2004 EC PYR PESTICIDE INFORMATION EXCHANGE PROCEEDINGS

November 25, 2004

at

1700 Labatt Hall
Simon Fraser University at Harbour Centre
515 West Hastings Street
Vancouver, British Columbia

Regional Program Report 04-02

Prepared by:

Environment Canada
Environmental Protection Branch
Commercial Chemicals Division
Pacific and Yukon Region

December 2004

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Ashpole, S, Bishop CA, Elliott, JE, Wilson LK. Pesticide exposure and reproductive effects in two species of native amphibians using agricultural habitat, South Okanagan, British Columbia.

Brad McPherson. Out with the old and in with the new – Recent changes in analytical procedures and packages.

Elliott, JE, Miller MJ, Wilson, LK. Assessing chlorinated hydrocarbon concentrations in prey and predicting accumulation in eggs of peregrine falcons (falco peregrinus).

Morrissey, C, Dods, P, Albert, C, Cullen, W, Williams, T and Elliott J. Assessing avian exposure to monosodium methanearsonate (MSMA) as used for bark beetle control in British Columbia forests

HANDOUTS:

M. Wan – PSF Agricultural Runoff Study Update 2003/2004

M. Wan – GBAP report update 2004/2005 – monitoring/toxicity of triazine herbicides

DISCLAIMER

The presentations in these proceedings represent the views and findings of their authors and do not necessarily reflect the opinions of Environment Canada and the other agencies involved in this Information Exchange.

Comments and inquiries regarding these proceedings should be addressed to:

Commercial Chemicals Division
Environmental Protection Branch
Environment Canada
#201 – 401 Burrard Street
Vancouver, BC. V6C 3S

EXECUTIVE SUMMARY

Established in 1995, the Environment Canada (EC) Regional Pesticide Committee of the Pacific and Yukon Region is composed of representatives from all operational Branches. The purpose of the committee is to coordinate and promote the exchange of information on regional pesticide matters pertaining to research, monitoring, pollution control, emerging issues, strategic approaches, coordination and communication not only with regional and HQ management bodies but also with other federal, provincial, municipal agencies, industries and academia.

The ninth annual Pesticide Information Exchange was held on November 25, 2004 at the Simon Fraser University Downtown Campus of Vancouver, B.C. This one-day event was held to exchange information on pesticides work being conducted by various government agencies in the PYR. Presentations covered a diverse array of topics, including the delivery of the EC National Pesticide Program, the Agricultural Policy Framework, current activities of the Pest Management Regulatory Agency (PMRA) of Health Canada, and an update on regional West Nile Virus control activities. In addition, the findings of various regional research projects were presented on subjects such as the surveillance of pesticides in Lower Fraser Valley surface waters and the impacts of pesticides on coho salmon habitat and resident bird species. There were a variety of presentation formats (platform, poster and handouts) at this year's workshop.

Agencies, departments and academia such as the B.C. Ministry of Water, Land and Air Protection (BCMWLAP), B.C. Ministry of Agriculture, Food and Fisheries (BCMAFF), Canadian Food Inspection Agency, EC (Ottawa and PYR), Fisheries and Oceans Canada (DFO), PMRA (Ottawa and PYR), University of British Columbia (UBC) and Simon Fraser University (SFU) were in attendance. A total of 43 people attended the event.

The Information Exchange identified the continued need to explore pesticide issues in a coordinated fashion and the importance of communicating the results of these research initiatives to decision-makers such as those at the PMRA. Much of the information presented resulted from partnerships of various groups within EC and outside agencies, such as the BCMWLAP, BCMAFF, DFO, UBC, SFU, PMRA, farmers' associations and private laboratories. It is anticipated that this event will enable participants to enhance and strengthen their working relationships to further pesticide research and program activities.

John Pasternak

2004 Pesticide Information Exchange
Environment Canada, Pacific and Yukon Region

November 25, 2004

1700 Labatt Hall
Main Level
Simon Fraser University at Harbour Centre
515 West Hastings Street, Vancouver, B.C.

FORMAT:	**Presentations**	**0900 - 1150**
	Lunch	**1150 - 1245**
	Presentations	**1245 - 1630**
	Closing Remark	**1630**

FACILITATOR: John Pasternak

AGENDA:

9:00 OPENING REMARKS by **John Pasternak** (EC)

9:05 **Pierre-Yves Caux** (EC) **-** Pesticide Program Brief – Pesticide Leadership in: the Federal House and Environment Canada

9:35 **George Derksen** (EC) - An Overview of Agriculture Policy Framework

10:00 ***BREAK (refreshment provided)***

10:15 **Dan Cronin** (BCMWLAP) – Integrated Pest Management Act and Regulations

10:45 **Valerie Hodge** (PMRA) - PMRA Update: Progress in Re-evaluation and Environmental Science Activities

11:15 **Tracy Hueppelsheuser** (BCMAFF) - British Columbia Crop Profiles

11:45 ***LUNCH BREAK (not provided)***

12:45 **John Pasternak** (EC) - An Update on West Nile Virus Control Activities in PYR and the Role of Environment Canada

13:15 **Valerie Hodge** (PMRA) - A Preliminary Analysis of Pesticides as a Potential Causal Factor for Species at Risk

13:45 **Laurie Wilson** (EC) - Raptor & waterfowl exposure to pesticides in agricultural ecosystems of southwestern BC

14:15 **Christy Morrissey** (EC) **-** Assessing avian exposure to MSMA (*monosodium methanearsonate*) as used for bark beetle control in BC forests.

14:45 ***BREAK (refreshment provided)***

15:00 **Taina Tuominen** (EC) - 2003 Surveillance of Current-use Pesticides in Waters of the Lower Fraser

15:30 **Peter Ross** (DFO) - Priority current-use pesticides (CUP) in coho salmon habitat

16:00 **Vesna Furtula** (EC) - Well water analysis in Brookswood Aquifer

POSTER DISPLAY (outside 1700 Labatt Hall; viewing time throughout the day)

Ashpole, S, Bishop CA, Elliott, JE, Wilson LK. Pesticide exposure and reproductive effects in two species of native amphibians using agricultural habitat, South Okanagan, British Columbia.

Elliott, JE, Miller MJ, Wilson, LK. Assessing chlorinated hydrocarbon concentrations in prey and predicting accumulation in eggs of peregrine falcons (falco peregrinus).

McPherson, B. Out with the old and in with the new – Recent changes in analytical procedures and packages.

Morrissey, C, Dods, P, Albert, C, Cullen, W, Williams, T and Elliott J. Assessing avian exposure to monosodium methanearsonate (MSMA) as used for bark beetle control in British Columbia forests

HANDOUTS (will be made available on November 25)

Mike Wan (EC) - PSF Agricultural Runoff Study Update 2003/ 2004

Mike Wan (EC) - GBAP report update 2004/2005 – monitoring/toxicity of triazine herbicides

ATTENDANCE LIST
(in alphabetical order)

NAME	AFFILIATION	PHONE	e-mail
Pierre-Yves Caux	EC-HQ	819-953-0602	pierre-yves.caux@ec.gc.ca
May Chiu	EC-EPB-EED	604-666-2165	may.chiu@ec.gc.ca
Leslie Churchland	EC-EPB-CCD	604-666-3601	leslie.churchland@ec.gc.ca
Al Colodey	EC-EPB-PPAD	604-666-2883	al.colodey@ec.gc.ca
Bob Costello	BCMAFF	604-556-3031	bob.costello@gems4.gov.bc.ca
Dan Cronin	BC MWLAP	250-387-9416	dan.cronin@gems8.gov.bc.ca
George Derksen	EC-EPB-PPAD	604-666-3220	george.derksen@ec.gc.ca
Joanne Edwards	BCMWLAP	604-582-5313	joanne.edwards@gems3.gov.bc.ca
John Elliott	EC-ECB-CWS	604-940-4680	john.elliott@ec.gc.ca
Randy Englar	EC-ECB-PESC	604-924-2531	randy.englar@ec.gc.ca
Bert Engelmann	EC-EPB-CCD	604-666-3197	bert.engelmann@ec.gc.ca
Vesna Furtula	EC-ECB-PESC	604-924-2503	vesna.furtula@ec.gc.ca
Laurie Gallagher	DFO	250-363-6810	gallagherla@pac.dfo-mpo.gc.ca
Sue Garnett	PMRA-PYR	604-666-2153	garnetts@inspection.gc.ca
Chris Garrett	EC-EPB-CCD	604-666-3332	christine.garrett@ec.gc.ca
Melissa Gledhill	EC-ECB-AASD	604-666-2649	melissa.gledhill@ec.gc.ca
Heather Goble	UBC–Civil Eng Dept.	604-590-2003	hgoble@dccnet.com
Valerie Hodge	HC-PMRA-HQ	613-736-3719	valerie_Hodge@hc-sc.gc.ca
Yvonne Herbison	HC-PMRA-PYR	250-470-4890	herbisony@inspection.gc.ca
Tracy Hueppelsheuser	BCMAFF	604-556-3028	tracy.hueppelsheuser@gems1.gov.bc.ca
Robert Kent	ECNRC	819-953-1554	robert.kent@ec.gc.ca
Jen-ni Kuo	EC-EPB-CCD	604-666-8286	jen-ni.kuo@ec.gc.ca
Sandi Lee	EC-ECB-CWS	604-940-4691	sandi.lee@ec.gc.ca
Laura MacLean	EC-ECB-AASD	604-666-	laura.maclean@ec.gc.ca
Gevan Mattu	EC-EPB-CCD	604-666-3198	gevan.mattu@ec.gc.ca
Aaron Miller	BCMWLAP	604-582-5342	aaron.miller@gems9.gov.bc.ca
Christy Morrissey	EC-ECB-CWS	604-940-4680	christy.merrissey@ec.gc.ca
Gail Moyle	EC-ECB-AASD	604-664-4073	gail.moyle@ec.gc.ca
John Pasternak	EC-EPB-CCD	604-666-1091	john.pasternak@ec.gc.ca
Peter S. Ross	DFO-IOS	250-363-6806	rosspe-@pac.dfo-mpo.gc.ca
Ilze Rupners	HC-PMRA-PYR	604-666-0741	rupnersi@inspection.gc.ca
Nick Russo	EC-EPB-EED	604-666-1092	nick.russo@ec.gc.ca
Mark Sekela	EC-ECB-AASD	602-664-4098	mark.sekela@ec.gc.ca
Patrick Shaw	EC-ECB-AASD	604-664-4071	pat.shaw@ec.gc.
Ryan Stevenson	EC-ECB-CCD	604-666-6480	ryan.stevenson@ec.gc.ca
Keith Tierne	SFU	604-291-5634	ktierney@sfu.ca
Denise Tomyn	EC-CFIA	604-666-2595	tomynd@inspection.gc.ca
Taina Tuominen	EC-ECB-AASD	604-664-4054	taina.tuominen@ec.gc.ca
Sylvia von Schuckmann	BCMWLAP	250-387-9557	sylvia.vonschuckmann@gems2.gov.bc.ca
Mike Wan	EC-EPB-CCD	604-666-3111	mike.wan@ec.gc.ca
Madeline Waring	BCMAFF	604-556-3027	madeline.waring@gems5.gov.bc.ca
Irene Wilkin	PMRA-PYR	604-666-7730	wilkini@inspection.gc.ca
Laurie Wilson	EC-ECB-CWS	604-940-4679	laurie.wilson@ec.gc.ca

PRESENTATION FORMATS

I. PLATFORM
II. POSTER
III. HANDOUT

I. PLATFORM PRESENTATIONS

ABSTRACTS AND POWER POINT FILES

(in order of presentation)

Pesticide Program Brief: Pesticide Leadership in the Federal House and Environment Canada

Pierre-Yves Caux, Conservation Strategies Directorate, Environment Canada, Gatineau QC.

Abstract

Environment Canada (EC) is undergoing a transformation to become an integrated department supporting a new national policy direction delivering on a national Competitiveness and Environmental Sustainability Framework (CESF). EC has proposed a new governance structure with priority management boards and teams to deliver on projects such as the Pesticide Program. The Program is horizontal in nature and has been designed according to the CESF's five pillars of action, namely, decision-making, information, science and technology, compliance and enforcement and education. Pesticides are just one part of pest control in Canada and the role other federal departments have, needs to be an integral part of the Program. EC's pesticide activities have begun to be coordinated with those of other departments. Federally, an RMAF and a logic model to the Memoire to Cabinet on "Building Public Confidence in Pest Control Activities in Canada" guide our work. Governance within EC is on a good footing, however, it is fragmented within the federal house and requires leadership for integration federally prior to going to the Federal / Provincial and Territorial (F/P/T) community. The Program aims to: provide science advice that promotes lasting partnerships and identifies policy priorities; develop tools and standards to implement our science; coordinate compliance and enforcement with the goal of providing a seamless and effective system and; provide effective information and reporting to influence environmental decision-making, regulation and policies and practices by the Pesticide Management Regulatory Agency, F/P/T, municipalities, industry and the public.



