Larry Broderick will give us a look at our resident and migrating hawks, with tips on identifying birds of prey, where to look for them, and some of their interesting habits. Larry has studied raptors for two decades. He co-founded West County Hawk Watch in 1990 for documenting migration, and studying Ferruginous Hawks and the resurging population of Bald Eagles in our county. He currently gives tours and workshops on Sonoma Land Trust properties and throughout Sonoma County.

To receive *Leaves* via email in PDF format just email your request to:

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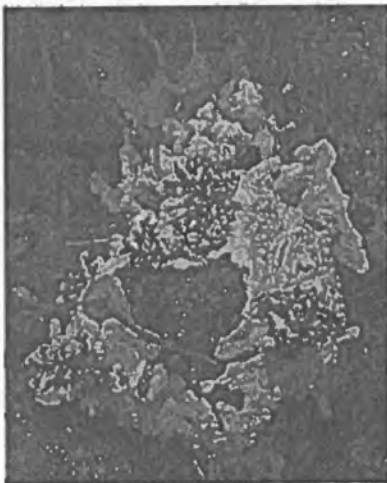
You will get your copy faster and help save paper.

MARINE VOMIT

Continued from page 1

have drastically changed the species composition of the benthic community. It has been well documented that the most important factor in controlling an invasion of Dvex is through early detection and rapid response to the infestation, such as took place in Sitka, Alaska in 2010.

No one knows for sure how or when this invader arrived in Drakes Estero from its native Japan. Many of the Pacific oysters cultivated by the Drakes Bay Oyster Company (DBOC) were originally imported from Japan and Dvex may have arrived as a "hitch hiker" years ago on the imported oysters. It can also spread by ocean currents and settle in new places that have adequate substrate for it to establish.



Didemnum vexillum
Photo courtesy of Gerald Moore

Since its arrival, it has been persisting and reproducing on the cultivated oyster shells and bags in Drakes Estero. The harvesting activities of DBOC cause fragmentation of the Dvex and facilitate the colonization of other areas of the Estero. A limited amount of it was found growing on natural solid mud and sandstone substrates and rocks at Bull Point in 2007, but until very recently many believed that it would not spread to the floor of the Estero or become attached to the eelgrass plants.

In 2010 Dr. Ted Grosholz, a researcher from UC Davis, conducted surveys of fouling invertebrates on some of the oyster racks in Drakes Estero and found that Dvex was prominent among them. He observed large colonies of Dvex growing on the leaf shoots of some of the native eelgrass. Until Dr. Grosholz's surveys, it was thought to be very unlikely that Dvex would grow on eelgrass in Drakes Estero. His observations are of great ecological concern because eelgrass is one of the most highly productive habitats on the California Coast and plays a vital role in providing nursery habitat for many fish species and forage areas for Black Brant and other waterfowl. Research has shown that invasive colonial tunicates such as Dvex can have negative effects on eelgrass growth, survival, and light transmission.

Following this alarming discovery, we also observed large amounts of the tunicate while kayaking with the Dvex researchers in Drakes Estero this past August. It covered more than 50% of the cultivated oyster shells hanging from the Oyster Company's racks and we were shocked to see significant amounts of the Dvex colonizing the floor of the eelgrass beds below and adjacent to the oyster racks. To my knowledge, this occurrence had not been reported before and was believed by many to be impossible.

The National Park Service (NPS) has been notified of this observation. What action they will take is unknown but the NPS Management Policies require removal of impacts that would cause "impairment" or "unacceptable impacts" to any key park resource, such as eelgrass and the associated benthic community in this case. Additionally, because Drakes Estero is designated as a potential wilderness area, the park managers are also required to "seek to sustain the natural distribution, numbers, population composition, and interaction of indigenous species" and to intervene to "correct past mistakes, the impacts of human use, and influences originating outside of wilderness boundaries".

It is clear that to successfully manage this infestation all of the prime Dvex habitat that the DBOC infrastructure (racks, lines, shells, bags) provides should be removed.

I have been a biologist working with invasive species for many years and know too well the disastrous and costly ecological repercussions of delaying the removal of invasive species or not responding to them at all. I don't think this is a risk worth taking with the Dvex invasion in Drakes Estero.

.....

Announcements

Sonoma County Breeding Bird Atlas (BBA) - Year 3 - New Volunteer Orientation

We are entering our third and critical year of surveys for the 2nd edition of the Sonoma County BBA. There are still many available blocks. Volunteers are needed to help survey these blocks. Join us for this fun and rewarding Citizen Science project.

New Volunteer Orientation:
Saturday February 23, 10-2 PM
4300 Liano Road, Santa Rosa
Contact Veronica Bowers at vlbowers@gmail.com to sign up.
Calling all BBA volunteers. There are blocks that still need volunteers.

Native Songbird Care & Conservation - New Volunteer Orientation

Located in Sebastopol, Native Songbird Care & Conservation specializes in the care of native songbirds, with an emphasis on migratory insectivores. We receive over 700 songbirds each year and release approximately 75% of them back to the wild. From May through August, volunteers are needed to help feed and care for baby birds, transport birds to the hospital, respond to calls from the public, and assist with administrative tasks.

Continued on page 3

● ELODEA

spread the word, not the weed!

Elodea (also known as "oxygen weed" in pet stores) is a very invasive submerged aquatic plant.

It is not native to Alaska.

Thick beds of Elodea were found in Sand and Delong Lakes in Anchorage in July 2011. Elodea is also found in Fairbanks (Chena Lake & Slough) and Cordova (Eyak Lake). While these are the only known infestations of this weed in Alaska, it is easily transported to other locations by float planes, boat propellers, and trailers.


We don't want Elodea in Alaska

- Safety: fouls float plane rudders and boat propellers
- Nuisance: impedes boat launching and navigation
- Economic: reduces property values by fouling launch sites/nearshore habitats
- Ecological: alters the food webs and habitat in lakes, sloughs, and rivers and has been shown to degrade salmon spawning habitat

Help keep Alaska's waters valuable. Please:

- inspect and clean your aircraft before every flight (**see back for details**)
- inspect and clean your boat and trailer before entering/exiting a lake
- support efforts to manage/eliminate *Elodea* in Alaska

For more Information:

Stop aquatic hitchhikers: <http://www.protectyourwaters.net>
You  "Sea Plane Inspection and Decontamination"

Report *Elodea* sightings:

U.S. Fish & Wildlife Service : 1-907-786-3510 or 3813

Fairbanks Cooperative Weed Management Area: 1-907-479-1213



Elodea Threatens Alaska's Fisheries and Aquatic Resources



Cecil Rich, Katrina Mueller, and Denny Lassuy
 U.S. Fish and Wildlife Service
 1911 E. Tudor Rd
 Anchorage, AK 99503

Background

Until recently, Alaska has been considered free of invasive submerged aquatic plants that greatly impact freshwater resources in other areas of the world where they are not native. The discovery of Elodea in Chena Slough in Fairbanks in 2010 drew attention to an established population in Eyak Lake and led to the discovery of Elodea in other waterbodies near population centers. Since then, it has been documented in several additional waterbodies in Fairbanks, Anchorage, and the Cordova region.

Elodea

- A genus of rooted aquatic macrophyte
- Not native to Alaska
- Cold tolerant, survives freezing
- Fragments and spreads easily
- Popular aquarium plant ("oxygen weed")



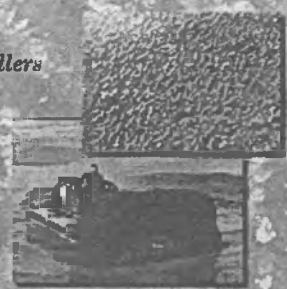
Potential Vectors

- Aquarists
- Float planes
- Boats/trailers
- Fragments



Impacts

- Safety: fouls float plane rudders/boat propellers
- Nuisance: impedes launching/navigation
- reduces property values
- Ecological
 - decreases stream velocity
 - increases rates of sedimentation
 - simplifies aquatic habitat structure
 - alters nutrient availability
 - overgrows native aquatic submerged plants
 - has been shown to degrade salmon spawning habitat



Known Alaska locations



Anchorage: Little Campbell, DeLong, and Sand Lakes
Fairbanks: Chena Lake and Chena Slough
Cordova: Acou, Eyak, McKeelby, and Martin Lakes, Alaganik Slough

What can be done?

- Containment to prevent further spread
- Eradication where feasible (e.g. herbicides)
- Strategic statewide outreach targeting potential vectors

Efforts to date

- Physical surveys
- Localized public outreach efforts
- Formation of Statewide Communication Plan working group in October 2011
- Pilot control projects in Fairbanks (mechanical, diver hand pulling/cutting); suction dredging planned for 2011

Next steps

- Response plan (prevention, control, eradication)
- Communication plan (development/implementation)
- Securing funding for eradication efforts

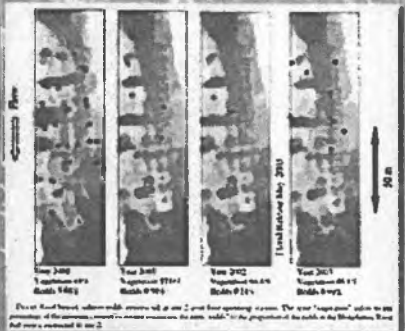
How you can help

- Train field crews to identify and document Elodea
- Report sightings to USFWS: (907) 786-3510 or 3813
- Support prevention, control, and eradication efforts
- Assist response team efforts: denny_lassuy@fws.gov
- Assist statewide communication efforts: katrina_mueller@fws.gov



Acknowledgements

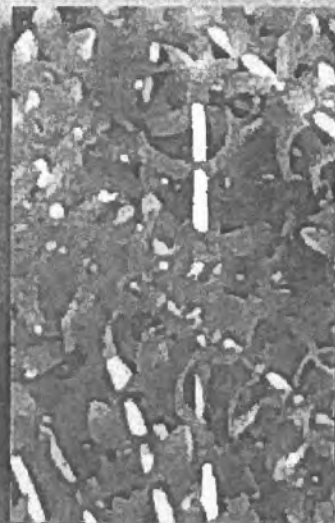
Darcy Etcheverry (Fairbanks SWCD)
 Tricia Wurtz and Kate Mohatt (Forest Service)



Four-year record of Elodea growth in a 2.0m x 2.0m x 2.0m experimental system. The first "upright" stems in the photograph are the stems that were planted in the system. The other stems are the stems that grew from the planted stems. The photograph is the same as the one in the top right of the page.

● **ELODEA**

spread the word, not the weed!



Before entering the aircraft

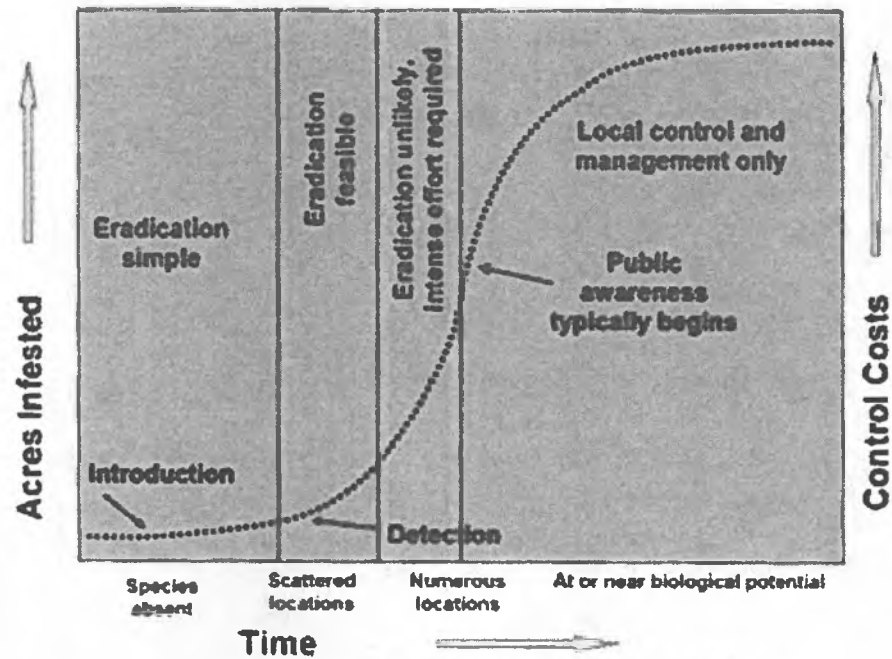
- Inspect/remove plants from floats, wires or cables, and water rudders.
- Check the transom, bottom, chine, wheel wells, and float step area.
- Pump water from floats.

Before takeoff

- Do not taxi through heavy aquatic plant growth prior to takeoff.
- Raise and lower water rudders to clear off plants, minimize cable stretch and improve steering effectiveness.

After takeoff

- Raise/lower water rudders several times to free aquatic plant fragments while over the waters you are leaving or over land.



Adapted from Hobbs and Humphries 1995

Hobbs, R.J. and S.E. Humphries. 1995. An integrated approach to the ecology and management of plant invasions. *Conservation Biology*. 9(4):761-770.

The Cost of Invasive Species



Zebra mussels invaded U.S. waters and have caused millions of dollars of damage by occluding pipes in municipal and industrial wastewater systems.

The negative consequences of invasive species are far-reaching, costing the United States billions of dollars in damages every year. Compounding the problem is that these harmful invaders spread at astonishing rates. Such infestations of invasive plants and animals can negatively affect property values, agricultural productivity, public utility operations, native fisheries, tourism, outdoor recreation, and the overall health of an ecosystem.

The most widely referenced paper (Pimental et al. 2005) on this issue reports that invasive species cost the United States more than \$120 billion in damages every year.

In 2011 alone, the Department of the Interior will spend \$100 million

on invasive species prevention, early detection and rapid response, control and management, research, outreach, international cooperation and habitat restoration.

The Environmental Impacts
In Executive Order 13112, invasive species is defined as an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Invasive species typically harm native species through predation, habitat degradation and competition for shared resources.