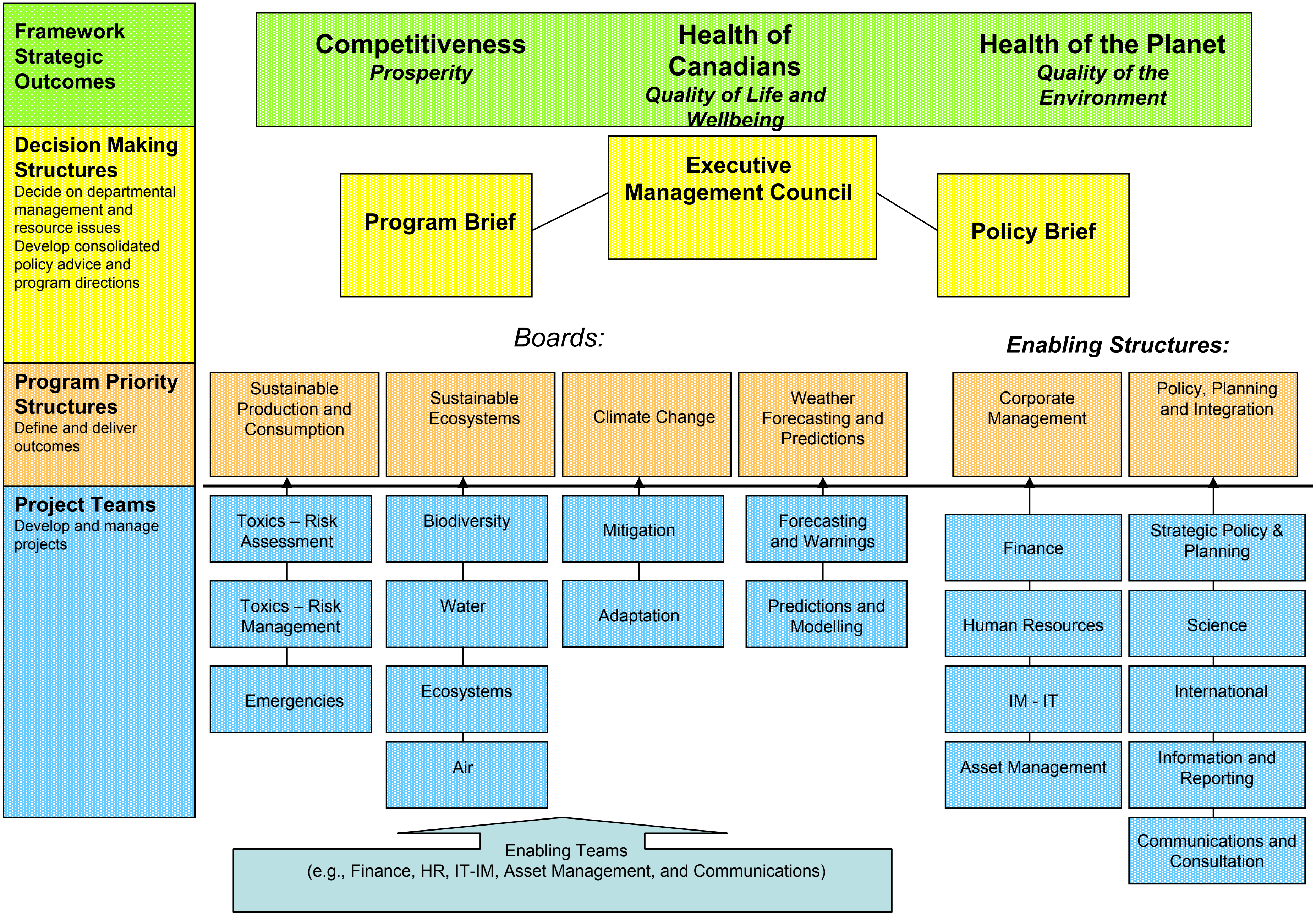

Pesticide Program Brief

Pesticide Leadership in:

the Federal House
and
Environment Canada

Environment Canada Environnement Canada

EC Management Structure



Everything you ever wanted to know about Policy Brief and Program Brief but were afraid to ask...

- Policy Brief - Discussion of new or evolving policies and horizontal policy issues
  - the Competitiveness and Environmental Sustainability Framework (CESF),
  - EC positions on proposed federal policies,
  - negotiating positions for international meetings,
  - Memoranda to Cabinet.

- Program Brief - Implementation of existing programs and policy decisions, and operational issues
  - RA/RM initiatives,
  - research & monitoring activities,
  - enforcement/emergencies, etc.

The plan going in...

- Fit program in context of CESF
- Fit within bigger picture
- Explain what we do & purpose
- Where are we & were to we need to be
  - challenges & opportunities
- Next steps - plan
  - tracking performance

Effective management of pesticides contribute to the Competitiveness and Environmental Sustainability Framework (CESF) which aims to enable Canada to attain the highest level of environmental quality as a means to:

- **Enhance human health - by developing new IPM approaches that reduce pesticide loads, hence human exposure**
- **Enhance ecosystem health - by using reduced risk pesticides and by developing and implementing environmental quality standards and monitoring our performance in meeting them**
- **Advance long-term competitiveness - by branding Canadian products as having been produced using the best available, environmentally sustainable farm practices**
- **By virtue of its mandate to, "enhance the quality of the natural environment," EC is destined with its Pesticide Program to play a key role in contributing to the goals of the CESF**
- **The Pesticide Program at EC contributes to the CESF by ensuring effective governance, by providing tools and standards and by integrating approaches for S&T, reporting and compliance and enforcement regimes**

Pesticides are just one part of Pest control in Canada

Identify pest problems

Federal organizations
Agriculture and Agri-Food Canada,
Canadian Food Inspection Agency,
Environment Canada, Fisheries and Oceans Canada,
Natural Resources Canada

Other players
Provinces/territories, growers

Develop and promote alternative approaches

Federal organizations
Agriculture and Agri-Canada,
Environment Canada, Fisheries and Oceans Canada
Natural Resources Canada

Other players
Industry, universities, provinces/territories

Develop less toxic pesticides
(Biopesticides, pheromones etc.)

Federal organizations
Agriculture and Agri-Food Canada,
Natural Resources Canada

Other players
Industry

Evaluation of pest control products

Federal organization
Pest Management Regulatory Agency

Other players
Provinces/territories

Understand and monitor impacts

Federal organizations
Agriculture and Agri-Food Canada,
Environment Canada, Fisheries and Oceans Canada, Health Canada,
Natural Resources Canada

Other players
Provinces/territories

Use of pest control products

Federal organizations
Federal departments managing land

Other players
Farmers, homeowners, forest managers,
aquaculture operators, industry

Ensure compliance

Federal organizations
Pest Management Regulatory Agency, Canadian Food Inspection Agency, Environment Canada

Other players
Provinces/territories

Our pesticide activities are being coordinated with those of other federal departments

Federal Pesticide Program

- PMRA
- EC

Provinces

Registration
Compliance & enforcement

Science advice
Knowledge generation
Issue Management

- EC
- PMRA
- DFO
- NRCan
- AAFC
- CFIA
- HC

Communication / Sharing of information and integration of activities

Provinces
academia
industry
public

Development of new pesticides, technologies, tools, BMPs

- AAFC
- CFS

Federally, an RMAF and a Logic Model to the MC on *"Building Public Confidence" in pest control activities in Canada,* guide our work; we predominantly conduct research, monitoring and analyze data

Final Outcome

Increased public and stakeholder confidence in pesticide regulation, protected health and environment, and increased competitiveness of the agri-food and forestry sectors

Intermediate Outcomes

A regulatory system that better protects health and environment and contributes to the competitiveness of the agri-food and forestry sectors

Immediate Outcomes

Increased knowledge by PMRA about pesticides and alternatives

Removal of pesticides and uses of higher risks

Outputs

Timely reports on adverse effects

Research data on alternative pest management strategies, and reduced risk and minor use pesticides for agriculture and forestry

Research and monitoring data on pesticides in the environment, forest environment, and marine and freshwater ecosystems

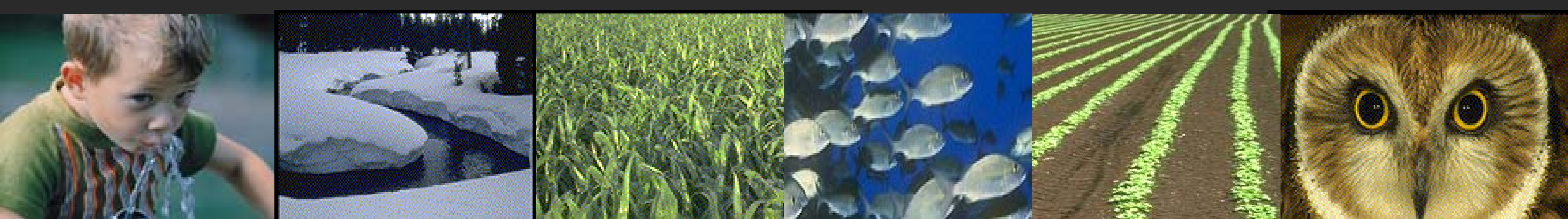
Improved process for regulatory decisions about pesticides that integrate risk reduction strategies for commodities and current data

Activity Area

Research, monitor and analyze data

Within Environment Canada, we have created a solid foundation for the Pesticide Program, however, we are not there yet

- The RMAF currently being employed is representative of Pesticide Science and not the Pesticide Program as a whole – we've created a solid foundation for integration with the OGDs
- We are coordinating/communicating with OGDs to achieve this goal



We are building an EC Pesticide Program that reflects our Competitiveness and Environmental Sustainability Framework

To do this, we need to:

1. **strengthen governance and ensure ongoing engagement at all levels – national, federal, local**
2. **advance a coherent, integrated approach to providing science advice**
3. **innovative tools, incentives and standards to protect the environment and human health**
4. **create a level playing field through an integrated and compliance and enforcement regime**
5. **establish an integrated information, prediction and reporting system which drives action and measures progress**

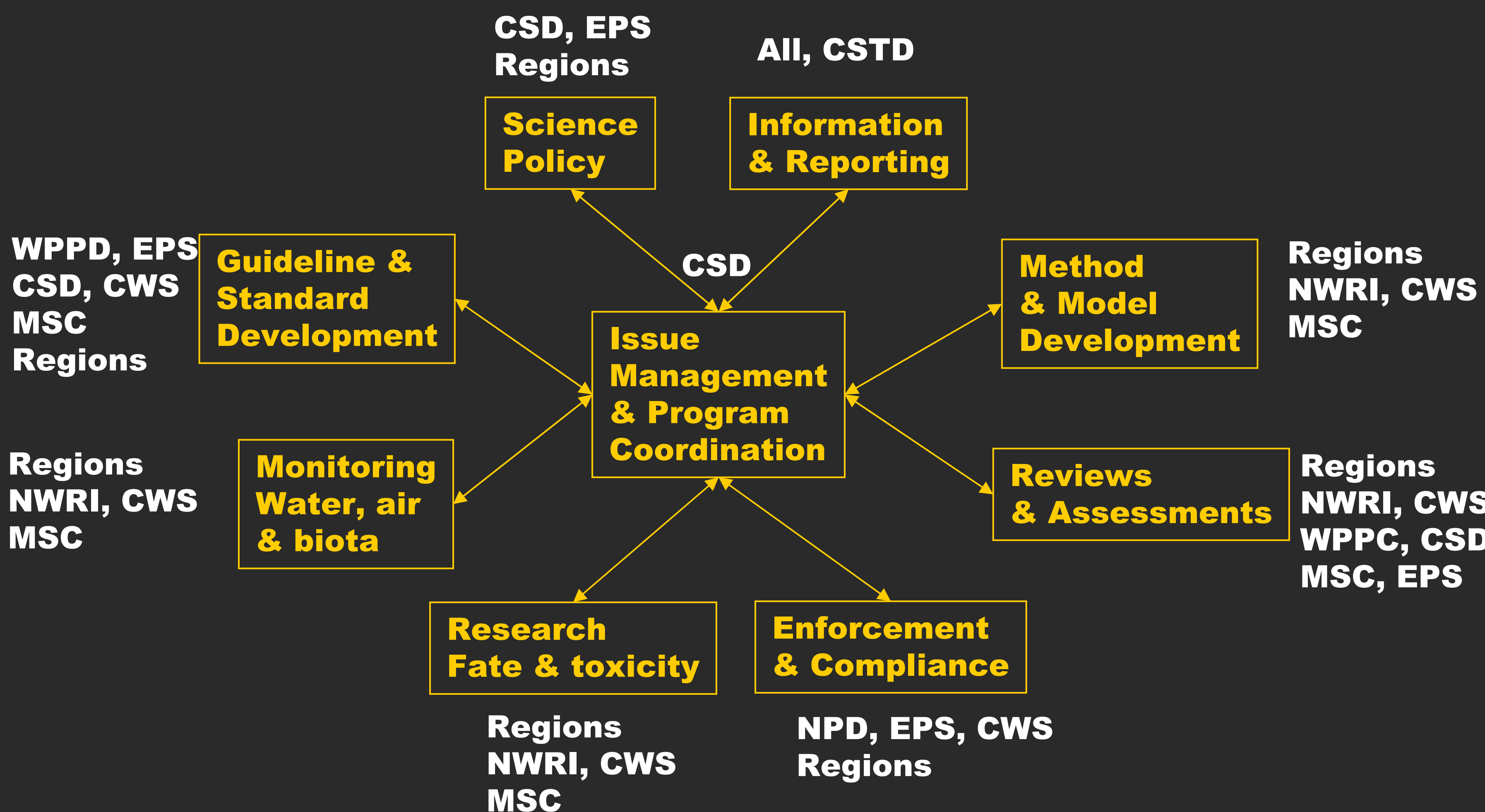
1. Governance within EC is on a good footing, however, it is fragmented within the federal house and requires the leadership of EC and PMRA for integration federally prior to going to the F/P/T community

- **Environment Canada**
  - **Pesticide Program Committee manages our science and policy activities**
    - **Regions, Services and Institutes represented**
- **Federal**
  - **EC/PMRA DG-level committee**
    - **EC & PMRA MOU**
  - **Interdepartmental Working Group – 5NR**
  - **NAESI-Pesticide Team - EC, AAFC and PMRA**
- **National – None**

- **Point to register: Internally, there is sound management and delivery for the program. With the PMRA, we are taking steps to lead on governance for the Federal House.**

1.

There are many science and policy activities conducted within the department - it is the role of the Pesticide Program Committee to coordinate these in order to provide consistent science advice



2.

Our science is done through our A-base, the Pesticide Science Fund (PSF) and the National Agri-environmental Standards Initiative (NAESI)

- A-base: Approx. $1.5 M in Regions, Services & Institutes
  - program outcome – wildlife protection, water and air quality monitoring, assessment and protection
- PSF: $7M over 4 years
  - monitoring in water and air to provide data on what are the pesticide environmental concentrations
  - research on amphibians, birds, fish and invertebrates to provide what and why are there impacts
- NAESI: $625K this year
  - development of environmental performance standards for pesticides providing targets for agriculture – what are we doing about it

- Point to register: emphasis is currently on monitoring so we can better set science priorities for research and for the development of tools and standards;

- Coordination of PSF and NAESI are well managed, but there is a need to integrate our A-Base activities

2.

An integrated approach to providing science advice that promotes lasting partnerships and identifies policy priorities

Partnership

Federal:

- PMRA
- AAFC
- OGDs

Provincial / Territorial

- CCME

Industry municipalities public

International

- Regulatory Harmonization

Policy priorities

- identify existing and emerging issues
  - WNV, *FA*, *SARA* considerations, PIC
- develop policies to address issues

3.