Invasive species are a leading cause of population decline and extinction in animals. For example:

- More than 400 of the over 1,300 species currently protected under the Endangered Species Act, and more than 180 candidate species for listing are considered to be at risk at least partly due to displacement by, competition with, and predation by invasive species.
- Invasive species are a leading factor in freshwater fish extinctions and endangerments.
- Brown tree snakes have been implicated in the precipitous decline in native forest birds and the modern extinction of at least 10 species in Guam.

More Facts about the Cost of Invasives:

- If zebra and quagga mussels invade the Columbia River, they could cost hydroelectric facilities alone up to \$250-300 million annually. This does not include costs associated with environmental damages or increased operating expenses to hatcheries and water diversions.
- Annually, the Massachusetts Department of Conservation and Recreation spends \$250,000 on staff, \$30,000 on equipment and \$25,000 on publications related to zebra mussel prevention and control. The state will spend an additional \$71,000 over 5 months to install new boat ramp monitors for zebra mussels.
- An aquatic invasive plant, Eurasian watermilfoil, reduced Vermont lakefront property values up to 16 percent and Wisconsin lakefront property values by 13 percent.
- From 2010 to 2020, an invasive forest pathogen (*Phytophthora ramorum*), called sudden oak death, is projected to cost \$7.5 million in tree treatment, removal and replacement costs, corresponding to a \$135 million loss in residential property values for California.
- Salt cedar (*Tamarix* spp.), an invasive tree, costs the western states \$450-2,800 annually per 2.5 acres (1 hectare) in water loss (municipal, agricultural and hydropower) as well as flood control losses. Eradication and re-vegetation projects are estimated to be \$7,400 per 2.5 acres.
- Annually, black and Norway rats consume stored grains and destroy other property valued over \$19 billion.
- Annually, nonnative species borne in the ballast or hulls of ships cost the Great Lakes Region \$200 million to control.
- U.S. agriculture loses \$13 billion annually in crops from invasive insects, such as vine mealybugs.

The Economic Impacts

Maryland Department of Natural Resources



Case Study: Nutria

Originally introduced for the fur trade, nutria destroy large areas of marshlands, causing significant landscape changes and erosion that threaten pollution and storm surge control, recreational and commercial fisheries, and habitats for native species. In 2005, the Service and its partners spent \$2 million dollars working with 15 trappers to eradicate over 8,000 nutria from Maryland's

Blackwater National Wildlife Refuge, thus helping to preserve local commercial fisheries and ecotourism valued at \$15 million annually. However, other nutria populations remain in Maryland and other states. In Louisiana, for example, an estimated population of 20 to 30 million nutria continues to destroy thousands of acres of wetlands each year.

USFWS



Case Study: Asian Carp

Asian carp, which we introduced through the aquaculture industry, are voracious eaters that threaten native fisheries, including the \$7 billion Great Lakes fisheries. Large silver carp, leaping out of the water at the sound of boat engines, also collide with and injure boaters. Invasive species already have been implicated in adverse effects of up to 46 percent of the Great Lakes

endangered species, and introduction of Asian carp to the region could cause further harm. In 2010 alone, the federal government committed \$78.5 million in investments to prevent the introduction of Asian carp to the Great Lakes, where they would threaten Great Lakes fisheries and could negatively impact remaining populations of endangered or threatened aquatic species.

NPS/Roy Wood

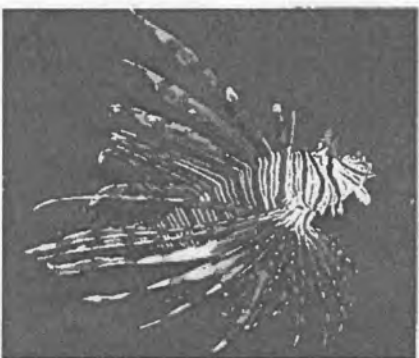


Case Study: Burmese Pythons

Burmese pythons in Florida are known to eat wood storks and Key Largo woodrats, both federally endangered species. From 1999 to 2009, federal and state agencies spent \$1.4 million on Key Largo woodrat recovery and \$101.2 million on wood stork recovery.

The introduction of a reproducing population of non-native pythons places additional pressure on these two species. Many large constrictor snakes can live in habitats and climates in our states and insular territories, and their introduction and spread could threaten other populations of endangered or threatened species.

USUS



Case Study: Lionfish

The Indo-Pacific lionfish, which likely was introduced to U.S. waters through the saltwater aquarium trade, has become widely established along the Southeast United States coast and Caribbean Sea in less than a decade. Lionfish have been found as far north as offshore of New York. Lionfish have established dense populations in the Gulf of Mexico and off the coast of South America. Recent estimates indicate that lionfish have surpassed

some native marine fish in population numbers. Some reports estimate more than 1,000 lionfish per acre in some locations. These fish are voracious eaters and their spines are venomous to humans. Lionfish are already estimated to reduce native reef fish recruitment by 79 percent. This species has the potential to harm economically important fisheries (including snapper and grouper), coral reef conservation efforts and tourism.

Nonnative, invasive species provide a modern example of Benjamin Franklin's famous saying that "[a]n ounce of prevention is worth a pound of cure." Through the Lacey Act, the Service imposes restrictions on the importation and movement across state lines of any species listed as "injurious" under this Act. This is an important tool in preventing the potential damage that nonnative, invasive species can cause.

U.S. Fish & Wildlife Service
<http://www.fws.gov>
January 2012



Price tag on managing invasive species: \$6 million a year



Wednesday, 15 August 2012

The first analysis of the economic effects of invasive species in Alaska finds that governments and nonprofit groups spent about \$29 million from 2007 to 2011, or nearly \$6 million a year, to manage those species. Tobias Schwörer of UAA's Institute of Social and Economic Research (ISER) and Rebekka Federer and Howard Ferren of the Alaska SeaLife Center did the analysis based on a survey of public and private organizations that deal with invasive species around the state. The research was funded by several federal and state agencies.



Invasive species are non-native plants and animals—introduced accidentally or intentionally—that crowd out local species, damaging the environment and causing economic losses. Scientists say the problem is at an early stage in Alaska, compared with what has happened in other places, but the number of invasive species is growing—and they are spreading into more areas.

The new analysis finds:

- The federal government put up most of the money—nearly 85 percent—for managing invasive species in the study period. Nonprofits contributed about 9 percent and the state government 5 percent.
- More than a quarter of the total spending from 2007 to 2011—\$8M—was for eradicating Norway rats on an Aleutian Island and northern pike in lakes in Southcentral Alaska. Roughly \$1.5M went for eradicating or containing several of the most invasive plants, including white sweetclover and knotweed. About \$700,000 went for monitoring the European green crab, which is approaching the coast of Southeast Alaska and threatens the commercial fisheries.
- About a third of the annual spending—nearly \$2M—was for eradicating and controlling species already here and preventing others from reaching Alaska. Another \$1.2M annually went for monitoring species scientists fear are finding their way here, and \$1.4M for research, primarily at the Agricultural Research Station in Fairbanks. About \$500,000 a year went for educating Alaskans about the dangers invasive species pose.



Every summer, UAA hosts an Annual Weed Pull on campus to target invasive species. This year, 30 volunteers collected 50 bags of weeds for disposal.

[Click here to see the full publication \(PDF, 2.1MB\), Managing Invasive Species in Alaska: How Much Do We Spend?](#) If you have questions, get in touch with Tobias Schwörer at tchworer@alaska.edu.

Aquarium plant threatens Peninsula waterways

Posted: September 13, 2012 - 2:58pm | Updated: September 14, 2012 - 8:39am

[Back](#) | [Next](#)



Photo by E. Bella, Kenai National Wildlife Refuge How Elodea moves from lake to lake: we don't want to see this when our boats are trailered!

Advertisement

By Libby Bella

Kenai National Wildlife Refuge

Interagency biologists working on northern pike control last week in Captain Cook State Recreation Area noticed fragments of a bright green, whorled-leaf aquatic plant washed up on the shore near a boat launch. This unusual plant was identified as a species of Elodea, likely *Elodea canadensis*, the Canadian waterweed. Elodea is known from several locations in Alaska including Fairbanks, Anchorage, and Cordova...and now Stormy Lake on the Kenai Peninsula. This is the first aquatic freshwater invasive plant species that has been confirmed in Alaska.

This perennial plant is native to much of North America south of mid-BC, Canada, and has naturalized in many places in the British Isles, where it is a problem. Canadian waterweed is closely related to western waterweed (*Elodea nuttallii*), a native of both North America and Eurasia. In Europe, western waterweed is more common, as it is thought to compete better through faster nutrient uptake. The two hybridize and are virtually impossible to tell apart unless you can find a rare flowering stalk.

So what's the big deal? Effects of Elodea infestations are severe. Its growth can be thick enough to choke and damage boat motors and prevent any kind of recreational use. Forget swimming or paddling around an Elodea-clogged lake – unless you like the feel of the Creature from the Black Lagoon grabbing your legs. Ecological effects include lower water quality, increased sedimentation, native vegetation displacement, and most seriously – which gets the attention of many residents – degraded salmon spawning habitat.

How did Elodea get here? There are several theories, but the prevailing one is that because it's a common aquarium plant, all the Alaska populations are the result of single or multiple aquarium dumps into our water systems. Elodea is sold in most pet stores and aquarium supply shops in Alaska and across North America. It has also been used in science kits for high school science labs to study plant carbon dioxide use. The plant may be spread by migrating waterfowl, but this is mostly speculative.

Alaska and the Kenai Peninsula already have a number of non-native plant species found across the landscape – so why worry about yet another invasive plant? Elodea may be especially difficult to control and particularly damaging because of three factors: the way the plant reproduces, the way it can be spread around Alaska, and the plant's habitat preference.

Elodea reproduces asexually from plant parts. In the fall, leafy stalks detach from a parent plant, float away, root, and start new plants. Winter buds grow from stem tips that overwinter in the water body's bottom. The plant is brittle and breaks apart when agitated, making it very difficult to chop up and remove without causing a major influx of reproductive-ready vegetative parts into the already-infected system. Flowering is rare in all Elodea species, with reproduction by seed virtually nonexistent.

A huge concern is how easily fragments of Elodea can be picked up by float planes and boats. Boat motors can fragment and chop the plant into smaller pieces, making it spread and reproduce faster. Sand Lake is very close to Lake Hood, the major float plane base in Anchorage – close enough to visualize how fast plant parts could be spread all over the state from this single source. Boat motors and other gear also readily pick up fragments of the plant and can spread it to nearby rivers and lakes where the reproduction pattern starts all over again.

Elodea prefers a cold, slowly-flowing (less than one meter per second) water system, with clear water and silty or organic substrate to root in. It can stand freezing and temperatures up to around 80F. In other words, Elodea is ideally suited to thrive in most of the wetland, pond, and slow-moving rivers systems of the western Kenai Peninsula and other big chunks of the state.

While we don't know all the potential spread avenues, we do know that most Alaskan water systems will be losers in an Elodea invasion. Biologists around the state are alarmed enough that a subgroup of our statewide invasion group (CNIPM) teleconferences regularly to discuss updates and options concerning the Elodea invasions.

What can we do to stop the spread of Elodea and other aquatic invaders? There are a number of ways to sanitize gear between trips or between waterways to prevent introduction into uninfected waterways. Wash all gear carefully to remove any mud, plant parts, and debris before leaving the boat launch or fishing spot. Later, you can dry the gear, freeze gear solid, or wash in water over 130F. If these steps aren't possible, blast gear using a 2 percent bleach solution to kill anything living on it. The strongest tool in our invasion toolbox for aquatic invaders, however, is prevention – keeping Elodea out of our ponds and waterways before it becomes a problem.

Dr. Elizabeth ("Libby") Bella is an ecologist at Kenai National Wildlife Refuge. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Invasive pike thriving on salmon, other species

Juneau Empire (AK) - Friday, January 25, 2013

Author: Dan Joling

ANCHORAGE — A federal and state study of two Alaska salmon streams indicates that nonnative northern pike can eat significant numbers of salmon smolt and will thrive on other species even when the salmon population declines.

The study by the U.S. Geological Survey and the Alaska Department of Fish and Game suggests that invasive pike and native salmon can co-exist in streams and rivers if their habitat does not overlap, but where they do, salmon recovery may depend on suppressing pike.

Northern pike were illegally introduced to southcentral Alaska in the 1950s. The study looked at two tributaries of the Susitna River: the Deshka River, which continues to have a sustainable salmon fishery, including chinook salmon, and Alexander Creek, where pike are believed to have caused the decline in chinook, chum, silver and sockeye salmon, plus rainbow trout and grayling, leading to fishing restrictions.

Salmon hatch and spend about a year in fresh water before migrating to the ocean. Juveniles in fresh water have no natural defense against toothy, voracious pike, which ambush fingerlings in slow-moving water.

Lead study author Adam Sepulveda of the USGS in Bozeman, Mont., said salmon were found to be the preferred prey for pike.

"We sampled 274 pike in a stream where salmon are still abundant, and we found over 600 salmon in the stomachs of these pike," he said in the announcement of the study. "Several of the pike had greater than 20 juvenile salmon in their stomachs."

The researchers found salmonids, including grayling, trout and whitefish, in 140 of the 274 pike stomachs sampled in the Deshka. Small pike ate more juvenile salmon than larger pike.

Salmon were pike's major prey in the Deshka and the lower reaches of Alexander Creek. In the middle and upper reaches of Alexander Creek, where salmon are rare, pike turned to slimy sculpins and Arctic lamprey, leading the authors to conclude that pike may push other species to low abundance or wipe them out.

Chinook salmon continue to meet or approach state return goals in the Deshka despite pike. That also happens in the Wood River Lake system flowing into Bristol Bay. Researchers attributed that to minimal habitat shared by juvenile salmon and pike. Chinook salmon rear in the middle and upper sections of the Deshka where the water is deep and relatively fast-moving. Spawning and rearing habitat for pike is primarily sloughs in the lower section.

Alexander Creek is the opposite with far more of the slow water that pike prefer.

"There's no place for those salmon to get away and avoid them," said state biologist Kristine Dunker, a co-author of the study.

Pike have long been suspected as the reason for low salmon numbers there, she said, and the department conducts an annual pike suppression effort in May during spawning. The authors said suppressing pike in systems where habitat is not limiting may be essential for salmon and other native fish to recover.

The authors acknowledge that pike suppression would be difficult for Susitna drainages. The Susitna Basin is remote and covers 20,077 square miles.

"Moreover, pike occur in the main stem of the Susitna River and reinvasion is likely," the study said. "Thus, managers must identify strategies to reduce the negative effects of pike on salmon populations."

The study was published in the January issue of Ecology of Freshwater Fish.

Section: State

Record Number: 3b56d4576328bc612b8ac95b4789c8f095573cc3

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Introduced northern pike predation on salmonids in southcentral alaska

Adam J. Sepulveda¹, David S. Rutz², Sam S. Ivey², Kristine J. Dunker³, Jackson A. Gross¹

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Accepted for publication November 27, 2012

Abstract – Northern pike (*Esox lucius*) are opportunistic predators that can switch to alternative prey species after preferred prey have declined. This trophic adaptability allows invasive pike to have negative effects on aquatic food webs. In Southcentral Alaska, invasive pike are a substantial concern because they have spread to important spawning and rearing habitat for salmonids and are hypothesized to be responsible for recent salmonid declines. We described the relative importance of salmonids and other prey species to pike diets in the Deshka River and Alexander Creek in Southcentral Alaska. Salmonids were once abundant in both rivers, but they are now rare in Alexander Creek. In the Deshka River, we found that juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*) dominated pike diets and that small pike consumed more of these salmonids than large pike. In Alexander Creek, pike diets reflected the distribution of spawning salmonids, which decrease with distance upstream. Although salmonids dominated pike diets in the lowest reach of the stream, Arctic lamprey (*Lampetra camtschatica*) and slimy sculpin (*Cottus cognatus*) dominated pike diets in the middle and upper reaches. In both rivers, pike density did not influence diet and pike consumed smaller prey items than predicted by their gape-width. Our data suggest that (1) juvenile salmonids are a dominant prey item for pike, (2) small pike are the primary consumers of juvenile salmonids and (3) pike consume other native fish species when juvenile salmonids are less abundant. Implications of this trophic adaptability are that invasive pike can continue to increase while driving multiple species to low abundance.

Key words: Alaska; diet; *Esox lucius*; Northern pike; prey-specific abundance; salmon; Susitna River

Introduction

The introduction and spread of nonnative species are altering aquatic and terrestrial communities worldwide. In particular, opportunistic predators that invade have had catastrophic effects on native biota (Ogutu-Ohwayo 1990), food web structure (Vander Zanden et al. 1999) and ecosystem function (Baxter et al. 2004) because alternative prey species can support the predator population after preferred prey have declined. Thus, predators can continue to increase and spread while eliminating native species (Ogutu-Ohwayo 1990; Albins & Hixon 2008).

Northern pike (*Esox lucius*) are opportunistic predators that have been introduced into freshwater systems across the globe and have been linked to the

decline and elimination of multiple fish species (e.g., Patankar et al. 2006; Byström et al. 2007; Johnson et al. 2008). Pike are ambush predators that require slow-moving, shallow vegetated waters for spawning, rearing and foraging (Casselman & Lewis 1996). They prefer soft-rayed fish, but are trophically adaptable and will switch to spiny-rayed fish, invertebrates and cannibalism when preferred prey are at low densities (Eklöv & Hamrin 1989).

In the Susitna River basin of Southcentral Alaska, shallow vegetated lakes and sloughs are common features that serve as critical rearing habitats for numerous soft-rayed fish species, particularly salmonids. Pike were introduced into Southcentral Alaska in the 1950's and have since spread to >100 lakes and 70 drainages within the Susitna basin (Rutz 1999). The

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doi: 10.1111/eff.12024

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expansion of pike is hypothesised to be a leading cause for the decline of multiple salmonid species in streams that once supported popular sport fisheries (Rutz 1999; Patankar et al. 2006). The economic and cultural costs of salmonid declines are considerable, as sport and commercial fisheries for salmon have been closed or restricted in systems where pike have established. Pike consumption of salmonids may also have severe ecological consequences because salmon are keystone species that provide food and nutrients to aquatic and terrestrial ecosystems (Cederholm et al. 1999).

We described the diet of pike in two tributaries of the Susitna River basin, the Deshka River and Alexander Creek. Our objectives were to (1) assess the relative importance of salmonids to the diet of pike, (2) assess how pike consumption of salmonids differ across space and time and (3) identify other native fish species that are vulnerable to pike predation. To make inferences about the importance of salmonids to the diet of pike, we sampled pike in the Deshka River because it has multiple salmonid populations that still meet Sustainable Escapement Goals (the number of spawning salmon required for sustaining fisheries). To make inferences about the impact of pike on other prey fish after salmonids have declined, we sampled pike in Alexander Creek because escapement estimates for the last decade have shown a downward trend in Chinook salmon (*Oncorhynchus tshawytscha*) abundance and a decline in sport harvest and catch trends for other salmonid species.

Methods

Study sites

The Susitna River basin originates from two major mountain ranges (Talkeetna and Alaska) and generally flows in a southerly direction before emptying into Upper Cook Inlet (Fig. 1). The basin has hundreds of shallow lakes and ponds, sloughs and side channels with large beds of aquatic vegetation, and thousands of square kilometres of adjacent interconnecting wetland areas that are ideal spawning and rearing habitats for pike. We sampled two streams in the Susitna River basin: the Deshka River and Alexander Creek (Fig. 1).

The Deshka River flows approximately 225 km from the headwaters just south of Denali National Park to the confluence with the Susitna River. Channel width varies from 91 m at the mouth to approximately 30 m upstream. The average discharge at the mouth is $25 \text{ m}^3 \cdot \text{s}^{-1}$. The lowest section of the Deshka has few slow-moving, sloughs and side channels, and the main channel provides little pike habitat because it is deeper, has high velocity and is domi-

nated by mid-channel gravel bars and riffles. Pike were first recorded in 1983, but age analyses of these fish suggest that they were introduced into the Deshka River around 1970 (*unpublished data*, D. Rutz). Area anglers did not capture large numbers and multiple age classes of pike until the early 1990s (Whitmore & Sweet 1998). The Sustainable Escapement Goal for Chinook salmon is 13,000–28,000 fish and escapement counts have ranged between 7,533 and 37,725 since 2005 (Oslund & Ivey 2010). Given that salmonids remain abundant in the Deshka River, we sampled pike from this location to describe the contribution of salmonids to pike diets.

Alexander Creek flows 64 kilometres from Alexander Lake to the confluence with the Susitna River. The main stem is surrounded with numerous side-channel sloughs. A large portion of the mainstem and the sloughs are shallow (<1.5-m deep), low gradient and densely vegetated. Most of the creek flows through large, adjacent interconnecting wetland areas that remain flooded throughout most of the spring, which coincides with the pike spawning migration. Summer discharge is around $7.7 \text{ m}^3 \cdot \text{s}^{-1}$. Pike were introduced to Alexander Lake in the late 1960s, although there is no harvest record of pike prior to 1985 (Mills 1985). Today, pike are widespread throughout the system. Pike are hypothesised to be primary drivers of declines in multiple fish species beginning in the late 1990s including Chinook, coho (*O. kisutch*), chum (*O. keta*) and sockeye (*O. nerka*) salmon, rainbow trout (*O. mykiss*) and Arctic grayling (*Thymallus arcticus*) (Rutz 1999). For example, average escapements for Chinook salmon from 1979 through 1999 were 3500 fish while escapement from 2000 through 2008 was 1600 fish. In 2010, counts declined to 177 fish (Oslund & Ivey 2010). The rainbow trout and grayling fisheries were closed to harvest in 1996 and the Chinook salmon sport fishery was closed in 2008. As salmonid stocks are currently at such low levels in Alexander Creek, this location offered an opportunity to study the dietary patterns of pike on nonsalmonid taxa.

Fish capture & handling

In the Deshka River, we used gill nets (2.5-cm bar mesh) to capture pike in five side-channel sloughs. Pike >370 mm (fork length, FL) were captured by their teeth or entangled, and pike <350 mm were often gilled. We fished five gill nets per slough for three, 90-min sets. The same five sloughs were sampled in spring (May 17–21st), summer (June 26–30th) and early fall (August 26th–29th).

In Alexander Creek, Alaska Department of Fish & Game (ADFG) began a gill netting operation to remove pike in side-channel sloughs of the upper,

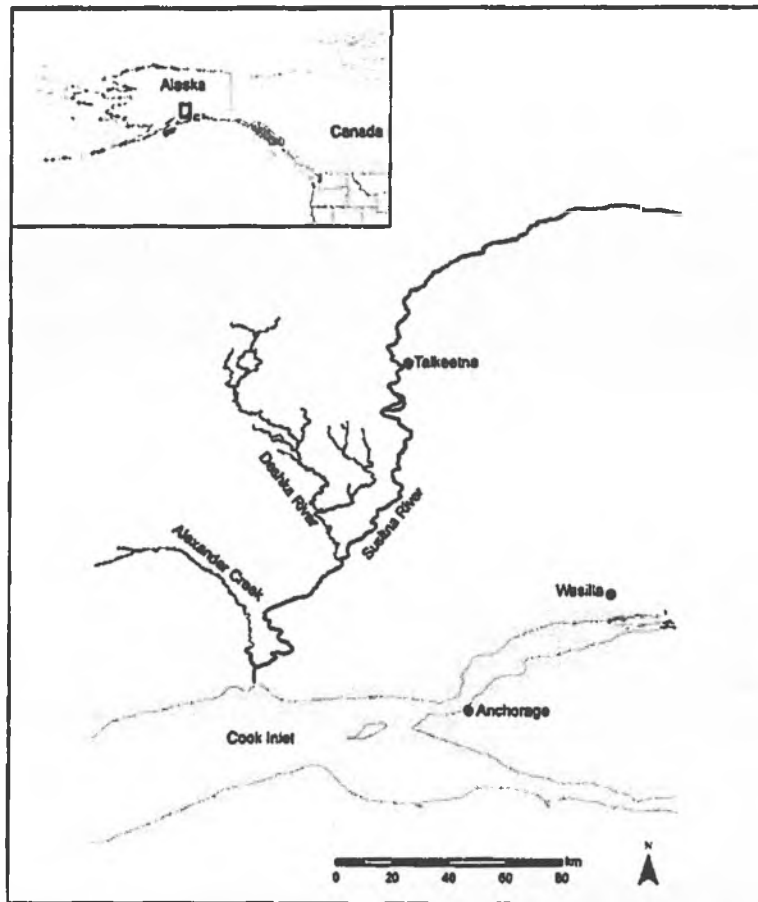


Fig. 1. Map of Alexander Creek and the Deshka River in the Susitna River basin.

middle and lower reaches in May 2011. Up to six experimental-mesh gill nets (six, 6-m panels of 1.9-cm, 2.5-cm, 3.2-cm, 3.8-cm, 4.4-cm, 5-cm bar mesh) were fished in each slough and checked every 24 h and all captured pike were euthanised. Sloughs were fished until an 85% reduction in pike catch was achieved. We sampled pike from five sloughs in each reach during the late spring (May 13–15th) and five sloughs in the upper reach in summer (June 20–24th). The remoteness of Alexander Creek, desiccation of sloughs and logistical difficulties prevented sampling in lower and middle reaches in June and all sites in August.

All fish were measured for length (FL; mm) and weight (g). We used gastric lavage to obtain stomach contents from pike captured in the Deshka River and we removed entire stomachs from fish that were captured in Alexander Creek. Five pike from each Deshka River slough were dissected to verify that gastric lavage removed all stomach contents. Stomachs and stomach contents were preserved in 95% ethanol until identification. To ensure that no fish was sam-

pled >1 time per sampling period in the Deshka River, we inserted floy-tags into the base of the dorsal fin of pike before releasing them near the capture location.

Stomach contents were identified by trained technicians at Rhithron Associates, Inc. (Missoula, MT). Prey fish were identified to species when possible, and invertebrates were identified to the lowest practical taxonomic level. We excluded contents that could not be identified in analyses. All prey items were identified, enumerated and measured for length and weighed (blotted wet weight).

Data analysis

To compare pike diets across time and space, we conducted two analyses. First, we assessed the proportion of Pacific salmonids in pike diets relative to the other prey taxa. For this analysis, we grouped all taxa that belonged to the *Oncorhynchus* genus (coho, Chinook, and sockeye salmon and rainbow trout) into the Total *Oncorhynchus* category. Second, we

assessed the proportion of each individual *Oncorhynchus* species in pike diets. Many samples could not be identified beyond the genus *Oncorhynchus*, so we placed these samples into the prey category, 'unidentified *Oncorhynchus* spp'.

For each prey category, we calculated the per cent occurrence (%O), per cent by number (%N) and per cent by mass (%M) according to Chipps & Garvey (2007). We also calculated the prey-specific abundance (PSA) for each prey item (*i*) as follows:

$$PSA_i = 100 \times \frac{\sum S_i}{\sum S_{ii}}$$

where S_i equals the wet weight of prey *i* in stomachs, and S_{ii} equals the total wet mass of prey in predators that contain prey *i*.