The development of tools and standards is how we implement our science

- Canadian Environmental Quality Guidelines
- Environmental Performance Standards
- Tools and techniques linking Standards to environmental farm plans
- Participating in IPM projects and promoting IPM concept & reduced pesticide exposure
- Regulatory and non-regulatory tools

4.

Compliance and enforcement needs to be coordinated with the aim of providing a seamless and effective system

- **Coordinate enforcement and compliance promotion with PMRA setting up a fair, consistent and predictable regime, focused on outcomes**

- ***FA, SARA, CEAA, CEPA, PCPA***
  - **Consistency in our policies**
  - **Complementary compliance and enforcement**

5.

Effective information and reporting are needed to influence decision-making, regulations and policies and practices by PMRA, F/P/T, municipalities, industry and the public

- We must deliver consistent advice and information. Too many voices are now giving inconsistent message.

- Consistent, accessible and timely information to those making decisions on the environment
- Information that facilitates planning and continuous improvement (IPM) and links economic, social and environmental information

- Point to register: the Federal House must speak with one voice.

Next steps / Action Plan

- **Pesticide Program Committee will continue to strengthen/coordinate EC Pesticide activities (*i.e.,* A-Base, PSF, NAESI; communication with stakeholders)**

- **Have EC & PMRA lead on governance & solidify federal partnership**

- **Obtain ADM level support/direction**
  - **Address priority issues**
    - ***FA vs. PCPA* conflicts (*e.g*., WNV)**
    - ***SARA* consideration**
  - **Focus on shared goals and objectives**
    - **interdepartmental gap analysis - link actions to RMAF**
  - **Include an evaluation framework to track performance**

Final words…

- Sounds good!
- A lot of activities going on…
- Q: how do I gauge whether there are enough activities in one area *vs*. another?
- You guys need an outreach policy…

EC Pesticide Program Logic Model

Final Outcome: Public confidence in increased conservation and protection of the environment from pesticides while contributing to the competitiveness of the agricultural sector

Intermediate Outcome (5-6yrs)	Consistent and effective science policy	Informed regulatory decision-making & contribution to the competitiveness of the agricultural sector	Stakeholders that are informed & working in a transparent system	User compliance & reduced risk to the environment
Short Term Outcome (2-3yrs)	Roles, responsibilities & processes are defined for EC Acts & regs. & appropriate tools developed	Knowledge generation to apply regulations & for those making environmental decisions (industry & public) Sector performance standards for environmental quality	Effective information and communications both internally and externally	Seamless system for compliace promotion and enforcement
Outputs (annual)	MOU annexes produced to formalize mechanisms Advisories produced for use by Federal house and stakeholders (municipalities) improved process & network	National agrienvironmental standards developed Canadian Environmental Quality Guidelines agreed upon Research & monitoring data provided for use by PMRA & stakeholders Improved process & network	Effective outreach & communication of risk reduction strategies MOU annex on information exchange Improved process & network	Compliance and enforcement strategy developed Improved process & network
Activities	Activities at EC on Acts & regulations	Activities at EC on research, monitoring, assessments, methods & guidelines	Activities at EC on stakeholder consultation and communication	Activities at EC gathering compliance data and assessing these

Outreach Policy

- Framing the issue
  - do all activities require outreach?
  - messages development – who & what?
- Part of or consistent with other EC / Federal communication and consultation plan

Summary

How will the program fair?

- ✓ Management boards
- ✓ Fit with CESF
- ✓ Fit within the federal mandate

- ☒ Work on governance at Federal level
- ☒ Work on PAA & outreach

Department of the Environment Act
CHAPTER E-10

An Act respecting the Department of the Environment

SHORT TITLE

Short title

1. This Act may be cited as the *Department of the Environment Act*.
R.S., c. 14(2nd Supp.), s. 2.

ESTABLISHMENT OF THE DEPARTMENT

Department established

2. (1) There is hereby established a department of the Government of Canada called the Department of the Environment over which the Minister of the Environment appointed by commission under the Great Seal shall preside.

Minister

(2) The Minister holds office during pleasure and has the management and direction of the Department.
R.S., c. 14(2nd Supp.), s. 3; 1978-79, c. 13, s. 13.

Deputy head

3. The Governor in Council may appoint an officer called the Deputy Minister of the Environment to hold office during pleasure and to be the deputy head of the Department.
R.S., c. 14(2nd Supp.), s. 4.

POWERS, DUTIES AND FUNCTIONS OF THE MINISTER

Powers, duties and functions of Minister

4. (1) The powers, duties and functions of the Minister extend to and include all matters over which Parliament has jurisdiction, not by law assigned to any other department, board or agency of the Government of Canada, relating to

(*a*) the preservation and enhancement of the quality of the natural environment, including water, air and soil quality;

(*b*) renewable resources, including migratory birds and other non-domestic flora and fauna;

(*c*) water;

(*d*) meteorology;

(*e*) notwithstanding paragraph 4(2)(*g*) of the *Department of Health Act*, the enforcement of any rules or regulations made by the International Joint Commission, promulgated pursuant to the treaty between the United States of America and His Majesty, King Edward VII, relating to boundary waters and questions arising between the United States and Canada, in so far as they relate to the preservation and enhancement of the quality of the natural environment; and

(*f*) the coordination of the policies and programs of the Government of Canada respecting the preservation and enhancement of the quality of the natural environment.

(*g*) and (*h*) [Repealed, 1995, c. 11, s. 18]

Idem

(2) The powers, duties and functions of the Minister also extend to and include such other matters, relating to the environment and over which Parliament has jurisdiction, as are by law assigned to the Minister.
R.S., 1985, c. E-10, s. 4; 1995, c. 11, s. 18; 1996, c. 8, s. 19.

Idem re preservation and enhancement of environmental quality

5. The Minister, in exercising his powers and carrying out his duties and functions under section 4, shall
(*a*) initiate, recommend and undertake programs, and coordinate programs of the Government of Canada that are designed
(i) to promote the establishment or adoption of objectives or standards relating to environmental quality, or to control pollution,
(ii) to ensure that new federal projects, programs and activities are assessed early in the planning process for potential adverse effects on the quality of the natural environment and that a further review is carried out of those projects, programs, and activities that are found to have probable significant adverse effects, and the results thereof taken into account, and
(iii) to provide to Canadians environmental information in the public interest;
(*b*) promote and encourage the institution of practices and conduct leading to the better preservation and enhancement of environmental quality, and cooperate with provincial governments or agencies thereof, or any bodies, organizations or persons, in any programs having similar objects; and
(*c*) advise the heads of departments, boards and agencies of the Government of Canada on all matters pertaining to the preservation and enhancement of the quality of the natural environment.
R.S., c. 14(2nd Supp.), s. 6; 1978-79, c. 13, s. 14.

GUIDELINES BY ORDER

Guidelines related to environmental quality

6. For the purposes of carrying out his duties and functions related to environmental quality, the Minister may, by order, with the approval of the Governor in Council, establish guidelines for use by departments, boards and agencies of the Government of Canada and, where appropriate, by corporations named in Schedule III to the *Financial Administration Act* and regulatory bodies in the exercise of their powers and the carrying out of their duties and functions.
R.S., c. 14(2nd Supp.), s. 6; 1978-79, c. 13, s. 14; 1984, c. 31, s. 14.

AGREEMENTS

Agreements

7. The Minister may, with the approval of the Governor in Council, enter into agreements with the government of any province or any agency thereof respecting the carrying out of programs for which the Minister is responsible.
R.S., c. 14(2nd Supp.), s. 6; 1978-79, c. 13, s. 14.

ANNUAL REPORT

Annual report

8. The Minister shall, on or before January 31 next following the end of each fiscal year or, if Parliament is not then sitting, on any of the first five days next thereafter that either House of Parliament is sitting, submit to Parliament a report showing the operations of the Department for that fiscal year.
R.S., c. 14(2nd Supp.), s. 7; 1978-79, c. 13, s. 14.

BACK

Environment Chapter of Agricultural Policy Framework – three main themes

Action at Farm Level :

Environmental Scans

Environmental Farm Planning

NFSP, WEBs Greencover

National Water Supply Expansion Program

Knowledge and Information Tools

NLWIS

Minor Use Pesticides PRRP

Research and Technology Assessment

Water Quality Survey

Performance Measurement

NAHARP

NAESI

Certification

BACK

Internationally, treaties and conventions give us obligations beyond our borders

- *MBCA* - Use of pesticides outside of Canada have an impact on our migratory species
- United Nations convention of POPs
- Rotterdam Convention
- Canada-US Water Quality Agreement
- NARAP objectives under CEC
- Partners in Flight program (Canada, US, Mexico, ENGOs)

BACK

Overview of Agriculture Policy Framework

George Derksen, Pollution Preventation & Assessment Division, Environmental Protection Branch, Environment Canada, PYR

Abstract

The Agriculture Policy Framework (APF) is a five-year Agriculture and Agri-Food Canada initiative to help Canadian agriculture make the most of new international opportunities by safeguarding and enhancing food safety and quality, advancing environmentally-sound agricultural practices and fostering innovation.

The Environmental Farm Planning, National Farm Stewardship, and Greencover programs are intended to identify and reduce environmental risks on BC farms. A set of National Beneficial Management Practices have been identified and which farmers can implement on a cost-shared basis.

In BC the EFP program is being delivered by farmers through the BC Agriculture Council. The Ministry of Agriculture, Food and Fisheries is addressing the resource material needs of the program, including the training of EFP advisors who will then be available to the various agriculture commodities. Various agriculture associations and groups will be designated as delivery groups and interface directly with farmers. Participation is voluntary and EFPs are confidential. An APF Environment Working Group has been tasked with managing the program.

An initial regional scan was conducted in 2003 to help identify priority environmental issues in seven regions of the province. The intent is to focus the EFP resources, $24 million over 5 years, on priority issues and areas.

There are several other components to the APF. The component that affects Environment Canada the most is the National Agri-Environment Standards Initiative (NAESI). The $25 million in funding will be focused on four thematic areas of NAESI and will include pesticides, water (nutrients and pathogens), air, and biodiversity.

Overview of Agriculture Policy Framework

2004 Pesticide Information Exchange

by George Derksen

Agriculture Policy Framework – Environmental Chapter and Other Components

- A five-year initiative 2003/04 – 2007/08 with numerous components
- For British Columbia's Environmental Farm Planning Program component
  - $24 million in federal dollars
  - $10 million in provincial in-kind dollars
- Different components are being delivered by various mechanisms

APF Components

- *On-farm Actions* – the B.C. program is being delivered by the agriculture sector through the BC Agriculture Council and is managed by an industry-agency APF Environment Working Group
- *Process and Performance Standards* - development and assessment
- *Indicators, Tracking and Monitoring*
- *Environmental Certification*

On-farm Actions

- Environmental Farm Planning Program (EFPP) – plans that identify environmental risks and prioritize action items
  - Voluntary but are required in order to access funding to address action items
  - $30K cap per farm
- National Farm Stewardship Program (NFSP) – cost-shared incentive funding for implementing listed beneficial management practices (BMPs)
- Greencover Canada Program (GCP) – similar to NFSP but focused more towards riparian areas, tree planting, land conversion & biodiversity consideration
- National Water Supply Expansion Program

Process and Performance Standards

- Environmental Technology Assessment for Agriculture (ETAA) – related to "process" standards
- Farming Systems and Practices Research – science gaps in nutrients and water – related to "process" standards and includes WEBs (Watershed Evaluation of BMPs)
- National Agri-Environmental Standards Initiative (NAESI) – related to "performance" standards
  - managed through a joint EC-AAFC departmental MOU
  - "standards" voluntary
  - $25 million for Environment Canada
- Minor Use and Pesticide Risk Reduction Program – delivered by AAFC in consultation with PMRA

Indicators, Tracking and Monitoring

- National Agri-Environmental Health Analysis and Reporting Program (NAHARP) – AAFC national indicators related to APF performance - models
- Water Quality Surveillance – project focused on microbiological pathogens
  - managed through a joint AAFC-HC departmental MOU
- National Land and Water Information Service (NLWIS) – AAFC lead to develop one-stop-shopping centre for water and land information on a web based information system

Environmental Certification

- **Environmental Certification – long term goal is for AAFC to develop some form of farm certification framework and program**

Process and Status of the BC Environmental Farm Planning Program

- Investment Agriculture Foundation (IAF) Agreement with AAFC and the BC Agriculture Council Agreement with IAF are both in place
  - APF Environment Working Group has been formed to manage and direct the program
  - Two EFP coordinators have been hired to support the Working Group and ongoing program delivery
  - Working Group has received and is approving EFP delivery groups
- Ministry of Agriculture, Food and Fisheries continue the ongoing development of EFP resource materials and training EFP advisors

cont'd ......

Process and Status of BC Environmental Farm Planning Program …

the future unfolds

- Delivery groups will begin engaging farmers and ranchers in a coordinated fashion
- Farmers and ranchers will begin conducting EFPs
- Farmers and ranchers will begin applying for cost-shared incentive funding
- Environmental risks on farms and ranches are reduced ……… over time
- Working Group begins reporting out on progress

EFP Delivery Groups (completed)

cont'd ….