We used multivariate analysis of covariance (MANCOVA) to test for an overall season effect (May vs. June vs. August) on diet composition in the Deshka River and for an overall reach effect in Alexander Creek (lower vs. middle vs. upper in May vs. upper in June). We used %M for each prey taxa as our response variable and pike length as our covariate. The interaction terms of season \times pike length and reach \times pike length were not significant, so only main effects are reported. The mass of prey items is a useful metric for predator-prey studies because it is measured in units that can be compared to other studies and can be used to compare the energetic importance of different prey types (Chipps & Garvey 2007). To test if the mass of consumed prey types varied among and within seasons in the Deshka River and among and within reaches in Alexander Creek, we used analysis of covariance (ANCOVA) with %M of each prey taxa as our response variable and pike length as our covariate. As these tests were *a posteriori*, we set appropriate alpha levels using the Bonferroni inequality overall alpha divided by *n* (e.g., the number of seasons or reaches). We used the Tukey Honest Significance Difference (HSD) test as a post-hoc test to identify the prey items with the highest %M. To satisfy assumptions of normality, we arcsine-square root transformed %M when necessary. We report all means using the untransformed, least-square means (± 1 SE).

To explore patterns of relative prey importance, we constructed bivariate plots of PSA versus %O. Dominant prey items have high %O in the diets and high PSA values, while rare prey items have low PSA and low %O values. Opportunistic feeding is represented for prey items that have high PSA and low %O in the diets, and generalised feeding is characterised by prey items that have low PSA and high %O. When plotted in this fashion, graphical techniques can be used to evaluate relative prey dominance and the degree of

homogeneity of the diet (Amundsen et al. 1996; Chipps & Garvey 2007).

Pike density can affect diet due to interactions among predators (e.g., kleptoparasitism and cannibalism; Nilsson & Brönmark 1999). Pike at high densities select different prey items and have decreased intake rates than pike at low densities (Nilsson 2001). To assess density effects on diet, we examined the relationships between pike relative abundance and the prey category with the greatest %M in each sampled slough in the Deshka River and Alexander Creek. In the Deshka River, we estimated pike relative abundance per slough as the total number of unique pike caught in all three gill net sets. In Alexander Creek, we used the total number of pike captured in each sampled slough to estimate relative abundance. We ran separate analyses for each stream because gill net capture effort differed. We also analysed the three Alexander Creek reaches separately because effort differed (i.e., each reach was sampled by a different field crew).

Pike diet can also be limited by gape size, which is a linear function of pike body length (Nilsson & Brönmark 2000). To test if pike diet is better predicted by prey size than by prey identity, we tested for correlations between the maximum length of prey items in each pike sample and pike length. All statistical analyses were performed in JMP 9.0.2 (SAS Institute, Carey, North Carolina, United States).

Results

Deshka River

Pike sample size and lengths are reported in Table 1. Pike length differed across our sampling dates (ANOVA: $F_{2, 216} = 13.26$, $P < 0.0001$). Pike sampled in May and August were of similar length and were larger than pike sampled in June (Tukey-HSD). Gastric lavage removed 96% ($\pm 3\%$) of the total mass of stomach contents ($n = 25$). We observed 14 species of fish, 6 types of invertebrates, 1 anuran and 2 small mammal species in pike stomach samples (Table 2).

All prey

Pike stomach contents differed among months (MANCOVA: Wilk's lambda = 0.78, $F_{28,404} = 1.89$, $P = 0.004$) and by pike length (MANCOVA: $F_{14,202} = 4.72$, $P < 0.0001$). Total *Oncorhynchus* were the dominant prey category by mass, the most frequently encountered prey item and the most numerous prey item in stomachs sampled in May, June and August (Table 2). We found up to 47, 14 and 8 Pacific salmonids/pike in May, June and August, respectively. The %M of Total *Oncorhynchus* did not differ among months (ANCOVA: $F_2 = 1.37$,

Pike diets in Southcentral Alaska

Table 1. Sample size for pike stomach contents and fork length (FL) of sampled pike in the Deshka River in May, June and August 2011.

Months	Pike sampled	Empty stomachs	Stomachs with unidentifiable contents	FL range (cm)	Mean FL (cm) ± 1 SE
May	97	18	4	25.0-67.7	40.9 \pm 1.6
June	99	10	3	24.7-65.0	35.9 \pm 1.0
August	78	19	1	28.5-70.5	45.0 \pm 1.0

$P = 0.26$), but it did differ by pike length (ANCOVA: $F_1 = 5.40$, $P < 0.0001$). The %M of Total *Oncorhynchus* decreased with pike size ($r^2 = 0.16$, $P < 0.0001$).

A bivariate plot of prey-specific abundance versus %O indicated that Total *Oncorhynchus* was the dominant food category for pike in May, June and August (Fig. 2). PSA (33%-58%) and O (32%-45%) for total *Oncorhynchus* exceeded all other prey taxa. In May, pike fed opportunistically on longnose suckers (PSA = 18%, O = 6%) and generally on Arctic lam-

prey (PSA = 4%, O = 15%). In June, pike fed opportunistically on round whitefish (PSA = 25%, O = 7%) and generally on Arctic lamprey (PSA = 2%, O = 11%). In August, pike fed opportunistically on round whitefish (PSA = 22%, O = 7%) and voles (PSA = 17%, O = 6%) (Fig. 2). All other prey taxa occurred infrequently and contributed little to consumed mass.

The number of pike captured ranged from 1 to 111 individuals per slough. The correlation between %M of Total *Oncorhynchus* and pike relative abundance/slough was not statistically significant ($R = 0.30$, $P = 0.32$), but the correlation between maximum prey size and pike length was ($R = 0.58$, $P < 0.0001$). We found no difference in this latter correlation among seasons (ANCOVA: $F_2 = 1.14$, $P = 0.32$).

Pacific salmonids

Pike stomach samples of *Oncorhynchus* species differed among months (MANCOVA: Wilk's lambda = 0.80, $F_{10,422} = 5.06$, $P < 0.0001$) and by

Table 2. Diet composition for pike sampled in the Deshka River in May, June and August 2011. Prey taxa are quantified by per cent number (%N), mass (%M), and frequency of occurrence (%O). *Oncorhynchus* spp. are prey that could only be identified to genus. Total *Oncorhynchus* is the sum value across all prey within the *Oncorhynchus* genus.

Diet Item	Scientific name	May			June			August		
		% N	% M	% O	% N	% M	% O	% N	% M	% O
Invertebrates										
Amphipods	Gammaridae	0	0	0	0	0	0	0	0	0
Aquatic beetles	Dytiscidae	0	0	0	0	0	0	0	0	0
Damselflies	Coenagrionidae	3	2	3	0	0	0	0	0	0
Dragonflies	Aeshnidae	1	1	2	2	2	2	5	3	5
Leeches	Erpobdellidae spp.	4	3	5	1	1	1	3	2	3
Mayflies	Siphonuridae	0	0	0	0	0	0	0	0	0
Salmonid fish										
Arctic grayling	<i>Thymallus arcticus</i>	1	1	1	0	1	1	0	0	0
Coho salmon	<i>Oncorhynchus kisutch</i>	0	0	0	0	1	1	12	16	11
Chinook salmon	<i>O. tshawytscha</i>	24	30	20	41	42	36	20	18	20
Rainbow trout	<i>O. mykiss</i>	3	3	3	0	0	0	2	2	2
Round whitefish	<i>Prosopium cylindraceum</i>	2	4	2	6	10	7	10	11	10
Sockeye salmon	<i>O. nerka</i>	0	0	0	0	0	0	0	0	0
<i>Oncorhynchus</i> spp.		21	15	21	28	23	29	12	13	12
Total <i>Oncorhynchus</i>		48	48	45	70	67	65	46	48	43
Other fish										
Arctic lamprey	<i>Lampetra camtschatica</i>	12	8	13	8	7	9	2	2	2
Burbot	<i>Lota lota</i>	1	1	1	0	1	1	7	7	7
Eulachon	<i>Thaleichthys pacificus</i>	0	0	0	0	0	0	0	0	0
Longnose sucker	<i>Catostomus catostomus</i>	6	8	8	0	0	0	7	0	7
9-spine stickleback	<i>Pungitius pungitius</i>	0	0	0	0	0	0	0	0	0
Northern pike	<i>Esox lucius</i>	0	0	0	1	0	1	0	0	0
Silmy sculpin	<i>Cottus cognatus</i>	6	6	6	6	6	6	2	2	2
3-spine stickleback	<i>Gasterosteus aculeatus</i>	14	16	14	2	2	3	11	9	10
Other										
Red-backed voles	<i>Myodes rutilus</i>	0	0	0	3	3	3	9	9	9
Shrews	<i>Sorex</i> spp.	0	0	0	1	1	0	0	0	0
Wood frog	<i>Rana sylvatica</i>	0	2	1	0	0	0	0	0	0

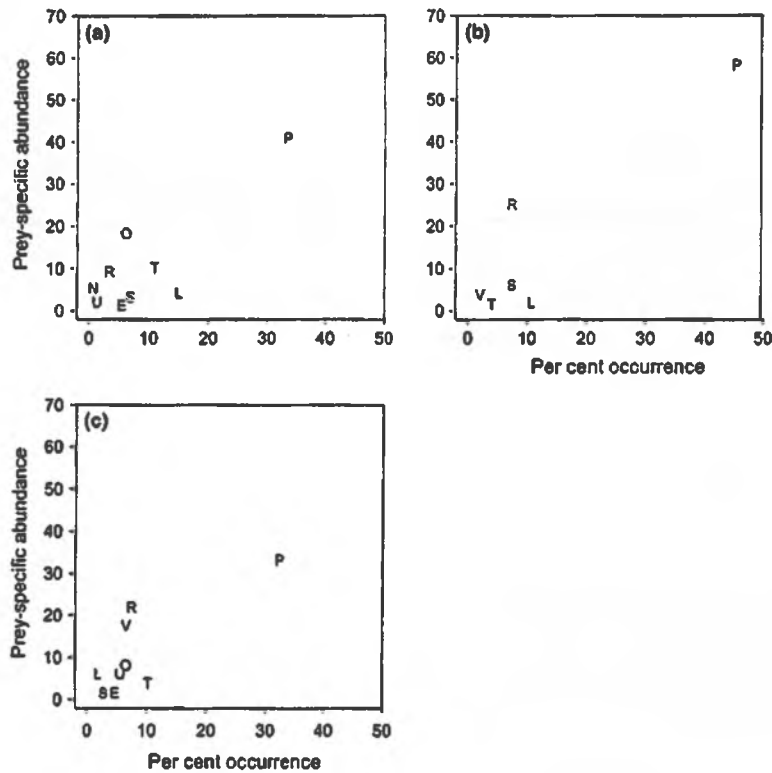


Fig. 2. Biplot representation of prey-specific abundance (per cent wet mass) versus per cent occurrence for all taxa in the Deshka River: Prey use by pike collected in (a) May, (b) June and (c) August. Letters correspond to individual prey taxa: E = Leech, L = Arctic lamprey, N = Northern pike, O = Longnose sucker, P = Pacific salmonids, R = Round whitefish, S = Slimy sculpin, T = Three-spine stickleback, U = Burbot and V = Vole. Prey that are not shown in the biplots had prey-specific abundance and occurrence values <5%.

pike length ($F_{5,211} = 13.37, P < 0.0001$). In May, pike stomachs contained Chinook salmon, rainbow trout and unidentified *Oncorhynchus* spp., but %M varied among species (Table 2; ANCOVA: $F_4 = 22.31, P < 0.0001$). Chinook salmon represented the greatest proportion of the total diet mass, while rainbow trout represented the least (Tukey-HSD). We recorded a maximum of 33 Chinook salmon/pike and 1 rainbow trout/pike in May. In June and August, we observed Chinook salmon, rainbow trout, sockeye salmon and unidentified *Oncorhynchus* spp. in pike stomach samples (Table 2). The %M of these species varied in June (ANCOVA: $F_4 = 49.25, P < 0.0001$) and August (ANCOVA: $F_4 = 7.00, P < 0.0001$). In June, Chinook salmon represented the greatest proportion of the total mass ($M = 42\%$) followed by unidentified *Oncorhynchus* spp. ($M = 23\%$). We observed a maximum of 13 Chinook salmon/pike and 9 unidentified salmonids/pike. Contributions of the remaining species were negligible. In August, Chinook salmon, coho salmon and unidentified *Oncorhynchus* spp. had similar M (13–18%), but M values for rainbow trout and sockeye salmon were <1% (Tukey-HSD). We

observed a maximum of 5 Chinook salmon/pike and 5 coho salmon/pike.

There was no correlation between pike length and %M of coho salmon ($r^2 = 0.00, P = 0.79$) or sockeye salmon ($r^2 = 0.00, P = 0.89$). Pike length explained little of the variation in the %M of Chinook salmon, unidentified *Oncorhynchus* spp. and rainbow trout ($r^2 = 0.15, P < 0.0001$; $r^2 = 0.03, P = 0.02$; and $r^2 = 0.08, P < 0.0001$, respectively).

The bivariate plot of PSA versus %O indicated that Chinook salmon were the relatively dominant food item in May, June and August (PSA = 13–44%, O = 21–33%; Fig. 3). Coho salmon did not occur in pike stomach samples in May, were rare in June and had similar importance to Chinook salmon in August (PSA = 11%, O = 14%; Fig. 3). Pike fed opportunistically on rainbow trout in May (PSA = 15%, O = 2%) and rarely in August (Fig. 3). Rainbow trout were absent from stomach samples in June.

Alexander Creek

Pike sample size and lengths are reported in Table 3. Mean length of pike did not differ among reaches in

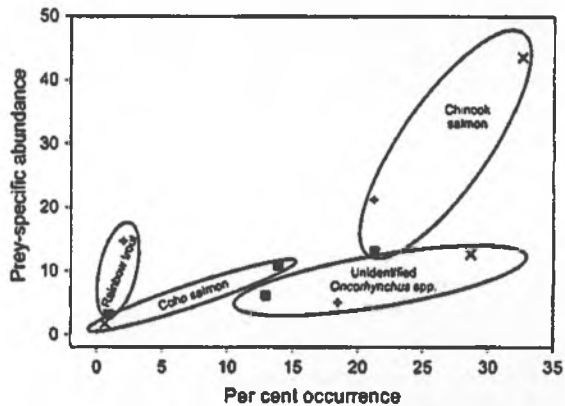


Fig. 3. Biplot representation of prey-specific abundance (per cent wet mass) versus per cent occurrence for Pacific salmonid species in the Deshka River. Symbols indicate the month in 2011 when pike diets were sampled: (+) = May, (x) = June and (■) = August. The ellipses surround specific prey categories.