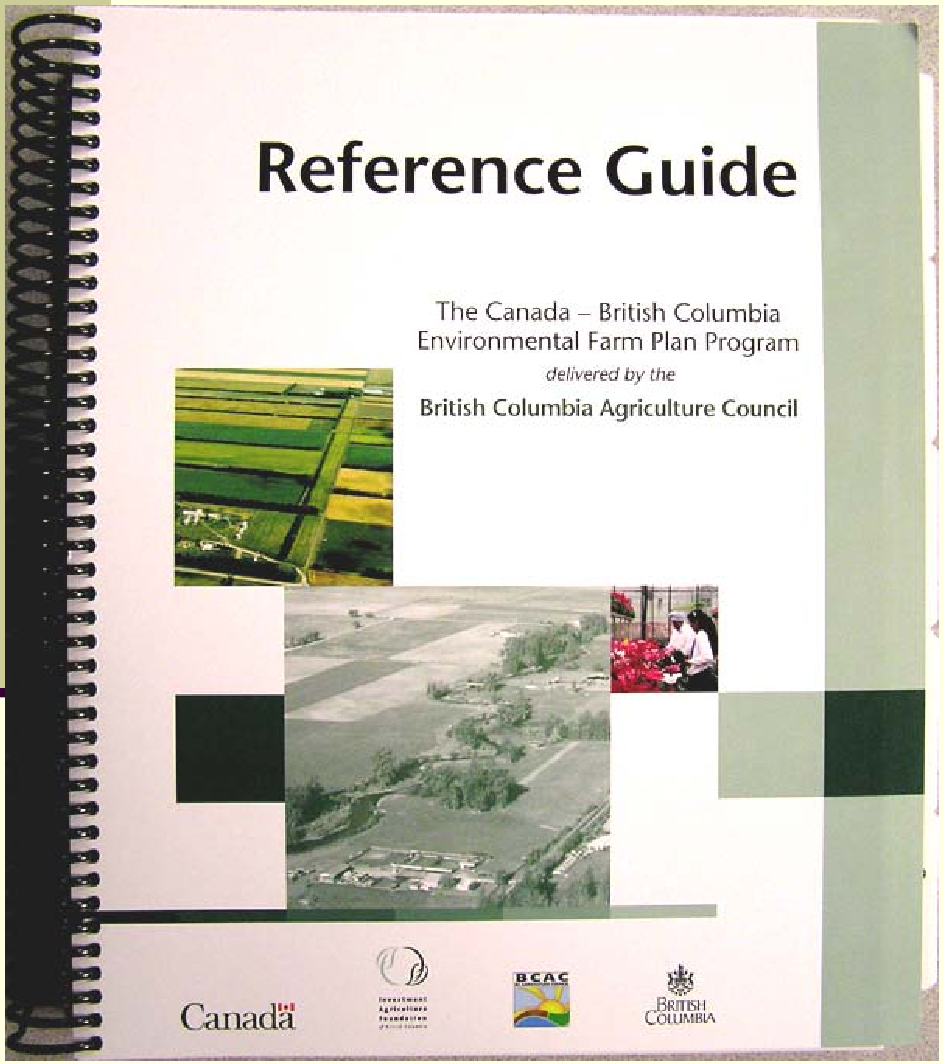
- BC Cattlemen's Association
- BC Fruit Growers' Association
- Certified Organic Association of BC
- Comox Valley Farmers' Institute
- BC Greenhouse Growers' Association
- Creston Valley Agriculture Society
- United Flower Growers
- Ground Crops (BC Potato & Vegetable Growers Association)
- Island Farmers Alliance
- Peace River Grain Growers
- BC Pork Producers Association

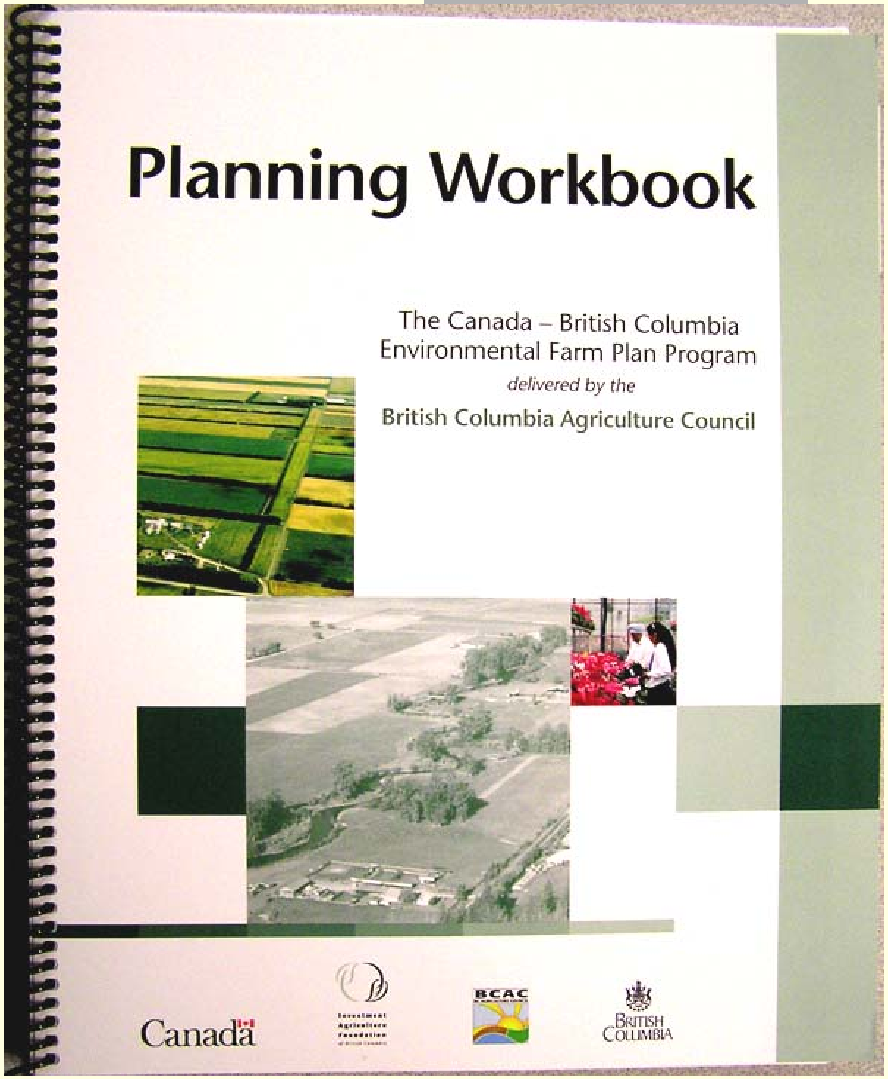
EFP Delivery Groups (in progress)

- BC Landscape and Nursery Association
- BC Milk Producers Association
- BC Berry Group
- Farmers Institute Highway 16
- BC Poultry Producers
- Peace River Forage Association of BC
- Horse Council of BC

MAFF Develops EFP Resource Material

cont'd …….





EFP Resource Material - pesticide example

	Knowing the Risks of Pesticides — Does not apply to this EFP ☐	Yes	No	?	N/A
168	Do you know the potential environmental risks from improper pesticide use?				
169	Do you minimize the development of pest resistance to pesticides, by alternating pesticide groups?				
170	When selecting pesticides, are pesticides with the least risk to the environment selected?				
	Transporting and Storing Pesticides — Does not apply to this EFP ☐				
171	*Pesticide Control Act Regulations Section 35* **Are pesticides transported in undamaged, labelled, closed and secured containers?**				
172	*Health Act, Sanitary Regulation, Section 42* (pesticide storage sites could be considered a "*probable source of contamination*") ***Are probable sources of contamination stored at least 30.5 m [100 ft] from any well?***				
173	*Pesticide Control Act Regulations, Sections 38 & 39* ***Are pesticides stored in closed, labelled containers and according to label directions?***				
174	*Pesticide Control Act Regulations, Sections 36* ***Are pesticides stored in a dry, locked storage vented to the outside with a sign on each entrance stating "Chemical Storage – Warning – Authorized Persons Only"?***				
175	*Canadian Farm Building Code*, 4.1.4. (where enacted by local government "No" answer is red box – if not enacted, "No" answer is yellow box) ***Does the storage: have an impervious floor, contain spills, separate pesticides from feed and water supplies, separate oxidizing from flammable pesticides, and have an insulated and heated cabinet for pesticides requiring frost protection?***				
176	Are pesticides stored at least 15 m [50 ft] from any watercourse?		1,3		
	Mixing and Using Pesticides — Does not apply to this EFP ☐				
177	*Pesticide Control Act Regulation, Section 2* ***Are pesticides used in a manner that will not result in unreasonable adverse effects?***				
178	*Pesticide Control Act Regulation, Section 4* ***Where required, does the pesticide applicator have a valid Pesticide Applicators Certificate?***				

EFP Resource Material - pesticide example

Pesticide Environmental Concerns

Primary environmental concerns related to pesticides are:

- pesticides inappropriately applied, spray or vapour drift, spills, backflow and improper disposal of chemicals or containers that results in soil, water or air pollution; or in damage to non-target organisms
- birds and wildlife coming into contact with pesticides or crops applied with pesticides that results in damage to birds and wildlife; or bio-accumulation

For detailed information on these concerns:

➔ see Soil Quality Factors, page 157, and refer to Contaminants
➔ see Water Quality and Quantity Factors, page 177, and refer to Contaminants
➔ see Air Quality factors, page 229, and refer to Contaminants
➔ see Impacts to Biodiversity and Habitat, page 245, and refer to Impacts to Biodiversity and Habitat

Pesticide Legislation

The following is the main legislation that applies to pesticides.

➔ see page 259 for a summary of these and other Acts and Regulations

Local Bylaws

The National Farm Building Code 1995 outlines standards for pesticide storage and **is enforced only where proclaimed by local governments**.

- Section 4.1.4: requires storage facilities for pesticides to be:
  - vented to the outdoors, accessible from outdoors only, secured against unauthorized entry
  - has an impervious floor that is curbed to contain spills,
  - identified with a sign at entrance stating "Danger – Chemical Storage – Authorized Person Only" or words to that effect
  - separated from all food, feed and water supplies
  - insulated and heated cabinet for chemicals requiring frost protection
  - separate oxidizing and flammable chemicals
  -

Drinking Water Protection Act

This Act prohibits introducing, causing or allowing anything that will result or is likely to result in a drinking water health hazard in relation to a domestic water system.

Health Act

This Act has conditions under the *Sanitary Regulations:*

- Section 9: prohibits accumulation or discharge of wastes that endanger the public health

Other EFP Documents Being Prepared by MAFF

- Riparian Management Guide
- Grazing Management Guide
- Irrigation Management Guide
- Nutrient Management Guide
- Pesticide/IPM - at present material is going to remain as the "production/beneficial management guides" that have and continue to be produced by MAFF and various commodity organizations.

Minor Use & Pesticide Risk Reduction Program (Minor Use Pesticide Research) cont'd

- **Matador** on mustard greens
- **2,4-D** on blueberries
- **Topas** on strawberries
- **Citation** on GH lettuce
- **BAS 516** on field lettuce, GH lettuce, broccoli and mustard greens
- **Poast Ultra** on brussels sprout
- **Success** on GH lettuce
- **Rimon** on broccoli

Minor Use & Pesticide Risk Reduction Program (Minor Use Pesticide Research)

- **Acrobat** on summer squash
- **Select** on basil and blueberries
- **Dual Magnum** on mustard greens and blueberries
- **Acramite** on raspberries
- **Gallery** on container ornamentals

(list provided by Victoria Brooks)

National Beneficial Management Practices (BMPs)

….. cont'd

- Improved Manure Storage and Handling
- Manure Treatment
- Manure Land Application
- Farmyard Runoff Control
- Relocation of Livestock & Confinement and Horticultural Facilities
- Wintering Site Management
- Product & Waste Management
- Water Well Management
- Riparian Area Management
- Erosion Control Structures (Riparian)

BMPs

….. cont'd

- Erosion Control Structures (Non Riparian)
- Erosion Control Land Management
- Improved Cropping Systems
- Winter Cover Crops
- Improved Pest Management
- Nutrient Recovery from Waste Water
- Irrigation Management
- Shelterbelt Establishment
- Invasive Alien Species Control
- Enhancing Wildlife Habitat and Biodiversity
- Species at Risk
- Preventing Wildlife Damage

BMPs

- Integrated Pest Management Planning
- Grazing Management Planning
- Soil Erosion Control Planning
- Biodiversity Enhancement Planning
- Irrigation Management Planning

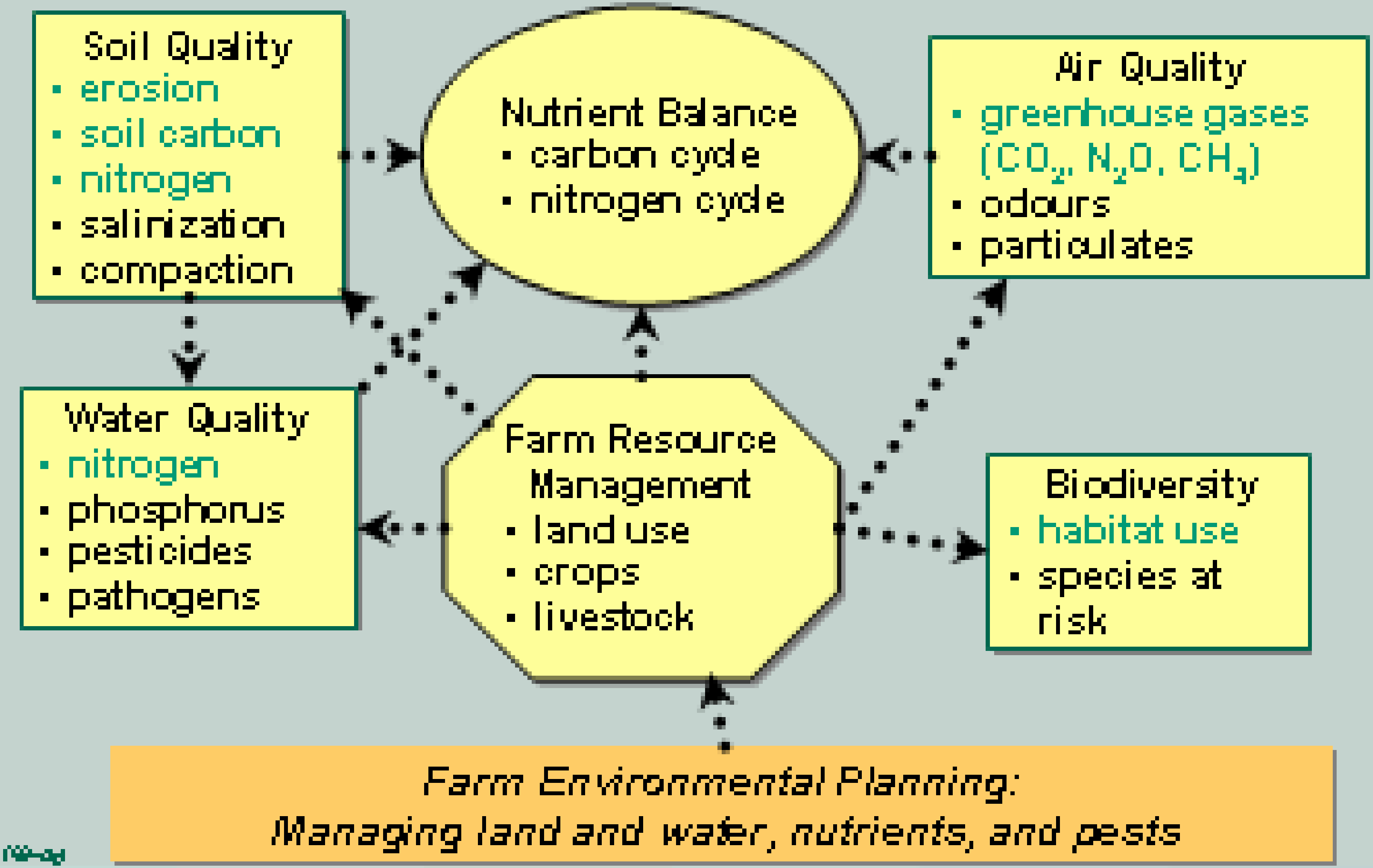
2003 Regional Scan – Water Quality High and (Moderate) Priority Issues and Risks ... cont'd