May, but pike in the upper reach in June were significantly smaller than pike sampled in May (ANOVA: $F_{3,165} = 35.13, P < 0.0001$). Pike stomach samples had 11 species of fish, 6 types of invertebrates, 1 anuran and 2 small mammal species (Table 3).

All prey

Pike stomach contents differed among reaches (MANCOVA: Wilk's lambda = 0.31, $F_{42,449} = 5.11, P < 0.0001$), but contents were not related to pike length (MANCOVA: $F = 0.14, P = 0.27$). Total *Oncorhynchus* was the relatively dominant prey category by mass (31%) in the lower reach of Alexander Creek (Table 4; ANCOVA: $F_{13} = 6.54, P < 0.0001$). We observed a maximum of two Pacific salmonids/pike in the lower reach.

In contrast, Total *Oncorhynchus* only occasionally occurred in pike diets in the middle reach, and it did not occur in diets in the upper reach in May or June. Rather, Arctic lamprey were the dominant prey item by mass (34%) in the middle reach (Table 4; ANCOVA: $F_{13} = 8.20, P < 0.0001$), and slimy sculpin were the dominant prey item by mass in the upper reach in May (72%) and June (68%; ANCOVA: $F_{13} = 28.85, P < 0.0001$ and $F_{13} = 80.32, P < 0.0001$ respectively). In May, we observed a maximum of 24

Arctic lamprey/pike in the middle reach and 14 slimy sculpin/pike. In June, we observed up to eight slimy sculpin/pike. Slimy sculpin%*M* in the upper reach did not differ between May and June (Tukey HSD). Pike length was not associated with the dominant prey items by mass in any reach (ANCOVA: $F_1 < 2.48, P > 0.12$). Other prey taxa that contributed to pike diet mass include Arctic grayling in the lower reach, Arctic grayling and Total *Oncorhynchus* in the middle reach, leeches in the upper reach in May and amphipods in the upper reach in June (Table 4).

A bivariate plot of *PSA* versus *O* suggested that Total *Oncorhynchus* was a relatively dominant food category found in pike stomachs in the lower reach in May (*PSA* = 28%, *O* = 27%; Fig. 4). Arctic grayling (*PSA* = 36%, *O* = 11%) and round whitefish (*PSA* = 28%, *O* = 2%) were important opportunistic prey. Pike fed generally on Arctic lamprey (*PSA* = 2%, *O* = 21%). In the middle reach, there was no dominant prey category (Fig. 4). Pike fed opportunistically on Arctic grayling (*PSA* = 52%, *O* = 12%) and generally on Arctic lamprey (*PSA* = 7%, *O* = 35%). In the upper reach in May, pike fed dominantly on slimy sculpin (*PSA* = 55%, *O* = 63%) and opportunistically on Arctic grayling (*PSA* = 35%, *O* = 6%). In the upper reach in June, pike fed dominantly on slimy sculpin (*PSA* = 45%, *O* = 39%), opportunistically on voles (*PSA* = 49%, *O* = 7%) and generally on amphipods (*PSA* = 1%, *O* = 42%). Contributions of the remaining species were negligible.

In May, there was some evidence that prey size increased with pike length, but this relationship differed among reaches (ANCOVA: $F_{1,2} = 8.31, P = 0.0004$). The relationship was weak in the lower reach ($R = 0.31, P = 0.04$), and correlation coefficients were somewhat greater in the middle and upper reaches (middle: $R = 0.58, P < 0.0001$; upper: $R = 0.50, P = 0.01$). In June, the correlation between prey size and pike length was not statistically significant in any reach ($R = 0.25, P = 0.06$).

Gill nets captured 24–277 pike/slough in the lower reach, 14–105 pike/slough in the middle reach and 39–163 pike/slough in the upper reach. In addition, we captured 7–16 pike in five sloughs in the upper reach in June. However, the correlations between

Table 3. Sample size for pike stomach contents and fork length (FL) of sampled pike in Alexander Creek in May and June 2011.

Month	Reach	Pike sampled	Empty stomachs	Stomachs with unidentifiable contents	FL range (cm)	Mean FL (cm) ± 1 SE
May	Lower	79	21	15	25.0–70.1	48.4 ± 1.4
	Middle	60	12	6	31.2–100.0	47.2 ± 1.8
	Upper	53	24	3	24.5–61.6	42.5 ± 2.1
June	Upper	63	7	7	24.2–53.9	31.7 ± 8.6

Table 4. Diet composition for pike sampled from the lower, middle and upper reaches of Alexander Creek in May and June 2011. Prey taxa are quantified by per cent number (%N), mass (%M), and frequency of occurrence (%O). *Oncorhynchus* spp. are prey that could only be identified to genus. Total *Oncorhynchus* is the sum value across all prey within the *Oncorhynchus* genus.

Diet Item	Lower			Middle			Upper_May			Upper_June		
	% N	% M	% O	% N	% M	% O	% N	% M	% O	% N	% M	% O
Invertebrates												
Amphipods	0	0	0	0	0	0	0	0	0	23	10	20
Aquatic beetles	7	7	7	1	1	3	2	0	3	2	2	3
Damselflies	2	0	2	5	5	3	0	0	0	0	0	0
Dragonflies	10	0	9	0	0	0	4	4	3	3	3	4
Leeches	6	6	5	2	1	5	9	8	13	4	4	8
Mayflies	0	0	0	0	0	0	0	0	0	1	1	2
Salmonid fish												
Arctic grayling	11	12	11	11	15	12	5	7	6	2	2	1
Coho salmon	0	0	0	0	0	0	0	0	0	0	0	0
Chinook salmon	2	2	2	2	2	1	0	0	0	0	0	0
Rainbow trout	6	6	5	2	3	3	0	0	0	0	0	0
Round whitefish	2	2	2	0	0	0	0	0	0	0	0	0
Sockeye salmon	0	0	0	0	0	0	0	0	0	0	0	0
<i>Oncorhynchus</i> spp.	20	22	20	7	8	8	0	0	0	0	0	0
Total <i>Oncorhynchus</i>	28	31	27	11	14	12	0	0	0	0	0	0
Other fish												
Arctic lamprey	19	17	21	45	34	35	1	0	3	0	0	0
Burbot	0	0	0	8	11	9	1	1	3	0	0	0
Eulachon	0	0	0	0	1	1	0	0	0	0	0	0
Longnose sucker	0	0	0	1	2	1	4	4	3	0	0	0
9-spine stickleback	1	3	4	0	0	0	4	4	3	0	0	0
Northern pike	0	0	0	0	0	0	0	0	0	0	0	0
Slimy sculpin	8	9	9	8	8	12	71	72	68	60	71	60
3-spine stickleback	0	0	0	7	8	6	0	0	0	0	0	0
Other												
Red-backed voles	0	0	0	0	0	0	0	0	0	6	7	5
Shrews	0	0	0	0	0	0	0	0	0	0	0	1
Wood frog	5	5	4	0	1	1	0	0	0	0	0	0

pike abundance and %M of any of the dominant prey taxa for these reaches were not statistically significant: Total *Oncorhynchus* in the lower reach ($R = -0.20$, $P = 0.70$), Arctic lamprey in the middle reach ($R = 0.73$, $P = 0.06$) and slimy sculpin in May and in June in the upper reach (May: $R = 0.40$, $P = 0.51$; June: $R = -0.31$, $P = 0.55$).

Pacific salmonids

The proportion of *Oncorhynchus* species occurring in pike stomachs differed among reaches (MANCOVA: Wilk's lambda = 0.83, $F_{9,394} = 3.58$, $P = 0.0003$), but not by pike length ($F_{3,162} = 1.48$, $P = 0.22$). Chinook salmon, rainbow trout and unidentified *Oncorhynchus* spp. were the only *Oncorhynchus* species that we found in stomach samples and we did not find any of these species in stomachs sampled from the upper reach in May or June (Table 4). The %M for each of these species did not differ among reaches (ANCOVA: $F_3 = 0.16$, $P = 0.92$ and $F_3 = 1.10$, $P = 0.35$) and %M was not related to pike length in any reach (ANCOVA: $F_1 < 2.05$, $P > 0.15$). The %M

for unidentified *Oncorhynchus* spp. differed among reaches (ANCOVA: $F_3 = 9.08$, $P < 0.0001$)—%M in the lower reach was greater than the middle reach and the middle reach did not differ from the upper reach in May or June. We also found that %M for unidentified *Oncorhynchus* spp. was not related to pike length (ANCOVA: $F_1 = 2.45$, $P = 0.12$).

A bivariate plot of PSA versus %O indicated that pike fed opportunistically on rainbow trout in the lower reach (PSA = 21%, O = 5%) and the contribution of Chinook salmon was negligible in the lower and middle reaches (Fig. 5). Pike fed generally on unidentified *Oncorhynchus* spp. in the lower reach (PSA = 6%, O = 20%), but the contribution of this prey item was negligible in the middle reach (Fig. 5).

Discussion

We found that salmonids constitute the major prey items for pike in the Deshka River and in the lower reach of Alexander Creek throughout the summer. In the Deshka River, salmonids were dominant prey

Pike diets in Southcentral Alaska

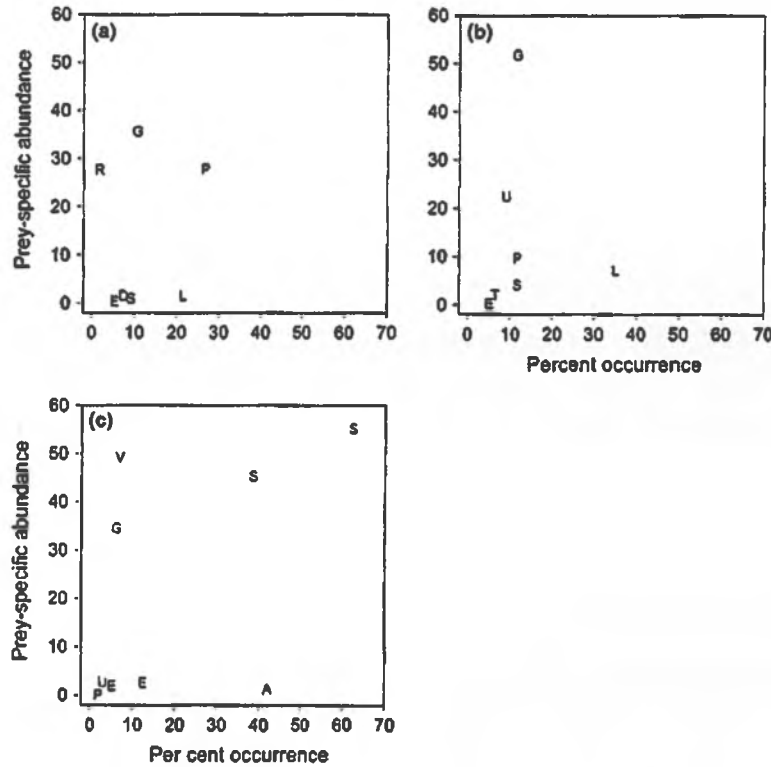


Fig. 4. Biplot representation of prey-specific abundance (per cent wet mass) versus per cent occurrence in Alexander Creek: Prey use by pike collected in (a) the lower reach in May, (b) the middle reach in May and (c) the upper reach in May (red letters) and June (black letters). Letters correspond to individual prey taxa: A = Amphipod, B = Aquatic beetle, D = Dragon fly, E = Leech, G = Arctic grayling, L = Arctic lamprey, P = Pacific salmonids, R = Round whitefish, S = Slimy sculpin, T = Three-spine stickleback, U = Burbot and V = Voles. Prey that are not shown in the biplots had prey-specific abundance and occurrences values <5%.

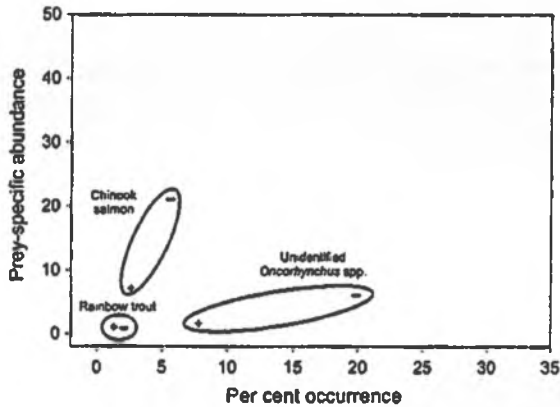


Fig. 5. Biplot representation of prey-specific abundance (per cent wet mass) versus per cent occurrence for Pacific salmonid species in Alexander Creek. Symbols indicate the reach in 2011 where pike diets were sampled: (-) = lower and (+) = middle. The ellipses surround specific prey categories.

items for pike and diet was not related to pike density. In Alexander Creek, salmonids were also frequently consumed by pike, even though salmonid abundance was low. We also found that the effects of

pike invasions may extend beyond salmonids because pike shifted to consumption of other native fish, like slimy sculpin and Arctic lamprey, when salmonids were rare. Implications of this trophic adaptability are that invasive pike can drive multiple species to low abundance and possible extirpation (Byström et al. 2007; Haight & von Hippel 2011).

We observed Pacific salmonids in 140 of the 274 pike stomachs sampled in the Deshka River and found that they were the dominant prey. Pike consumed >600 Pacific salmonids, the majority of which were Chinook salmon juveniles (<100 mm) in May and June and coho salmon juveniles (<100 mm) in August. Rainbow trout were rare in pike diets, but their PSA was high relative to their %O because larger rainbow trout (>150 mm) were consumed. If our snapshots of pike stomach contents are indicative of daily consumption patterns, then extrapolation of our data suggests that pike consume a large proportion of recruiting salmonids. This extrapolation is supported by other studies – Kekäläinen et al. (2008) found that pike ate 29% of stocked Atlantic salmon (*Salmo salar*) smolts and Jepsen et al. (1998) estimated that

pike were responsible for 56% of Atlantic salmon smolt mortality during a 3 week period. The ability for salmon to coexist with invasive pike comes into question when consumption and predation levels are this high.

In fact, Spens & Ball (2008) found that pike and salmon coexistence is rare in Swedish boreal lakes and that self-sustaining salmon populations were only possible if pike were removed. However, their 'pike-salmonid noncoexistence rule' does not seem to apply to the Deshka River, where species like Chinook salmon have remained near Sustainable Escapement goals in the Deshka River despite the intensity of pike predation on salmonids that we observed. Understanding the mechanisms that allow for this incongruity may help managers with limited resources to prioritise habitats for pike suppression.

One aspect that may facilitate coexistence is spatial refugia. In other Alaskan systems where pike are native and are found with nondeclining salmon populations, such as the Wood River Lake system that flows into Bristol Bay, there is evidence of habitat segregation. Sockeye salmon in the Wood River Lake system are largely pelagic foragers and spend little time near the vegetated banks where pike are found (Chihuly 1976). Similarly, Chinook salmon spawn and rear in the middle and upper sections of the Deshka River, where there are large cobbles, deep water and riffles. Spawning and rearing habitat for pike is primarily found in sloughs in the lower section of the Deshka River, so there is minimal habitat overlap. Pike predation on juvenile salmon may be limited to these lower reaches for much of the year and to short, temporal windows when salmon smolts from upper reaches move downstream. The Alexander Creek drainage is the opposite; it has thousands of square kilometres of pike spawning and rearing habitat, and habitat that is restricted to Chinook salmon is rare. These observations suggest that the effects of predation by introduced pike on juvenile salmonids are strongly mediated by the physical template of habitat (Warren & Liss 1980).

We could not test the hypothesis that pike are responsible for Pacific salmonid declines in Alexander Creek. However, we did find that Pacific salmonids were a relatively dominant prey item in the lower and middle reaches and that they were absent from stomach samples in the upper reach. This absence contrasts with historical spawning survey data in Alexander Creek, which found that ≈ 3600 Chinook salmon adults returned annually and most of these fish spawned in the upper reaches (Yanusz & Rutz 2009). More recent survey data show the opposite pattern and align with our stomach content data; there were 110 returning adults and spawning frequency declined with proximity to Alexander Lake

where there are estimated to be $>13,000$ pike (36 fish/hectare; Oslund & Ivey 2010; Rutz 1999; Yanusz & Rutz 2009). In comparison, estimated pike densities are 1.78 fish/ha (Roach 1996) and 1.39 fish/ha (Dye 2002) in other Alaskan waters where pike are native and occur with salmon. Pike populations downstream of the lake are also abundant; ADFG removed >4000 pike from 60 side-sloughs of Alexander Creek in May and June 2011 (ADFG, unpublished data). Pike can achieve high abundance and densities in Alexander Creek because there is ample spawning and nursery habitat. When pike are abundant, our data suggest that they can have negative effects on salmon: individual pike consumed >40 salmonids per sampling event, $>73\%$ of individuals had nonempty stomachs and diet was independent of pike density.

Pike prefer salmonid prey in the Susitna River basin (Rutz 1999) and once salmonids decline, pike predation pressure shifts to other taxa (Haught & von Hippel 2011). In general, diet plasticity allows predator population size to be independent of the abundance of their preferred prey. As a result, predator encounter rates with preferred prey can remain high, even after preferred prey have declined (Fagan et al. 2002; Symondson et al. 2002). Not surprisingly, diet plasticity is a characteristic of many invasive predators that have been implicated in native species extinctions (e.g., Ogutu-Ohwayo 1993; Caut et al. 2008). Pike in Alexander Creek fit this theory. First, we found that pike have catholic diets. They fed on >20 different taxa and nonsalmonid prey dominated their stomach contents in reaches where spawning salmon are now rare. Specifically, pike stomach contents were dominated by slimy sculpin in the upper reach and Arctic lamprey in the middle reach. Second, pike abundance in Alexander Lake and Alexander Creek is high even though salmonids have declined. Third, we found salmonids in pike stomach contents in the middle and lower reaches despite the low abundance of salmonids. We did not link pike to any native species extinctions, but pike have been associated with the local extinction of multiple fish species in other systems (e.g., Patankar et al. 2006; Byström et al. 2007; Spens & Ball 2008).

Future directions

Suppressing pike in systems where habitat is not limiting, like Alexander Creek, may be essential for salmonids and other native fish to recover to desired escapement goals. Indeed, pike eradication was required for self-sustaining salmon populations in Sweden (Spens & Ball 2008). However, complete

removal of pike in tributaries to the Susitna River basin will be difficult because this basin is extensive (52,000 km²) and remote. Moreover, pike occur in the main stem of the Susitna River and reinvasion is likely. Thus, managers must identify strategies to reduce the negative effects of pike on salmon populations.

Our diet data in the Deshka River suggest that removal of pike <400 mm could help reduce predation on Pacific salmonids. We found that small pike consumed more Chinook and coho salmon biomass than large pike in the Deshka River. Most of these salmonids were <100 mm. The weak correlation between prey length and pike size indicates that large pike also consumed small prey, like Arctic lamprey and insects, but small salmonids were rare in their diet. ADFG managers have been aware that small pike consume a disproportionate number of juvenile salmonids (Rutz 1999). In 1998, they implemented slot limits in Alexander Lake that allowed for unlimited take of pike <558 mm and limited the take of pike ≥ 558 mm. The rationale was that large pike can limit the abundance of small pike through cannibalism and that most anglers will only travel to fish for pike if they can keep large fish (Yanusz & Rutz 2009). Angling pressure was minimal in this remote drainage, so slot limits had little effect on small pike abundance (Yanusz & Rutz 2009). We also found that pike cannibalism was rare in Alexander Creek. Additional tools that are effective at suppressing small pike, as well as larger pike, in remote areas are needed in Southcentral Alaska.

Our stomach content data confirm that juvenile salmonids are the major prey item for invasive pike in systems where salmonids are still abundant, but that pike will feed on alternative prey after salmonids have declined. Thus, invasive pike are a threat to the ecosystem structure and function of many streams in Southcentral Alaska, especially in systems where pike spawning and rearing habitat are not limited. We believe that actions that limit the spread of pike to new drainages and that suppress pike populations in invaded drainages will benefit salmonids and other native species.

Acknowledgements

This study was funded by the Alaska Sustainable Salmon Fund (Project # 44609). We thank Alaska Department Fish & Game's Division of Commercial Fisheries (Soldotna, AK) and Division of Sport Fisheries (Palmer, AK) and Bob Pence (Alaska Pike Hunters) for providing logistical and technical support in the field. We thank Joshua Bischoff, Adrian Baer, Kasuan Brandel, Kiche Brandel, Eric Hollerback, Don Reeves and Matt Wamke for help in the

field. We also thank Erik Schoen and Bob Gresswell for helpful comments on the manuscript. Any use of trade, product or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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February 8, 2013

Rep. Paul Seaton
House Fisheries Committee
State Capitol Room 102
Juneau, AK 99801
f. 465.3472

RE: HB 89 "Aquatic Invasive Species"

Dear Chairman Seaton and Committee Members:

I am writing on behalf of the Cordova District Fishermen United Board of Directors and our membership to express our support of the intent of House Bill 89, as it would be a valuable addition to the Department's arsenal for the management of Aquatic Nuisance Species.

As was evidenced in the Pacific NW, marine debris associated with the 2011 Japanese tsunami poses increased opportunity for the introduction and transmission of invasive species into Alaskan waters. The outside beaches in the Gulf of Alaska and the PWS area, where the majority of debris washes ashore, are remote, uninhabited and yet hold some of our most productive salmon streams. Having a rapid response system in place gives the Department the tools to quickly implement eradication efforts and prevent the spread of ANS.

I would also like to acknowledge the concerns expressed by the Alaska Shellfish Growers Association, although in our region we currently don't have the same ANS complications, we can recognize their concern and request for amended language.

Thank you for your thorough consideration of HB 89.

Sincerely,

Alexis Cooper
Executive Director



February 4, 2013

Representative Paul Seaton
State Capitol
Juneau, AK 99801

Re: HB 89

Dear Rep. Seaton:

While ASGA supports the intent of HB 89, we are uneasy that it could potentially allow a state agency to be held harmless when unilaterally deciding to destroy private property.

Specifically, 16.05.093(f) holds the State of Alaska harmless if the Alaska Department of Fish and Game (ADFG) unilaterally decides it is necessary to destroy a crop of shellfish, shellfish production equipment or other floating infrastructure to eradicate an invasive species at a shellfish farm.

You attempted to respond to our concerns with 16.05.093(h) which states in part: “the department shall consider the potential effects of its response measures on private property while selecting the most effective methods to eradicate or control the aquatic invasive species.”

Frankly, the language is not as strong as we had hoped. Some background might help.

While an invasive species such as the “sea vomit” infecting Whiting Harbor is a serious concern, oyster farmers can completely eradicate the organism from their crops, gear and floating infrastructure utilizing a variety of strategies. While these tunicates are very hard to eradicate from submerged reefs and rocks, there are many treatments an oyster farmer can employ to safely kill the organism without harming the crop of oysters, culture gear, vessels and infrastructure.

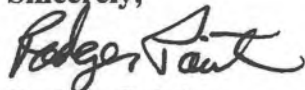
Despite the legitimate concerns about the spread of the tunicates in the marine environment and resulting impacts to habitat and wild organisms, there is no threat to human health from consuming oysters that had been covered by the “marine vomit.”

ADFG should work closely with the operators of infected farms to ensure invasive organisms are fully eradicated before ordering destruction of shellfish stocks and other private property. This seems like a common sense response and a course the agency is likely to follow, but we worry about the lack of recourse should ADFG personnel make a quick decision without consultation and interaction with the permit-holder.

We understand the need for a quick response to a situation such as Whiting Harbor and support your intent, but the "hold harmless" clause troubling, particularly when coupled with the soft language in AS 16.05.093(h): "...the department shall consider the potential effects of its response measures on private property while selecting the most effective methods to eradicate or control the aquatic invasive species."

We'd be pleased to work with you and the House Special Committee on Fisheries to resolve this dilemma.

Sincerely,



Rodger Painter
ASGA President

c.c. House Special Committee on Fisheries
Cora Campbell, ADFG
Ron Josephson, ADFG
Cynthia Pring-Ham, ADFG



Alaska Committee for Noxious and Invasive Plant Management

January 10, 2013

Representative Paul Seaton
345 W. Sterling Hwy. Suite 102B
Homer AK, 99603
907-235-2921
Representative_Paul_Seaton@legis.state.ak.us

RE: HB365 An Act relating to the rapid response to, and control of, aquatic invasive species

The Alaska Committee for Noxious and Invasive Plant Management (CNIPM) is the professional society for the study and management of invasive species in Alaska. Invasive species cause hundreds of billions of dollars in management costs, crop losses, loss of property value, damage to infrastructure, and cause a host of environmental problems across the USA each year. In Alaska we are lucky that many of the most harmful invasive species have not arrived yet and those that are already here have not yet overrun Alaska's relatively pristine natural resources. We appreciate the introduction of HB 365 last session by the House Resources Committee, and understand that it is your intention to submit a similar bill during the 2013 legislative session. Our board offers for your consideration comments and context on the content of the bill and recommendations for additional legislative needs.

The CNIPM board feels that this legislation is an excellent step toward developing rapid response capabilities for priority invasive species in Alaska. As currently written, HB 365 would direct the Alaska Department of Fish and Game to increase the priority of rapid response to identified aquatic invasive species, specifically with rapid response planning. Effective response to new invasions requires all resource management and permitting agencies to recognize the urgency and elevate the priority for swift management.

The CNIPM board appreciates your request to provide comments to the text outlined in HB 365. Our comments on this legislation include:

1. Page 1 line 1 should be amended to include "prevention of" in the title
 - o An important component of invasive species management is preventing introductions of new species into an area. Adding prevention to the rapid response planning will help make state management actions more effective in limiting the impacts of invasive species.
2. We suggest including a definition of "rapid response", for example: "initiation of eradication efforts or critical interim measures to achieve containment while a longer term eradication or suppression strategy is formulated".
3. The bill should continue to deal with rapid response to both marine and freshwater invasive species.
 - o A bill for rapid response of aquatic invasive species is an excellent first step towards managing those species that pose the greatest threat to Alaska's resources and economy. Limiting the scope to marine environments would be short sighted and not address the aquatic ecosystem as a whole. Certain resources, such as anadromous salmon, could be negatively impacted by aquatic invasive species in both marine and freshwater habitats.