- Vancouver Island
  - Riparian function
  - Sedimentation
  - Nutrients
  - Pathogens
  - (**pesticides**)
- Thompson
  - Riparian function
  - Pathogens
  - Nutrients
  - (**pesticides**)
- Lower Fraser Valley
  - Riparian function
  - Nutrients
  - Pathogens
  - **Pesticides**
- Kootenays
  - Pathogens
  - Nutrients
  - Riparian function

2003 Regional Scan – Water Quality High and (Moderate) Priority Issues and Risks

- Prince George/Cariboo
  - Riparian function
  - Pathogens
  - Sedimentation
- Peace
  - Riparian Function
  - Pathogens
  - Nutrients
  - Petroleum products and **pesticides**
- Okanagan
  - Riparian function
  - **Pesticides**
  - Petroleum products
  - Nutrients
  - Pathogens
  - Sedimentation

Promote Sustainable and Profitable Resource Use



NAESI Thematic Groups

Pesticide

- Yr 1
- 7 projects approved
- $625K

Air

- Yr 1
- 13 projects approved
- $1.755M

Water Quality & Conservation

- Yr 1
- 17 projects approved
- $1.9M

Biodiversity

- Yr 1
- 8 projects approved
- $700k

THE END

BC Provincial Pesticide Regulatory Reform

Dan Cronin, Pesticides Analyst, Environmental Management Branch
Ministry of Water, Land and Air Protection

Abstract

The BC Ministry of Water, Land and Air Protection is revising the legislation that it administers regulating pesticide use in BC. A new Act called the *Integrated Pest Management Act* was passed by the Legislature in October, 2003 and will be brought into force by regulations now under being drafted and expected to be passed by January 2005.

The Act moves the pesticide regulatory regime from one where all pesticide uses are reviewed and approved to a risk and results-based system. Only pesticide uses of high concern will require approval by permit. High concern uses include:

- the application of high risk pesticides (permit restricted pesticides);
- the application of pesticides for which no ministry standards have been set; and
- aerial application of pesticides over residential areas.

Pesticide uses formerly regulated by permits following a review and approval process will be regulated with pest management plans (PMPs). These plans will generally be required for industrial uses of more than 20 ha per year and forest operations on crown land. This new regime requires proponents to:

- develop a plan in accordance with the regulations, including consultations with potentially impacted persons; and
- submit a notification document of the intended use of pesticides to the administrator, the receipt of which will be verified by a confirmation issued by the Ministry.

Pesticide sale and uses will also be regulated with licenses. Licenses will be required for the application of pesticides to landscapes and structure, industrial sites of less than 20 ha and private forest land.

Uses under PMPs and licenses must be done in accordance with the public notice and use standards set by the administrator in the regulation.

The Act continues the Integrated Pest Management Committee, whose members include representatives from Health Canada, Environment Canada, as well as the BC Ministries of Agriculture, Food and Fisheries, Forests, and Health Planning. The committee will advise the administrator on pesticide issues.

Additional information on the pesticide regulatory reform process and detailed proposals can be found at the following Ministry of Water, Land and Air Protection website:
http://wlapwww.gov.bc.ca/epd/epdpa/ipmp/pestact/index.html

Integrated Pest Management Act and Regulations

British Columbia

Ministry of Water, Land and Air Protection
Environmental Management Branch
Integrated Pest Management Program

Background

- Current ***Pesticide Control Act*** and Regulations
  - Enacted in 1970's
  - Requires ministry approval of all pesticide uses on public land and private land used for forestry, public utilities and transportation

Problems With Current PUP and PMP Regulation

- Regulatory Burdens
- Excessive Government Workload Required
- Program Inconsistency
- Unnecessary delays and administrative burdens
- IPM and PMPs absent from regulations
- Inadequate fines and penalties

Developing a New Model

- New model developed with consultation:
  - Initial discussion paper and workshops (Sept 2002 – March 2003)
  - IPM Act passed by Legislature (Oct 2003),
  - Intentions paper for regulations (November 2003)
  - Workshops with stakeholders to develop standards (February – July, 2004)

Key Elements of the New Model

- Reduce unnecessary red tape
- Shift to Provincial results-based standards
- Improve auditing and inspections
- Divide regulation making powers between Minister and Administrator

Key Elements of the New Model (cont’d)

- Incorporate Pest Management Plan System
- Continue Authorizations for High Concern Uses
- Require Notification of Residents before Pesticide Use in and Around Residences

Key Elements of the New Model (cont'd)

- Continue to issue Licenses for pest control service companies and sales outlets
  - Update provincial standards
- Proposed use of Licenses instead of Pest Management Plan System for private forest land owners
  - Requested by PFLA
  - Standards developed in meetings with PFLA

Outcomes

- Increased efficiency
- Increased flexibility
  - e.g. to amend provincial standards
- Consistent with Ministry Strategic Shifts
  - Shift toward results-based regulation
  - Continued protection of human health and the environment

Next Steps

- IPM Act and Regulations to be enacted by January 2005.
- Develop key policies and guidance documents for implementation.

Pesticide Vendor Licences:

Licencing Sales outlets

- Certified dispensers
- Storage requirements
- Records of sales

Certified Dispensers

- Available to assist with pesticide storage and emergency response.
- Provide Advice to customers who are not themselves holders of a certificate or licence

Fees for Vendor Licences

- $250 per year for domestic pesticides and up to 100 kg per year of commercial pesticides
- $1000 per year for more than 100 kg per year of commercial pesticides

Pesticide Use Licences:

Licencing for Pesticide Use

- Certified applicators
- Notification
- Integrated Pest Management Requirements
- Human health and environmental standards
- Record keeping

Who Needs a Licence

- Service companies / Individuals
- Non-service uses on public land
  - Structural / Landscape pests
  - Forestry use, vegetation management on industrial sites: <20 ha per year , noxious weed control <50 ha per year
  - *Bti* for mosquito Larvae: <1ha per year

Who Needs a Licence (Cont.)

- Non-service uses on private land
  - Multi-residence buildings with 4 or more units
  - Vegetation Management for public utilities transportation or pipelines:< 20ha per year per agency
  - Forestry use – PFLA proposal

Notification

- Residences
- Outdoor public use areas
- Schools / Child care facilities
- Mosquito fogging
- Fumigation
- Vegetation management on industrial sites, public utilities transportation, or pipelines: < 20ha per year per agency
- noxious weed control: < 50ha per year per agency

Fees for Pesticide Use Licences

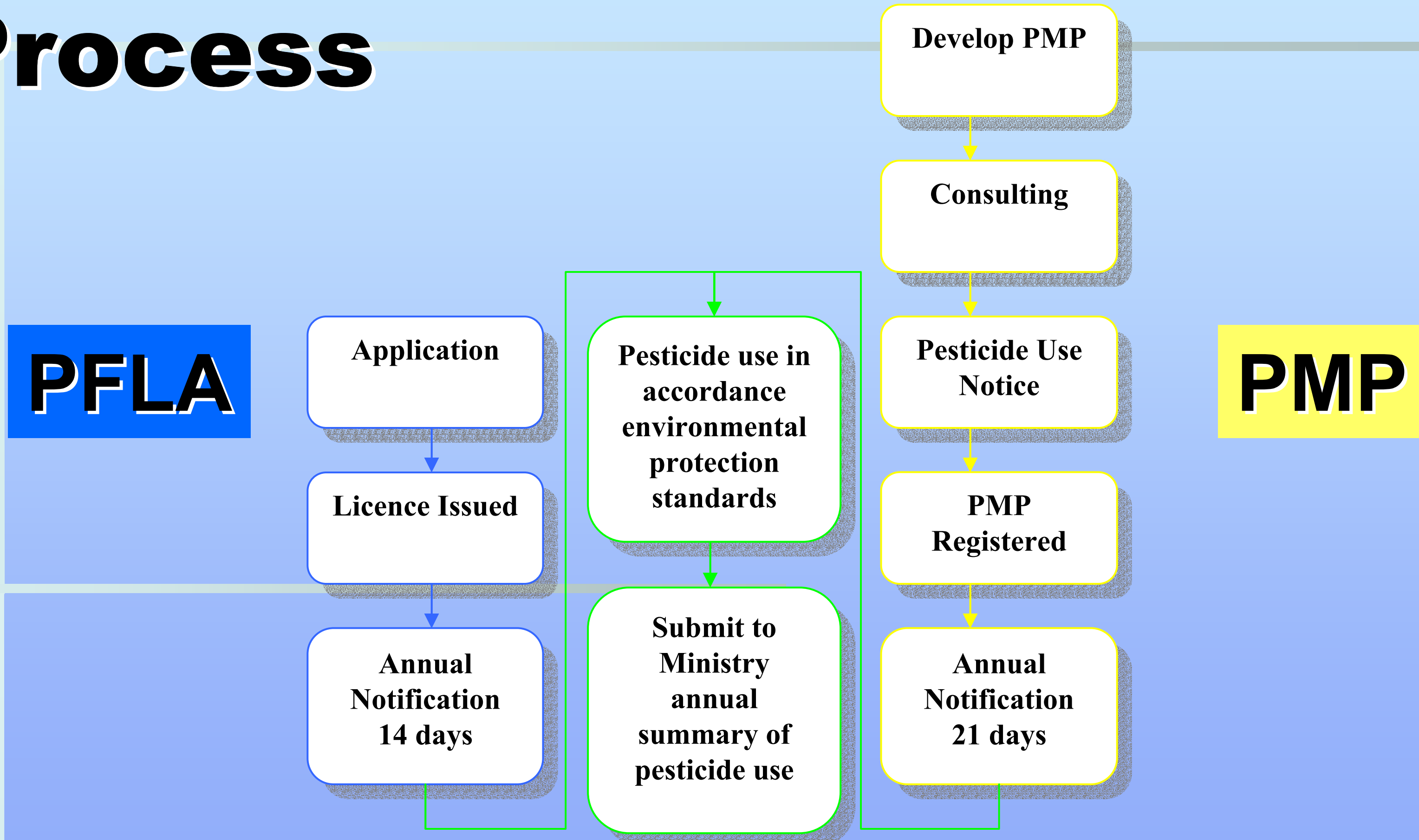
- For landscape or structural:
  - 1 office $250 per year
  - 2-3 offices $500 per year
  - >3 offices $1000 per year
- For other purposes
  - <50 ha per year $250 per year
  - 50-500 ha per year $500 per year
  - >500 ha per year $1000 per year
- For wood pole treatment
  - <1000 poles per year $250 per year

Licences on Private Forest Land:

PFLA Proposed Requirements

- Under license not PMP
- Follow same IPM and environmental protection standards as PMP holders.
- Specific notification requirements
- Not exempt from existing legal obligations to consult First Nations

PFLA Proposed Requirements VS. PMP Process



Permits:

When is a Permit Required

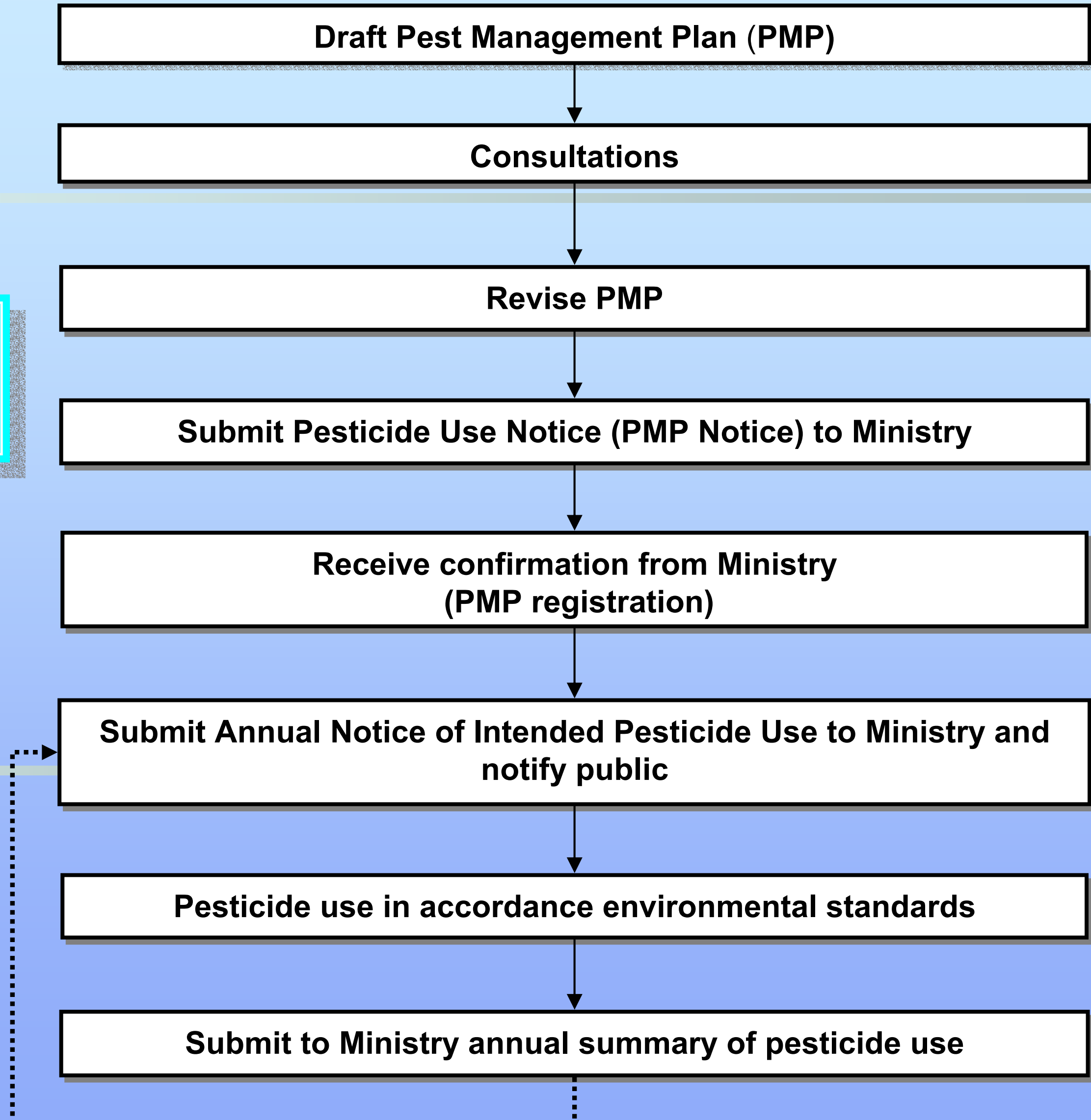
- Permit-Restricted Class pesticides
- Aerial application over urban areas
- Aerial use over non-urban areas except *Bt* products or Glyphosate or for agriculture
- Pesticide application to public land or a body of water except where a licence or PMP is required
- Pesticide use that requires deviation from standards under a licence or PMP

Pest Management Plans (PMPs):

Who is Required to Prepare a Pest Management Plan?

- Vegetation and pest management on public land used for forestry (treatment area >20ha).
- Mosquito management (except for small scale uses where only *Bti* is used)
- Invasive plant management on public land > 50ha
- Vegetation management and wood preservation on railways
- Vegetation management on road, pipeline, or transmission rights-of-way
- Vegetation management on industrial sites >20ha on public land
- Wood pole preservation on public utility rights-of-way.

PMP Development Process



Pest Management Plan (PMP) Contents

- Project location and responsible parties
- Integrated pest management elements:

  * Planning
  * Identify targeted pests
  * Monitoring strategy (activity)
  * Specify thresholds
  * Identify treatment options
  * Monitoring strategy (effectiveness)

- Operational practices:

  * Pesticide handling
  * Application procedures.
  *Environmental protection

Consultation - Public

- Newspaper advertisements
  - Ad in a local paid circulation newspaper 45 days before PMP Notice is submitted
  - Two ads must be placed within a two week period.
  - Include contact information, location of application and where PMP can be viewed

Public Consultation

- Direct contact with specific stakeholders
  - people who may be significantly impacted
- Maintain records of communication
  - Comments and proponent response

Consultation - First Nations

- Regulations establish objectives
- Guidelines
  - Assist in determining when to consult
  - Recommend steps to take
- Administrator given authority to arbitrate adequacy of consultation

Notice to Ministry/Confirmation

- Submit Pesticide Use Notice (PMP Notice) to MWLAP
- MWLAP Provides confirmation of receipt of PMP Notice (PMP registration)

Notification

- Prior to pesticide use, submit annual notice of intended pesticide use to MWLAP
  - 21 days in advance
- Notify other parties (Public, First Nations)
  - Signage
  - Direct notification

Pesticide Treatment

- Proceed with pesticide use in accordance with IPM
- Maintain operational records
- Observe standards required for protection of environment

Environmental Standards for PMPs

- Same standards as for licensees with some additional requirements
- Specific standards for Railway, Forestry, Invasive Plant, and Mosquito Control
- Developed in consultation with industry

Reporting- Auditing

- Maintain operational records of treatment programs
- Submit annual summary of pesticide use to MWLAP
- MWLAP conducts auditing to ensure compliance

FEES

- Fees based on the specified area of pesticide use or in any one-year of the term of the PMP Notice:

    less than 50 ha in any one-year of the term– $500.00;

    50 to less than 500 ha in any one-year of the term – $1,000.00;

    500 ha or more in any one-year of the term– $2,000.00.

- Fees based on the treatment of poles on a right-of-way:

    1,000 to less than 10,000 poles per year – $1,000.00;

    10,000 or more poles per year – $2,000.00.

Benefits

- Eliminate most authorizations
- Incorporate IPM into Provincial Regulations
- Focus on compliance
- Provincial consistency

?

PMRA Update: Progress in Re-evaluation and Environmental Science Activities

Valerie Hodge, Pest Management Regulatory Agency, Health Canada, HQ

Abstract

The new Pest Control Products Act received Royal Assent on December 12, 2002, and will come into force on a date yet to be determined. Since 2002, there has been a lot of activity within the PMRA related to the new Act, some of which will directly impact and improve the sharing and exchange of scientific data between the PMRA and other government departments. Coordination of research and monitoring activities through the 5NR working group on pesticides is helping to strengthen the linkages between research and regulatory scientists. Mandatory and voluntary reporting of adverse effects will provide an alert mechanism for health and environmental risks requiring investigation, and provide information that can be used to help prioritize re-evaluations, including special reviews. The PMRA will be drafting its milestones for its contribution to Health Canada's Sustainable Development Strategy which may include activites that are presently underway (e.g., re-evaluation program) and that will be implemented in the near future (e.g., mandatory reporting, development of an approach to regulate low risk pesticides). Advancements are also being made in methodology to estimate concentrations of pesticides in drinking water sources (groundwater and surface water), for dietary exposure assessments, as well as environmental concentrations due to runoff. Other projects to improve/strengthen environmental risk assessment methodology for pesticides are also being targeted. An important tool for mitigation of environmental risk, determination of buffer zones, has been reinforced by the incorporation of a newly developed drift "model" for ground-boom applications. PMRA's Re-evaluation Program, in particular, will benefit greatly from many of these initiatives. Specifically, the development of triggers for special reviews, sharing of research and monitoring data from other governmental departments, and adverse effects reporting will be useful.

PMRA Update: Progress in Re-evaluation and Environmental Science Activities

Valerie Hodge

Environmental Assessment Division, PMRA

Presented at Pacific & Yukon Region

Pesticide Information Exchange

November 25th, 2004

New Director,
Environmental Assessment Division

- Karen Lloyd

Lead for the PMRA:
~ Research and Monitoring Interface
~ Sustainable Development

Presentation Outline

- Environmental Science Activities
    - Water modelling
    - Drift models
    - Sustainable Development
    - Research and monitoring
    - Low risk pesticides
    - Adverse effects reporting
    - Special reviews

Presentation Outline *continued*

- Re-evaluation Program
  - Background
  - Program structure
  - Work plan

Water Modelling

- Estimating the Water Component of a Dietary Exposure Assessment
  - Groundwater and surface water
- Estimating Environmental Concentrations due to Runoff
  - Developed a scenario for a receiving water body
  - Discussing implementation of runoff modelling and mitigation

Water Modelling *continued*

- Estimate pesticide concentration in both surface water and groundwater -use Tiered approach - similar to EPA
- Level 1 and Level 2 -both use a scenario based approach
- Use the same models for the Level 1 and Level 2 assessment
- Level 1 purpose -to screen out pesticides that do not pose any DW concern
- If Level 1 concentration is unacceptable - move to a more refined Level 2 assessment

Water Modelling *continued*

- Groundwater
  - LEACHM (Leaching Estimation and Chemistry Model)
- Surface water
  - linked PRZM/EXAMS (Pesticide Root Zone Model; Exposure Analysis Modeling System)
  - Water body
    - Reservoir
    - Prairie dugout -if the product is used in prairies

Water Modelling

Agricultural Scenarios

- Scenarios are based on information from the Expert System for Pesticide Regulatory Evaluations and Simulations (EXPRES) developed by Environment Canada

- Currently using 11 of the EXPRES scenarios, including lower Fraser River Valley (raspberry), Okanagan Valley (orchard) and Peace River District (barley)

Water Modelling

Agricultural Scenarios *continued*

- EXPRES has detailed information on soil properties, crop parameters, agricultural practices, and daily weather data)

Drift Modelling

- Used as a mitigation measure
- Based on application method
  - Aerial (AgDisp)
  - Airblast (Ganzelmeier, German data)
  - Ground (drift trials, researcher Tom Wolf, AAFC in affiliation with PMRA)

Sustainable Development

- **Section 4**(2) Consistent with, and in furtherance of, the primary objective, the Minister shall
  - (*a*) support **sustainable development** designed to enable the needs of the present to be met without compromising the ability of future generations to meet their own needs;

Sustainable Development

- The PMRA is currently identifying its milestones for its contribution to Health Canada's Sustainable Development Strategy 2004-07
- Still in draft form

Sustainable Development *Milestones*

- Incorporate new science policies, methodologies and research and monitoring findings into decision-making
- Re-evaluate registered products
- Develop and implement mandatory and voluntary reporting of adverse effects

Sustainable Development *Milestones Continued*

- Develop an approach to regulate low risk pesticides
- Provide public access to information used to make decisions

Research and Monitoring

- 5NR working group on pesticides, co-chaired by Karen Lloyd
- WG supports the following:
  - Setting of priorities for research and monitoring
  - Sharing of results
  - Strengthening of linkages between research and regulatory decision-making

Low Risk Pesticides

- PMRA Objective:
  - Facilitate access to low risk pesticides
  - Reduce the regulatory and assessment burden for certain low risk products

Mandatory Reporting

- **PCPA Section 13.** An **applicant** for registration of a pest control product,… **shall report any prescribed information that relates to the health or environmental risks or the value of the pest control product** to the Minister ...

- Types of information to be reported
- Time frame for reporting

Adverse Effects Reporting Regulations

- Proposed Regulations
  - Canada Gazette Part I, October 23, 2004
  - Come into force January 1, 2006
- Mandatory for applicants and registrants
- Definition of an adverse environmental effect
  - *Section 2(c) of Adverse Effects Reporting Regulations*
  - *Severe, major, minor*

Adverse Effects Reporting Regulations *continued*

- Comments may be submitted until January 6, 2005 to Cameron Laing, Alternative Strategies and Regulatory Affairs
- www.canadagazetteducanada.gc.ca/part1/2004

Adverse Effects Reporting Forms

- Draft reporting forms: www.pmra-arla.gc.ca
  - "What's New"
- Dana Bruce, Adverse Effects Reporting Program, Health Evaluation Division
  - Comments by January 6, 2005

Voluntary Reporting of Adverse Effects

- Medical and research community and individuals
- Currently under development

Special Reviews

- **PCPA Section 17.** (1) The Minister shall initiate a **special review** of the registration of a pest control product if the Minister has reasonable grounds to believe that the health or environmental risks of the product are, or its value is, unacceptable.

How is a special review initiated?

- Adverse effects reporting by industry, or a serious adverse effect identified in an international forum or through submitted data
- Request by public (voluntary adverse effects reporting)
- Emerging issues requiring a regulatory follow-up
- National or International commitments or policies to address a particular aspect of health or safety

PMRA Re-evaluation Program
Background

- As of 2001, approximately 550 pesticide active ingredients, and their end-use products, were registered
- 405 active ingredients and their currently registered products, in use prior to December 31, 1994, and are included in the program

PMRA Re-evaluation Program
Program Structure

- Program 1
  - a suitable Risk Assessment Document or Reregistration Eligibility Decision document has been published by US EPA
  - Sufficient detail is available
  - Relevant to Canadian uses

PMRA Re-evaluation Program
Program Structure

- Program 2
  - Detailed in-house evaluation is required
  - Doesn’t meet criteria for Program 1 (e.g., unique use situation in Canada)
  - Previous re-evaluation efforts are ongoing

PMRA Re-evaluation Program
Program Structure

- Program 3
  - Focus on re-evaluation of pest control products scheduled for reassessment in the U.S. under the FQPA
  - Particular attention to products with common mechanism of action, aggregate exposures, and risks to susceptible subgroups such as children
  - Organophosphates, carbamates, probably human carcinogens

PMRA Re-evaluation Program
Program Structure

- Program 4
  - Targeted reviews, i.e., a Special Review (in future, could be triggered by adverse effects reporting)

PMRA Re-evaluation Program
Workplan

- Example, for the period from April 2003 to June 2004:
  - Program 1 – 61 actives ingredients scheduled for review; 38 have been published
  - Program 2 – 22 active ingredients
  - Program 3 – 19 organophosphate active ingredients; 14 have been published
  - Program 4 – Turf Special Review: 2, 4-D, dicamba, MCPA, mecoprop

British Columbia Crop Profiles

Tracy Hueppelsheuser, BC Ministry of Agriculture, Food and Fisheries
e-mail: Tracy.Hueppelsheuser@gems1.gov.bc.ca voice: 604 556-3001

Abstract

The BC Crop Profile Project is an initiative of the BC Ministry of Agriculture, Food and Fisheries (BCMAFF). Its primary purpose is to provide crop information to the Pest Management Regulatory Agency (PMRA). Profiles have other purposes, including providing information to provincial staff, chemical companies, other government agencies. Profiles are included in Minor Use pesticide registration submissions, and are useful for PMRA's pesticide re-evaluation process. Crop Profiles provide the PMRA with relevant information that can be used for more accurate risk assessments, for example:

- **Crop production practices** in moderate detail, such as length of time the crop is in the field from seeding to harvest, or description of the greenhouse structure
  Many uses: for example, establishing pre-harvest intervals or determining environmental impacts.
- What kind of **worker activities** take place in the crop, and at what stages
  Helps establish worker exposure guidelines.
- Major **weed, disease and insect problems**, estimates of how much loss they cause, if they are adequately controlled (and if not, why)
  This will further the case for registration of appropriate products.
- **Current usage** of chemical and biological products
  Can help promote registration of 'greener' products to replace old technologies, and indicate usage of preferred management approaches (ex. IPM).

Crop profiles go through an extensive editing process before they are finalized. First, they are written by the Crop Profile Writer(s) based on information from the appropriate production guide, textbooks, research papers and other relevant sources. Next, they are reviewed by the Minor Use Coordinator. Specialists from BCMAFF edit the document, and finally industry participants review it. Consensus is reached among stakeholders in the final document.

As the Crop Profiles are being developed, a separate document called the "Pest Gaps Analysis" is created. This document is meant to identify "gaps" in the management of the crop. Gaps are issues that hinder crop production from the perspective of pest management. A gap can be a pest that is not adequately controlled with existing management techniques. It can also be a pest that is adequately controlled for the time being, but which may not be in the future. For example, if a pest is currently being controlled solely by a pesticide that is under review, there is the

possibility that this pesticide will not be available in the future and the pest will therefore not be managed. Identification of these gaps also helps direct BCMAFF Plant Health staff activities. Further, this document lists potential solutions to these gaps. Solutions are as specific as possible, and include scientific research, pesticide registrations, and educational projects.