Alaska Committee for Noxious and Invasive Plant Management

4. Terminology in the legislation should direct rapid response to incipient infestations that have the highest capacity to negatively affect valuable resources while being sufficiently limited in scope that control is feasible, whether it is found over a limited or broader geographic area.
 - In the best practices of invasive species management, rapid response is tied to early detection – with the understanding that management is most effective when managers are directing effort at small, isolated, incipient populations. Please see the attached “Invasion Curve” for reference. While the scope of new infestations must be limited in order to allow for effective “rapid response,” the terminology of ‘limited’ geographic area created confusion in 2012 committee hearings. Thus, we recommend removing “limited geographic area” and replacing with “incipient populations that are limited in scope.” After speaking with bill sponsors, we understand the intent of this wording, but it may cause conflicts for those that read the bill and view this as a directive to only manage invasive species that have not spread from one introduction point. With the challenges of detecting dangerous new invasive species in our huge state, a harmful new invader may have arrived multiple times and be present in far apart locations by the time it is noticed. For example, while Elodea has been found in several communities throughout the state, its range is still extremely limited compared to the amount of Alaska’s uninfested waters and the likelihood for effective rapid response actions is high.
 - In order to effectively plan for and implement rapid response, a quantitative risk and decision methodology should be developed determining the risks, benefits, and costs of a set of management choices, including no action and delayed action. In the delayed action case, the benefits of collecting more information to make a more informed decision outweigh the costs of the delay. This methodology takes into account future consequences of all management alternatives. Such an effort directs resources to the highest priority infestations, applies the most cost effective management effort, and minimizes the highest potential losses for the economy and environment of the state.
5. The proposed amendment submitted by the house finance committee should read ‘The Department of Natural Resources and the department shall include in leases and permits a provision that the department shall be held harmless for an act under (b) of this section that affect private property of the lessee or permittee.’
 - Though we are not lawyers and are uncertain of the particular language that is constitutionally required or which language is appropriate for statute versus regulations, the State of Alaska has a public trust duty to act to protect the publicly owned resources of the State. It is common practice for State leases and permits to include a hold harmless agreement for anticipated or required State actions.
 - The Dept of Natural Resources’ plant health and quarantine regulations state that the director of the Division of Agriculture can establish quarantines to protect the state’s agriculture industry from pests. 11 AAC 34.100 sets forth that any treatment required under the quarantine will be at the owner’s expense. We see the hold harmless clause preferable to the Division of Agriculture’s regulations because the lease or permit holder would not be required to pay for the determined method of control. Rapid response to invasive species is an



Alaska Committee for Noxious and Invasive Plant Management

emergency situation, where decisive control actions will protect Alaska's critical natural resources.

6. Include a provision for the establishment of a rapid response fund.
 - o To adequately address the threat of aquatic invasive species and create the capacity for effective response, we recommend a rapid response fund be established within the Department of Fish and Game or Department of Natural Resources. This fund could be accessed for containment, eradication, and monitoring activities to deal with the highest priority aquatic invasive species. Rapid response funds would result in actual management as opposed to just more planning. In addition, if state funds for implementation were made available they could be used to match federal funds to address new issues efficiently. This need is underscored by a recent study by UAA's Institute for Social and Economic Research, which found that the federal government pays for about 84% of the invasive species management taking place in Alaska, while the State pays for only about 5%.
 - o We suggest that dispersal of funds be done in cooperation with appropriate agencies, university professionals, and user groups, as opposed to unilateral control by one department or division.

Though this legislation will be a significant step forward for invasive species management in Alaska, an Invasive Species Council will be necessary in the future as we move towards effective management of invasive species on a statewide scale. This panel of experts from various agencies and stakeholder groups would work together to determine State priorities for invasive species management and the best projects to strategically control the most harmful invasive species with limited funds. Other states utilize councils to accomplish their goals, and there are many models that could be adapted to fit Alaska's needs.

If we can be of any additional assistance on invasive species issues, please do not hesitate to contact us. CNIPM is a volunteer organization composed of concerned citizens, scientists, and land managers that volunteer or work for non-profit, tribal, local, state, and federal agencies across Alaska. The goals of CNIPM are to heighten the awareness of problems associated with non-native invasive plant species and to bring about greater statewide coordination, cooperation, and action to halt the introduction and spread of these undesirable plants. To learn more about the mission and goals of CNIPM, please visit www.uaf.edu/ces/cnipm.

Sincerely,

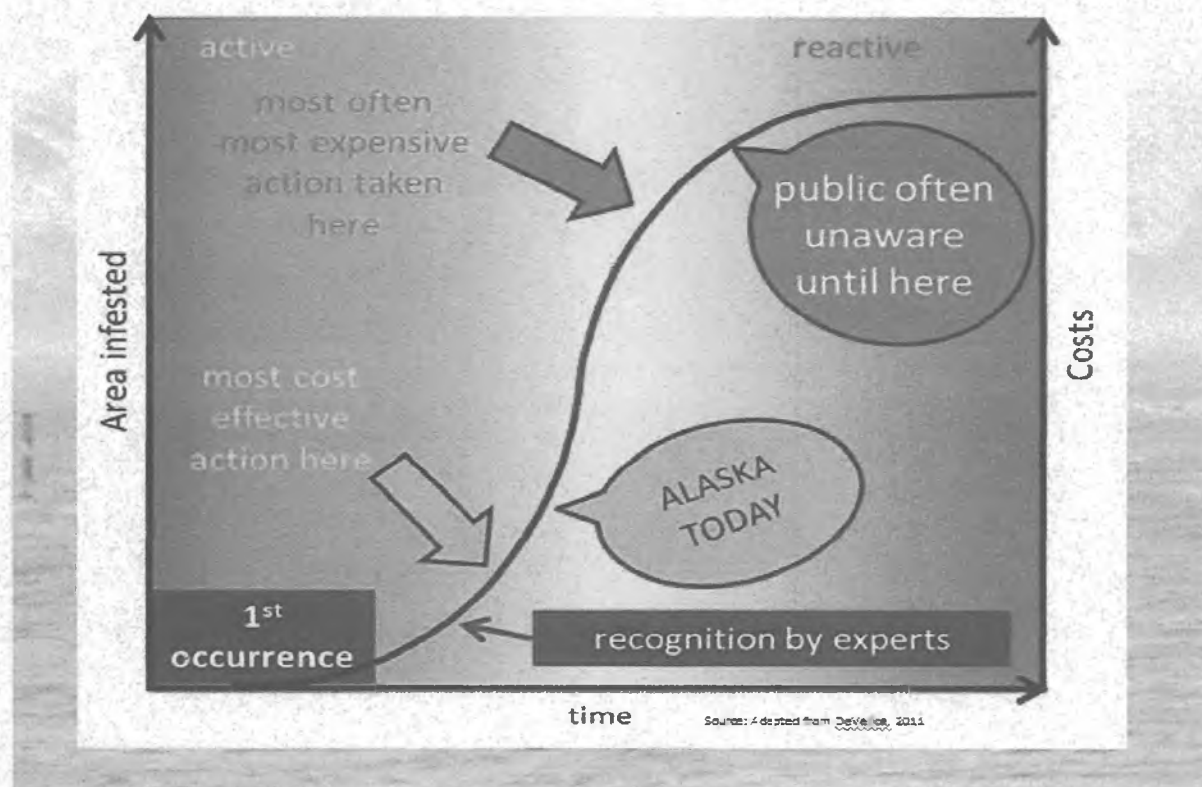
Tim Stallard, Chair
Alaska Committee for Noxious & Invasive Plant Management
Phone: (907) 347-2214
Weeds.free.ak@gmail.com



Alaska Committee for Noxious and Invasive Plant Management

Invasion Curve:

As species establish, costs go up!





ANCHORAGE SOIL & WATER CONSERVATION DISTRICT

COMPOSTING 101

BASICS OF COMPOSTING

Composting is the natural process by which organic materials are broken down by soil organisms into a rich, dark, humus-like material called compost. Composting is a natural process that occurs in nature, but it can be accelerated and controlled by the composting process.

PLANNING FOR 50/50 MIX

For every 100 pounds of green waste, you need 50 pounds of brown waste.

The Next Composting Hour Presenters

Topic	Presenter
Composting 101	Michelle Brown
Composting in the Home	Michelle Brown
Composting in the Office	Michelle Brown
Composting in the Community	Michelle Brown
Composting in the School	Michelle Brown
Composting in the Business	Michelle Brown
Composting in the Restaurant	Michelle Brown
Composting in the Hospital	Michelle Brown
Composting in the Government	Michelle Brown
Composting in the University	Michelle Brown
Composting in the Church	Michelle Brown
Composting in the Synagogue	Michelle Brown
Composting in the Mosque	Michelle Brown
Composting in the Temple	Michelle Brown
Composting in the Shrine	Michelle Brown
Composting in the Mausoleum	Michelle Brown
Composting in the Crypt	Michelle Brown
Composting in the Tomb	Michelle Brown
Composting in the Vault	Michelle Brown
Composting in the Columbarium	Michelle Brown
Composting in the Crematorium	Michelle Brown
Composting in the Funeral Home	Michelle Brown
Composting in the Mortuary	Michelle Brown
Composting in the Undertaker	Michelle Brown
Composting in the Embalmer	Michelle Brown
Composting in the Burial	Michelle Brown
Composting in the Interment	Michelle Brown
Composting in the Reinterment	Michelle Brown
Composting in the Exhumation	Michelle Brown
Composting in the Disinterment	Michelle Brown
Composting in the Entombment	Michelle Brown
Composting in the Inhumation	Michelle Brown
Composting in the Cremation	Michelle Brown
Composting in the Burial	Michelle Brown
Composting in the Interment	Michelle Brown
Composting in the Reinterment	Michelle Brown
Composting in the Exhumation	Michelle Brown
Composting in the Disinterment	Michelle Brown
Composting in the Entombment	Michelle Brown
Composting in the Inhumation	Michelle Brown
Composting in the Cremation	Michelle Brown

DIRT DAY
SATURDAY, MAY 19
10am - 4pm

ANCHORAGE SOIL & WATER CONSERVATION DISTRICT
NORSEMAN



Separate Title 21 chapter applauded by local residents
PNZ decision earns positive response

BY MIKE NESPER
Anchorage Star

Those in favor of creating a separate chapter for Chugiak-Eagle River to Title 21, which regulates municipal land use, had reason to celebrate Monday night.

The Anchorage Planning and Zoning Commission passed a motion requiring Chapter 21.10 be on the same level of review as the provisionally adopted chapters of the Title 21 rewrite by its Oct. 3 meeting. A round of applause followed the unanimous decision by the nearly 30 in attendance at Gruening Middle School.



ANCHORAGE SOIL & WATER CONSERVATION DISTRICT

"A weed is but a misplaced plant!"
- Emerson (1834-1882)

Policy Discussion: Invasive / Non-Native Plants

This was the Anchorage Soil and Water Conservation District's first public meeting on the topic of invasive and non-native plants. The meeting was held on Tuesday, October 23rd, 2012, at the Anchorage Convention Center. The meeting was attended by approximately 100 people. The meeting was a success and provided a great opportunity for the community to learn more about the issue of invasive and non-native plants. The meeting was also a great opportunity for the community to provide input on the issue of invasive and non-native plants. The meeting was a great success and provided a great opportunity for the community to learn more about the issue of invasive and non-native plants. The meeting was also a great opportunity for the community to provide input on the issue of invasive and non-native plants.



ANCHORAGE SOIL & WATER CONSERVATION DISTRICT

FY2012 Annual Report

The ASWCD Mission:

Supporting self-governance and private property rights, to assist landowners and managers with conservation and development through technical, financial and educational programs

BOARD OF SUPERVISORS & TEAM

Bret Burroughs, Chair
Jon Nauman, Vice-Chair
Linda Boggs, Treasurer/Secretary
Fred Wolfley, Supervisor
Denise Chythlook, Supervisor

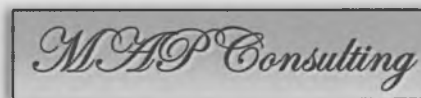


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The ASWCD's boundaries are the same boundaries as the Municipality of Anchorage: from Portage to the Knik River, including the communities of Portage, Girdwood, the Turnagain Arm, Anchorage, Eagle River, Chugiak, and Eklutna

LETTER FROM THE CHAIR

To look back on fiscal year 2012 brings a list of accomplishments to be proud of for the team of the Anchorage Soil and Water Conservation District. The ASWCD is truly making a difference in the community with our assistance in many areas, including agency and non-agency issues, on-the-ground assistance to property owners and developers. The District is showing that our qualified and confidential support and back-to-basics business plan works. We treat our business like you treat your business; that is why we accomplish projects and assistance directly to the community with limited overhead, and why the District operates through the utilization and support of the private sector rather than having employees and building a bureaucracy.

Our recipe for success creates a winning formula in our community that produces results. We fill needs property owners require, confidential on-the-ground assistance, with limited funds requires a dedicated volunteer board, and dedicated contractors. Holding overhead and administration costs under 10% (standard is between 20-50%) is critical. We are accountable for every dollar spent, and integrity, transparency, protection of private property rights, and respect are the tenets we live by.

The upcoming year is already setting up to be exciting. This is your District and we're here to help, but if you're expecting a bureaucracy, you're not going to find it here. Your Anchorage Conservation District is here to help our neighbors develop and take care of the natural resources in their control.

Bret M. Burroughs



ANCHORAGE WOODLOT, BIOMASS UTILIZATION & COMPOSTING

In 2012, the ASWCD's Anchorage Woodlot began its fifth season under a self-sustaining business model that was implemented in the 2008 season.

The ASWCD has been involved with the Anchorage Woodlot since its inception in 2000, transitioning from the Anchorage Fire Department to ASWCD management beginning in 2005. In 2008 we completed our transition from being supported with federal funds to this self-sustaining model that secures the woodlot's operations as long as the community needs it.

With property owners being supported in their active management of their property and being wildfire-aware and active stewards of their land, the woodlot has become a cornerstone program of the community.

The ASWCD Anchorage Woodlot processes all brush, limbs, and other material dropped off, into a ground material (more than 2,500 tons a season), that is available to the community free of charge. All firewood and firewood-suitable logs are also picked up by the members of the community at no charge.

This year's Anchorage Woodlot was made possible in partnership with Alaska Land Clearing, LLC and Mayor Sullivan's Administration, who allowed us to use a temporary site as our regular location, a Municipal snow disposal site was full of snow thanks to a record snow year. Thank you from the ASWCD and the community we serve!

Whether it be firewood and groundcover from the woodlot, composting, biomass to energy or heat, or biomass to value added product, the District has been supporting utilization in any form. Anchorage has tremendous biomass and compost feedstock resources, that are greatly untapped.