British Columbia Crop Profiles

Tracy Hueppelsheuser

BC Ministry of Agriculture, Food and Fisheries

Outline of presentation:

- Primary purpose and other uses
- Information included and why it is useful
- Validation process for documents
- Some examples of what documents look like
- Where to get Crop Profiles
- Demonstration of Crop Profiles (pdf) and questions

Primary Purpose:

- To provide current crop production and pest management information to Pest Management Regulatory Agency (Health Canada),
- In order to help them make good regulatory decisions based on relevant information
  - for new pesticide registrations and
  - Re-evaluation of old registrations

Information includes:

- Crop production practices, ie.
  - Acreage and growing regions
  - Length of time the crop is in the fields from seeding to harvest
  - Description of the greenhouse structure
  - Equipment used
  - Future plans and current research
  - Includes photos!

Why this is useful:

- Establishing pre-harvest intervals
- Determination of potential environmental impacts, and mitigation measures

Information includes:

- Worker activities that take place in the crop
- When these activities take place and
- at what crop stages

Why this is useful:

- Helps establish worker exposure guidelines, such as re-entry intervals and personal protective equipment required

Information includes:

- Major and minor weed, disease, and insect pests
- Description of damage
- Estimates of the loss
- If pests are adequately controlled with available tools, and if not, why

Why this is useful:

- Shows where needs for pest management tools are, including new pesticides, or other approaches and methods.
- PMRA will only register pesticides that have “value” to the growers; so confirming a need exists is important.

Information includes:

- Current usage of pesticides and other pest control methods
- Includes biological control agents, microbials, cultural practices, etc.

Why this is useful:

- PMRA can use this information for realistic risk assessments for registrations of new pesticides and for re-evaluations of old ones.
- Shows were old chemistries are still used, where new ones are preferred, and preferred management approaches (ie. IPM uptake)

- Without this type of use information, PMRA reviewers have no choice but to use worse-case scenarios: ie. ALL the crop would be treated with the MAXIMUM number of applications with ALL the registered chemicals.

- This is *UNREALISTIC* and *MISLEADING*, and leads to over-estimation of risk

- PMRA has been asking for this type of document for some time, and are using the completed Profiles now.

- BC is the first province to initiate and complete crop profiles in this format.

- Agriculture and Agri-Food Canada is developing national crop profiles now. They are attempting to capture needs from all growing regions.

Validation of Information:

- First drafts written by Crop Profile Writer(s) based on
  - textbooks,
  - in house publications (production guides, factsheets, industry journals, etc),
  - research papers, and
  - discussions with staff and industry resources.

Validation of Information:

- Edited by BC Ministry of Agriculture, Food and Fisheries staff:
  - Minor Use Coordinator
  - Industry Specialists
  - Entomologists, pathologists, weed specialists
- Edited by Agriculture and Agri-Food Canada staff

Validation of Information:

- Edited by Industry:
  - Growers
  - Grower association representatives
  - Field people from processing plants
  - IPM consultants
  - Field staff from agriculture products suppliers

Validation of Information:

- Consensus is reached on the information presented through
  - Focus groups, or
  - By the Writer(s) cross-checking with stakeholders throughout writing process.

- Plan is to update Profiles every 2-3 years

- *It is in the growers' and their industry's best interest to provide accurate information*

Other uses of Crop Profiles:

- Helps grower groups and others to determine pest control needs and potential solutions
  - Through the “gaps analyses”, which focuses on needs and solutions, and gives direction,
  - AAFC research and minor use priority setting,
  - Directing BCMAFF activities

Other uses of Crop Profiles:

- Gives commodity groups a document to ‘showcase’ their industry with.
- Allows chemical companies to learn more about our crops and where their products might have a fit.
- Supporting information to be included with pesticide registration submissions

Other uses of Crop Profiles:

- Provide information for program development to other agencies such as
  - Environment Canada,
  - Department of Fisheries and Oceans
  - BCWLAP
- Consumer interest groups such as World Wildlife Fund
  - currently interested in promotion of integrated pest management and pesticide risk reduction

Crops were chosen by:

- Horticultural crops (we expect the prairies to take the lead on field crops)
- Those that are important to BC agriculture
- Those that are identified by PMRA as “representative crops” for generating residue data (DIR98-02) for various crop groups

23 BC Crop Profiles completed (Nov 2004)

- Apple
- Beets
- Blueberry
- Broccoli
- Brussels sprouts
- Cabbage
- Carrot
- Cauliflower
- Sweet cherry
- Cranberry
- Greenhouse tomato
- Ginseng
- Grapes
- Lettuce (field)
- Onion (green and bulb)
- Peach
- Pear
- Potato
- Prune/plum
- Raspberry
- Strawberry
- Turnip/rutabaga

18 BC Crop Profiles in progress (Nov 2004)

- Asparagus
- Beans (snap)
- Celery
- Cucumber (field)
- Floriculture
- Greenhouse cucumber
- Greenhouse pepper
- Hazelnut
- Mushroom
- Nursery
- Parsley
- Peas
- Radish
- Spinach
- Summer squash
- Sweet corn

Crop Profile for

Potatoes

in British Columbia

Crop Group 1: Root and Tuber Vegetables

Production Facts

(Annual BC Horticultural Statistics, 2000)

- There are more potatoes grown in BC than any other vegetable
- BC ranked 6th among the provinces in potato production
- BC produced 56,025 tonnes of potatoes on 2353 ha, which had a value of almost $27 million

- 4% of potatoes were of the early varieties; the remaining 96% were mid-season or late varieties
- 17% of the potatoes were destined for the processing market; all were of the mid or late varieties
- 11% of BC potatoes were sold through farm or roadside sales; with the remaining potatoes being sold wholesale (72%) or processed (17%)

May, 2002

Last Updated: October, 2003

British Columbia
Ministry of Agriculture, Food and Fisheries

Crop Profile: Potatoes in British Columbia

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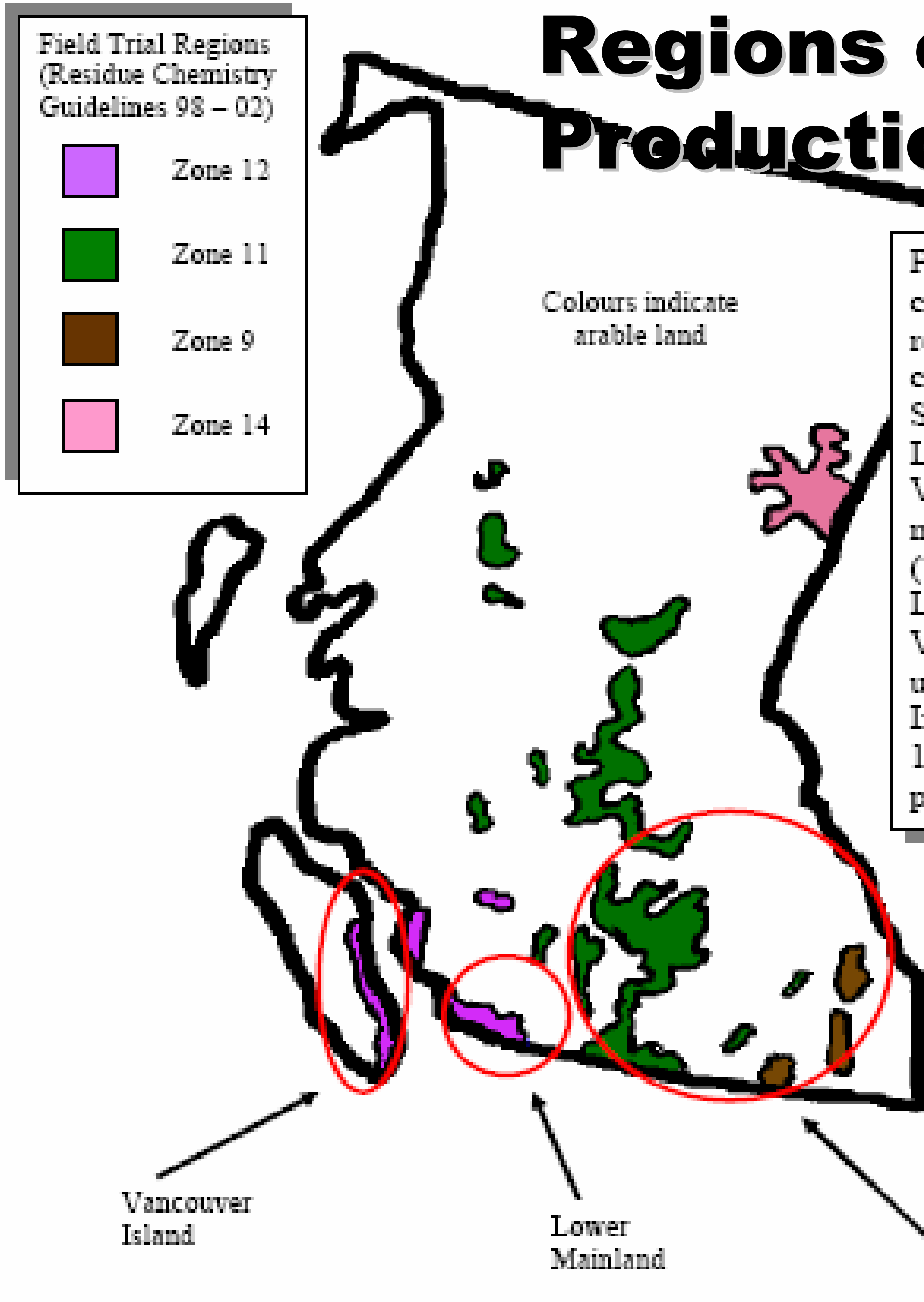
Regions of Potato Production in BC



Potatoes are grown commercially in the 3 regions of BC indicated by circles on the map: the Southern Interior, the Lower Mainland, and Vancouver Island. The majority of the production (79%) occurs within the Lower Mainland, with Vancouver Island making up 11% and the Southern Interior responsible for 10% of commercial potato production in the province.

Table 5. Chemical control of insect pests

Active Ingredient (Trade Name)	Insect Pest♦	% Acres Treated*		Est. # Apps. *		REI (h)	PHI (d)	Application Method+	Comments
		Seed	Table	Seed	Table				
Chlorpyrifos (Pyrifos 15G, Pyrinex 480 EC)	Wireworms	40	35	1	1	24	70	In furrow at planting	This product is available under an emergency use registration from 1999 to 2004..
Imidacloprid (Admire)	CPB, aphids, leafhoppers, overwintering TFB	5	0	1	N/A	24	7	In-furrow or foliar	
Acephate (Orthene)	Aphids, TFB, Leafhoppers	0	0	N/A	N/A	48	21	Foliar spray	
Azinphos-methyl (APM, Guthion, Sniper)	Aphids, TFB, Leafhoppers, CPB	0	0	N/A	N/A	48	7	Foliar spray	This product will be phased out for potatoes. Last date of sale: Sept. 30, 2003. Last date of use: Dec. 31, 2005.
Bacillus thuringiensis var. kurstaki (Bioprotec, DiPel 2XDF)	Caterpillars	0	5	N/A	1	24	0	Foliar spray	DiPel 2XDF was registered in 2004. Limited opportunity so far.
Carbaryl (Sevin XLR)	TFB, CPB Leafhoppers	20	20	1-3	1-3	48	7	Foliar spray	
Carbofuran (Furadan)	CPB, TFB, Leafhoppers	5	5	1	1	48	7	Foliar spray	
Chlorpyrifos (Pyrinex)	CPB, TFB	0	0	N/A	N/A	24	7	Foliar spray	
Cyhalothrin-lambda (Matador)	TFB, CPB Leafhoppers	15	15	2	2	24	7	Foliar spray	
Cypermethrin	TFB, CPB	80	80	1-2	1-4	24	7	Foliar spray	

- Numbers in tables are generally ***best estimates*** from the consensus of the experts in the industry (growers, consultants, government, retailers, etc).

- There was no official survey done of growers' practices. In some cases there were formalized data collection:
  - Marketing agencies provided spray records which were used in the tables (ie. greenhouse vegetables, 2003 data),
  - Consultants surveyed a number of growers (potatoes).
  - An IPM survey was done of growers in an industry to determine baseline IPM information. Results are presented in the Profile (nursery).

Red Raspberry Production and Pest Management Schedule[1]

Time of Year	Activity	Action
January Plants dormant	Plant Care	Prune tops
	Worker Activity Summary	Pruning of canes occurs from October through January; Pruning is done mainly by the owner/operator, and occasionally by contractors; Pruners may spend several hours in the field, but canes have no leaves and no sprays have been applied for several weeks, at minimum
February Plant tops dormant; roots becoming active	Plant Care	Top canes if necessary; Chop prunings; Set out new plantings
	Soil Care	Perform spring soil test; Apply manure, if used; Incorporate manure and lime in sites of new plantings
	Weed Control	Apply herbicide for weeds within rows
	Worker Activity Summary	Pruning as described above
March Buds starting to swell and open	Plant Care	Finish all pruning and topping of canes; Finish chopping prunings; Continue with new plantings
	Disease Control	If field has history of spur blight, apply pre-bloom fungicide; Apply delayed dormant spray for cane diseases and yellow rust; Apply a spray for bacterial blight control; Begin monitoring for Phytophthora root rot, spur blight, cane blight, and Botrytis cane wilt
	Insect Control	Drench crowns for crown borers, if needed; Begin monitoring for climbing cutworms and clay coloured weevils; Apply controls if needed
	Worker Activity Summary	Monitoring for diseases and insects is done by either pest management professionals or by owner/operators: Each field is monitored about once per week; Chemical pesticides are typically applied with over-the-row boom sprayers (some airblast sprayers are used, but there are virtually no backpack sprayers used in raspberries)
April New canes and fruiting laterals growing quickly	Plant Care	Remove first flush of primocanes by "shoot burning"
	Soil Care	Apply commercial fertilizer; Fertilize new plantings

- CDs are available from BCMAFF for use to develop your programs

- Information is to be used ‘in good faith’ meaning the industries will not be put at risk by any use of these documents

- These are BCMAFF’s documents, and information should be referenced appropriately

Demonstration:

- View Crop Profile documents as pdf
- Choose crops to look at
- Sections of interest
- Find information

An Update on West Nile Virus Control Activities in PYR and the Role of Environment Canada

John Pasternak, Commercial Chemicals Division, Environmental Protection Branch, Environment Canada

Abstract

The purpose of this presentation is to provide an update on Environment Canada's role in relation to the West Nile Virus (WNV) control activities using pesticides in British Columbia (BC) and the Yukon Territory (YT). To date, there have been no reported cases of avian / mosquito-borne WNV found in BC or the YT. By the nature of its transmission cycle involving the movement of infected carrier birds and mosquitoes, it is inevitable that this virus will arrive in BC from Western Canada and / or the USA in the very near future. In 2004, WNV was detected in Quebec, Ontario, Manitoba, Saskatchewan and Alberta. It has also been identified in all American states except for Washington, Alaska and Hawaii.