The ASWCD has assisted several potential start-ups with business plans, providing technical expertise, supplying data, and/or support through their respective processes, testing, permitting, or exploration of the possibilities. The ASWCD also teaches composting classes and is providing support to the community in their, and our, quest to become more self-sufficient and less wasteful of our resources.

Summary of Organic Waste Composting Data for Anchorage

Material	Estimated Volume (tons)	Composting Method
Food Waste (Commercial and Household)	12,373	Composting
Food/Wood/Plant Waste	2,200	Composting
Construction Debris and Land Clearing Waste (Wood/Brush/Log)	10,000	Composting
Yard Waste	4,500	Composting
Other Wood Waste	15,740	Composting
Food Waste (Commercial and Household)	24,174	Composting
Food Waste (Household)	12,000	Composting
Yard Waste	15,740	Composting
Construction Debris	10,000	Composting
Wood/Paper	10,000	Composting
Brush/Log	10,000	Composting

ANCHORAGE WOODLOT
COMPOSTING 101
BASICS OF COMPOSTING
PLANNING FOR SUCCESS
MONITORING
TIPS
BY GARDEN MUSEUMS, CORP.



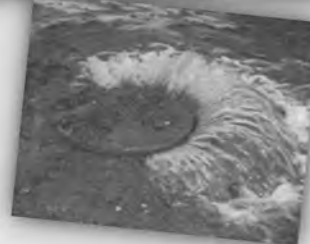
ACTIVE PROPERTY MANAGEMENT & CONSERVATION PLANNING

The District is always available to the residents of our District to assist in become active managers and stewards of the natural resources in their control. Whether it be a Conservation Plan for an agricultural or non-agricultural facility or property, assistance with permitting, or technical support, we are helping property owners use and develop their land.

Conservation Plans provide several benefits for property owners, including making properties more chore-friendly and easier to manage, bringing them into compliance with Municipal Code, particularly the provisions of "The Large Animal Ordinance," and helping to provide protection under State law for agricultural properties within the Municipality.

The District team works one-on-one with property owners, in the strictest of confidentiality, to design and implement site-specific Best Management Practices as wanted by the property owner, such as creating vegetation and buffering strategy, manure and mud management plans, and to address drainage, erosion, or other natural resource concerns, as well as assist property owners in many other aspects.

Highlights during FY12 include: the District began working to address a serious drainage issue off of Homestead Trail Road; began working to address a flooding issue for a property owner in Valdez; began the planning for upgrades and maintenance to the trails and facilities of Ruth Arcand Park and the William Chamberlin Equestrian Center; our support for a project to protect the water resources of Potter Marsh continued; and the ASWCD assisted several property owners in issues with agencies, acting in an advocacy and/or mediation capacity.



ASSISTANCE TO CONSORTIUM OF CHUGIAK-EAGLE RIVER COMMUNITY COUNCILS, AMC 21.10

The rewriting of Title 21, the Municipality's Land Use Code, has taken more than a decade, but is now in its final process and will be adopted by the end of FY13. Recognizing the need to preserve community values in Land Use Code, the property owners, residents, and business owners in the Chugiak-Eagle River (C-ER) area requested, and the Assembly granted, a separate chapter specific to the C-ER area. This allows the Chugiak-Eagle River community to write its own chapter -- the absolute essence of self-governance and self-determination. By Statute the District is charged with assisting in the settling of land, so how could the District say no when the Consortium asked for assistance.

The Consortium has worked more than five years in research, community input, and hundreds upon hundreds of hours in the collection and documentation of input and in the preparation of their separate chapter by the ASWCD.



Separate Title 21 chapter applauded by local residents PNZ decision earns positive response

BY MIKE NESEPER
Alaska Star

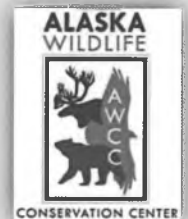
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WILDLIFE NATURAL RESOURCES: ANCHORAGE AND RURAL ALASKA WORKING TOGETHER

The District continued its support of programs and projects that benefit both Alaska's wildlife and Alaska's people. In supporting the Wood Bison Reintroduction project, which will bring back a species that used to help sustain Alaskans and has only been extinct in Alaska for less than 100 years, and the programs of the Alaska Moose Federation which support better management of our moose natural resources.

In the reintroduction of Wood Bison, many people have worked together to make this happen for rural Alaska: The AWCC, Alaska Department of Fish and Game, ASWCD, Canada's National Recovery Team for Wood Bison, the Canadian Wildlife Service, Environment Canada, International Union for the Conservation of Nature/Species Survival Commission- Bison Specialist Group, Alaska Outdoor Council, Safari Club International, the Wildlife Conservation Society, Tanana Chiefs Conference, Eastern Regional Subsistence Advisory Council, and Fish and Game Advisory Committees representing the three regions being considered for wood bison restoration. For more information see www.alaskawildlife.org.

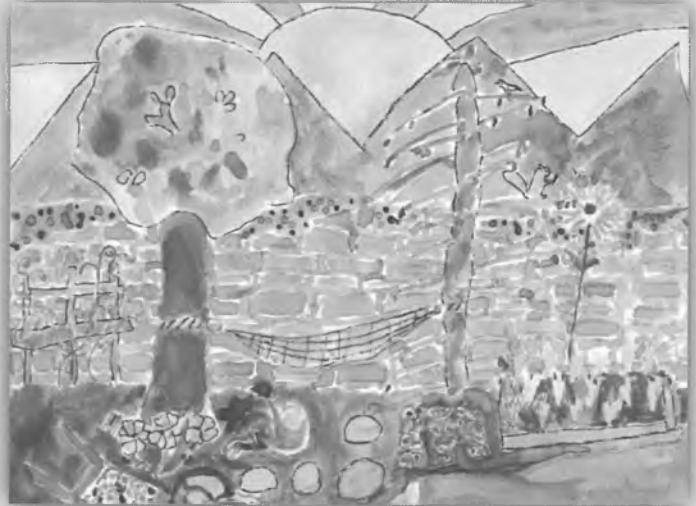


The ASWCD has also been a supporter of the Alaska Moose Federation (AMF) since the beginning. The AMF is working to improve our management of moose resources, a resource that in the past has been taken for granted, or sometimes just plain wasted. Supporters of this effort include the ASWCD, Sampson Steel, Pruhs Corporation, NC Machinery, Alaska Mill and Feed, Native Village of Eyak, Tyonek Native Corporation, Sportsman's Warehouse, Surveyor's Exchange, Wendy's of Alaska, Great Northern Engineering, Granite Construction, Alaska Air Taxi, Alaska Highway Safety Office, Evert's Air Service, all of their outstanding volunteers, and many others. For more information go to www.growmoremoose.org.



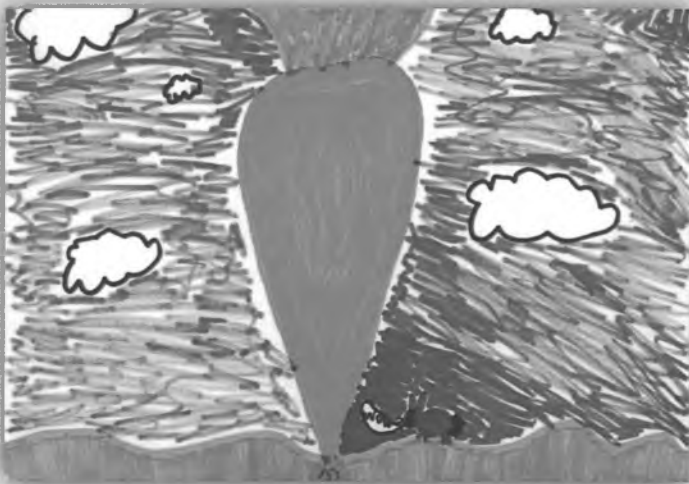
2012 ANNUAL POSTER CONTEST

The ASWCD's annual poster contest concluded in June. This year's contest asked entrants to draw what they would grow in their garden - big enough to feed a community, a garden to feed your family year-round, or an herb garden on a window sill. What would your garden grow?



This year's grand prize winner was Tabitha Silver (above left), 13 years old in the 8th grade at Central Middle School. Tabitha also placed first in her grade category, 6th to 8th grade. The grand prize runner-up and first place in the 2nd to 5th grade category was Gwendolyn Mueller (above right). Gwendolyn is 10 years old and in the 5th grade at Chugiak Elementary.

The other first place winners were Norah Fredenhagen in the Preschool to 1st grade category, 7 years old and 1st grade at Northern Lights ABC (below left); and in the 9th to 12th grade category, Rachel Blakeman, 17 years old in the 11th grade at West High (below right).



WHAT THEY'RE SAYING THIS YEAR

I wanted to thank you for the work you do, and especially for the advice and support offered to me by Ryan Stencel, your Operations Manager.

In the spring of 2011, I began the process of learning how to complete erosion control around my new home, located on a steep (and beautiful) lot way up in Bear Valley. I was required by the Municipality to do this, I wanted to ensure that my home remained safely where it was built, and I wanted to be a good neighbor. I called around trying to figure out how best - and cheapest, of course - to accomplish this. After many calls where I was given another number to call, I finally connected with Ryan. Talking with Ryan, I finally began to make progress with my education and to accumulate something more than a list of phone numbers of people who were nice but unable to help.

Ryan immediately offered to come out and look at the site. She arrived with Brad Melocik, a DOWL HKM Engineer, and the two of them were very honest and helpful. First, they told me that the plan to hydroseed my steep slopes might work for one year, but would likely all slough away soon thereafter. (Certainly not what I was hoping to hear.) They suggested I needed to explore more intense erosion control options with a better chance of long-term success. Ryan gave me the names of some people who would offer better options for my site.

Once I had determined what to do, she communicated with the Municipality on my behalf to explain what was planned.

Under the guidance of [the erosion control company I chose], last year (2011) we put in composting blankets/bags, netting and mulch. Once again, Ryan was so helpful in getting the mulch we needed - and a lot of it - from the wood lot to cover all the slopes. This year, we are repairing a few spots that did not make it through the winter and have planted 750 willow stakes so they can root and hold the slopes in place. We also needed more mulch, which of course, we got from you.

I realize this is probably more information than you need, but I wanted you to know that Ryan was so helpful on so many levels:

- Without the visit by Ryan and Brad, the suggestions they offered, and the contact info for [contractors], I would likely have gone through with the hydroseeding and be facing the same problems again right now - with my money down the drain. I would never have found a good erosion control person on my own.

- While I might have gotten Municipality approval without her help in explaining what was planned, I doubt that it would have gone as smoothly or as timely had I been trying to explain the project myself to them.

- Without the mulch your organization offers from the wood lot, I would probably not have been able to afford to complete this project.

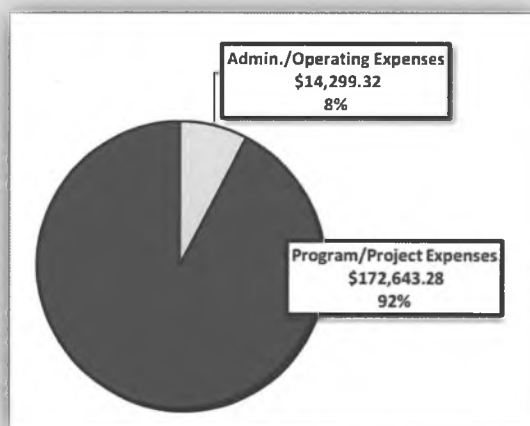
I understand that you are a volunteer Board and I want to thank you very much for your work and to let you know how much I appreciate the benefits I have enjoyed because of the work you do, and your great representative, Ryan Stencel. Hopefully, this reminds you that your work is having a positive impact on our community.

S.W.



ANCHORAGE SOIL & WATER CONSERVATION DISTRICT FISCAL YEAR 2012 FINANCIAL REPORT

Program / Project / Funding Source	Admin. / Operating Expense	Program or Project Expense	Total FY2012 Expenses	FY2012 Revenue & Proceeds
Admin	\$ (12.50)	\$ 12.50	\$ -	\$ -
Anchorage Woodlot, 2011 Season	\$ 21.40	\$ 21,344.78	\$ 21,366.18	\$ 13,799.45
Anchorage Woodlot, 2012 Season	\$ 14.00	\$ 20,227.76	\$ 20,241.76	\$ 29,558.65
Biomass Utilization, MOA Solid Waste Services Grant	\$ -	\$ 963.75	\$ 963.75	\$ -
Composting, MOA Partnership	\$ -	\$ 2,607.50	\$ 2,607.50	\$ 720.00
Consortium of Chugiak-Eagle River Community Councils	\$ -	\$ 34,738.29	\$ 34,738.29	\$ 19,937.99
DNR / SOA Annual Cooperative Agreement	\$ 200.00	\$ 775.00	\$ 975.00	\$ 2,500.00
Homestead Trail Drainage, SOA	\$ -	\$ 2,778.07	\$ 2,778.07	\$ 15,000.00
Operating Account	\$ 14,076.42	\$ 84,594.29	\$ 98,670.71	\$ 54,541.50
Peters Creek Completion, FY11 SOA	\$ -	\$ -	\$ -	\$ 2,619.92
Peters Creek, FY12 SOA	\$ -	\$ 2,640.06	\$ 2,640.06	\$ 25,000.00
Potter Marsh Project	\$ -	\$ 225.00	\$ 225.00	\$ -
Ruth Arcand Park Trails, FY13 SOA	\$ -	\$ 967.41	\$ 967.41	\$ -
SOA / AACD FY11 Operating Grant	\$ -	\$ -	\$ -	\$ 8,777.64
Valdez Flooding Project, SOA	\$ -	\$ 768.87	\$ 768.87	\$ 25,000.00
TOTALS	\$ 14,299.32	\$ 172,643.28	\$ 186,942.60	\$ 197,455.15





ANCHORAGE SOIL AND WATER CONSERVATION DISTRICT

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