The WNV Surveillance Program in BC is led by the BC Centre for Disease Control. This agency has been responsible for coordinating WNV monitoring throughout the province and helping local governments plan for WNV control activities. The BCCDC also provides extensive information to the public, local governments and health agencies on the subjects of WNV health effects and transmission.

The use of pesticides for mosquito control in public areas in BC requires a provincial Pesticide Use Permit (PUP) or a Pesticide Management Plan (PMP). The permitting agency is the BC Ministry of Water, Land and Air Protection (BCMWLAP). BCMWLAP has granted a special province-wide PUP to enable all regions of BC to use pesticides to control mosquitoes to protect the general public from WNV. This permit specifies that different levels of control are permissible based on the level of WNV infection in mosquitoes, wildlife and humans in the subject or in the adjacent jurisdiction. It also allows the use of four insecticides for the control of mosquitos: *Bacillus thuringiensis* var. *israelensis* (Bti), methoprene, malathion and pyrethrins. Although WNV has was not detected in BC in 2004, approximately 12 local governments conducted mosquito larvaciding using Bti and / or methoprene as part of their pre-emptive WNV control strategy. No pesticides were applied in the YT in 2004 for the control of mosquito-born WNV, although applications of methoprene and Bti took place the purpose of mosquito nuisance control.

A federal position on the use of pesticides to control mosquito-borne WNV has been developed by the Pest Management Regulatory Agency (PMRA) with input from Environment Canada (EC) and the Department of Fisheries and Oceans

(DFO). The “Government of Canada Position on the Use of Pest Control Products to Control Potential Vectors of West Nile Virus” is in draft form and is awaiting Assistant Deputy Minister approval from the three departments. This position provides guidance to the proponents of pesticide use for the control of mosquito WNV to enable them to meet the legal requirements of the *Fisheries Act* and the *Migratory Birds Convention Act*. EC has also prepared a national draft policy document which is consistent with the messages in the federal position.

Regional Commercial Chemicals Division (CCD) staff have been involved in the development of the province-wide PUP for WNV control via their participation in the provincially led BC Pesticide Control Committee. Advice was provided to BCMWLAP to enable the development of PUP conditions which are consistent with Environment Canada’s draft national position on the use of pesticides to control mosquito-borne WNV. Similar advice has also been given to various municipal stakeholders. In the future, regional staff will provide further advice to local stakeholders such as BCWLAP, local governments and contractors to avoid environmental impacts from mosquito WNV control activities and to encourage and promote compliance with federal environmental legislation. Environment Canada will respond as appropriate in relation to spills, errors, or when environmental best practices are not being followed during the application of pesticides for the control of mosquito WNV and/or when these result in a violation of federal legislation, such as the *Fisheries Act* or the *Migratory Birds Convention Act*.

An Update on West Nile Virus Control Activities in PYR and the Role of Environment Canada

Presentation by:

John Pasternak
Commercial Chemicals Division
Environment Canada

2004 Pesticide Information Exchange

25 November 2004

Presentation Outline

Background

Issues

WNV Pesticides Activities in PYR

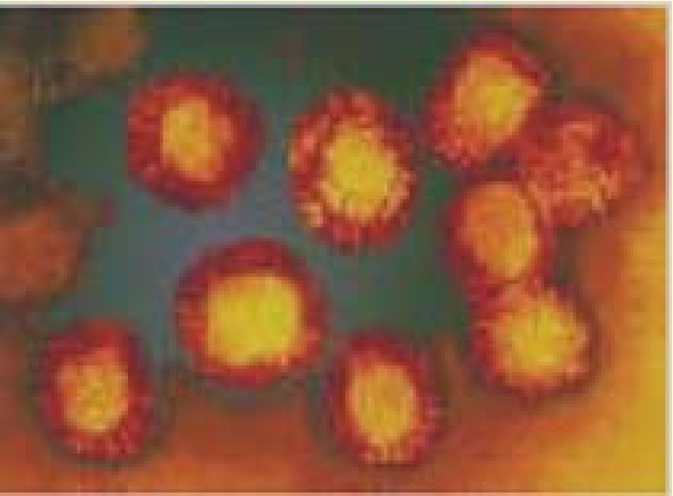
Environment Canada’s Role and Activities

Guidance to Proponents

Future Activities

Background

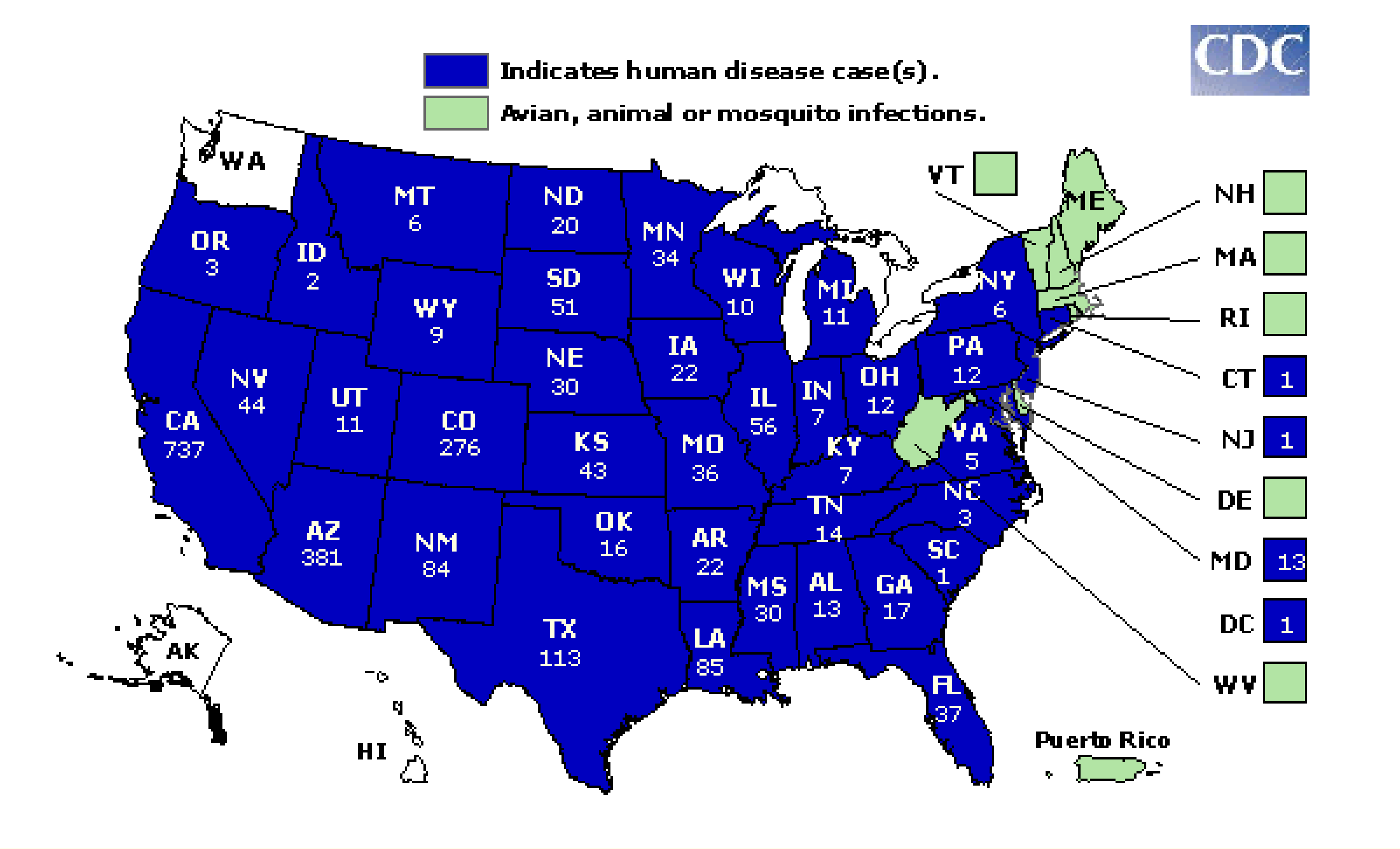
- First isolated in 1937, West Nile district, Uganda.
- Outbreaks in Africa, and in parts of Europe, Asia.
- First recorded outbreak in North America, New York City in 1999.
- Of those infected, often no symptoms. About 20% of those infected have mild flu-like symptoms.
- If bitten by infected mosquito, <1% chance of getting seriously ill. Serious cases can result in *meningitis* (inflammation of the lining of the brain or spinal cord) and *encephalitis* (inflammation of the brain itself).



West Nile Virus Magnified

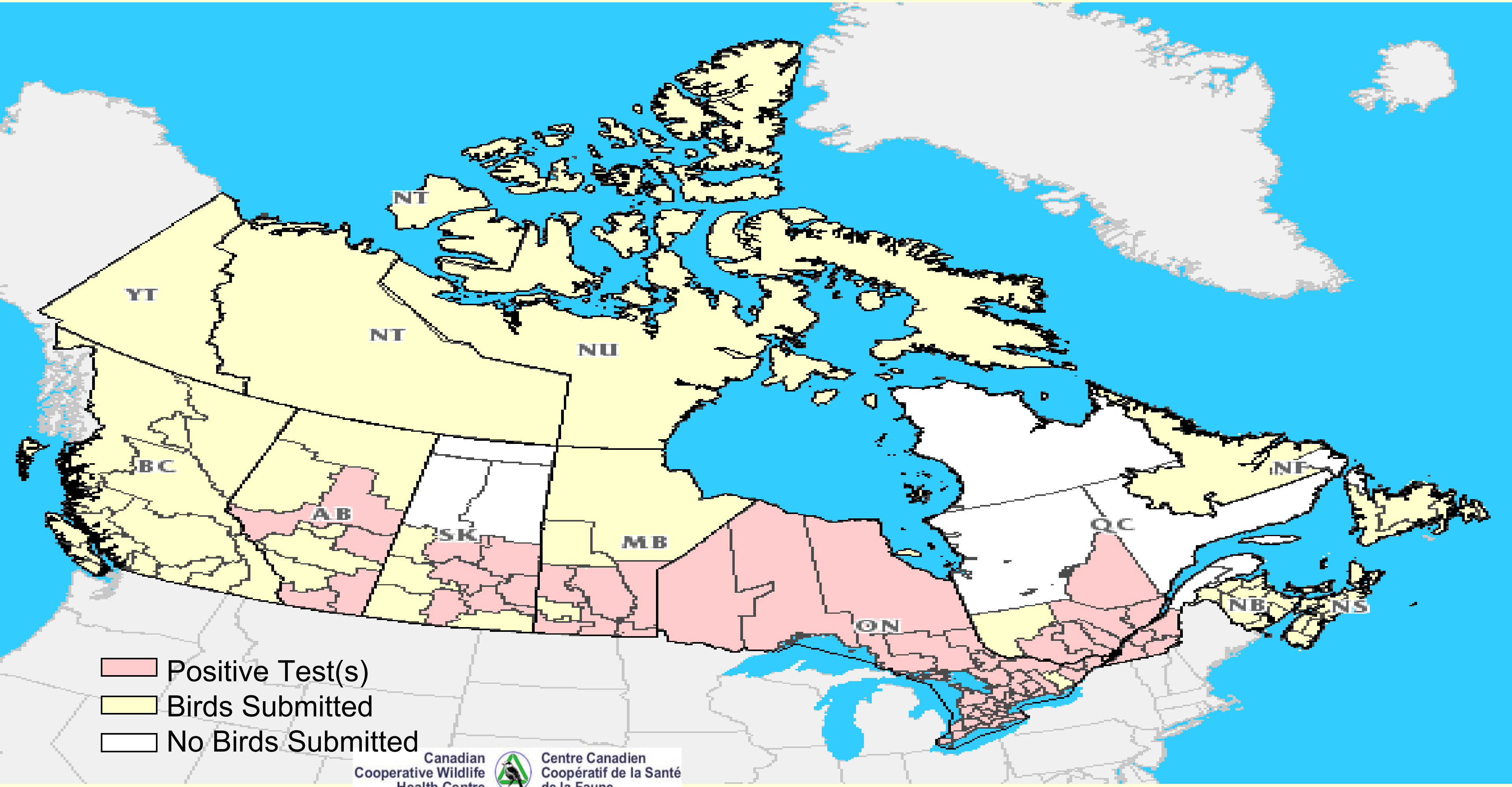

West Nile Virus
Transmission
Cycle
West Nile
Virus
Mosquitoes
(vectors)
West Nile Virus
Incidental
infection
Birds
(virus reservoirs)
Incidental
infection

2004 West Nile Virus Activity in the United States*



* Reported to Center for Disease Control (CDC) as of November 8, 2004.

Dead Birds Submitted for West Nile Virus Diagnosis by Health Region in Canada*



Notes: * Data as of October 29, 2004
Total birds submitted = 6,232 (Total for 2003 was 11,323)

WNV Activity in Canada*

Province / Territory	Human Cases (confirmed or probable)	Positive corvids (confirmed)	Positive Mosquito Pools	Positive Equine Cases (presumed or confirmed)
British Columbia	0	0	0	0
Alberta	2**	9	1	3
Saskatchewan	10	29	30	0
Manitoba	3**	16	54	0
Ontario	**13****	**237**	**59**	**5**
Quebec	1	101	12	1
NB, NS, PEI, NF, YK, NWT, NT	0	0	0	0
TOTAL (to date in 2004)	**29**	**416**	**176**	**14**
Total 2003	**1388**	**1633**	**579**	**445**

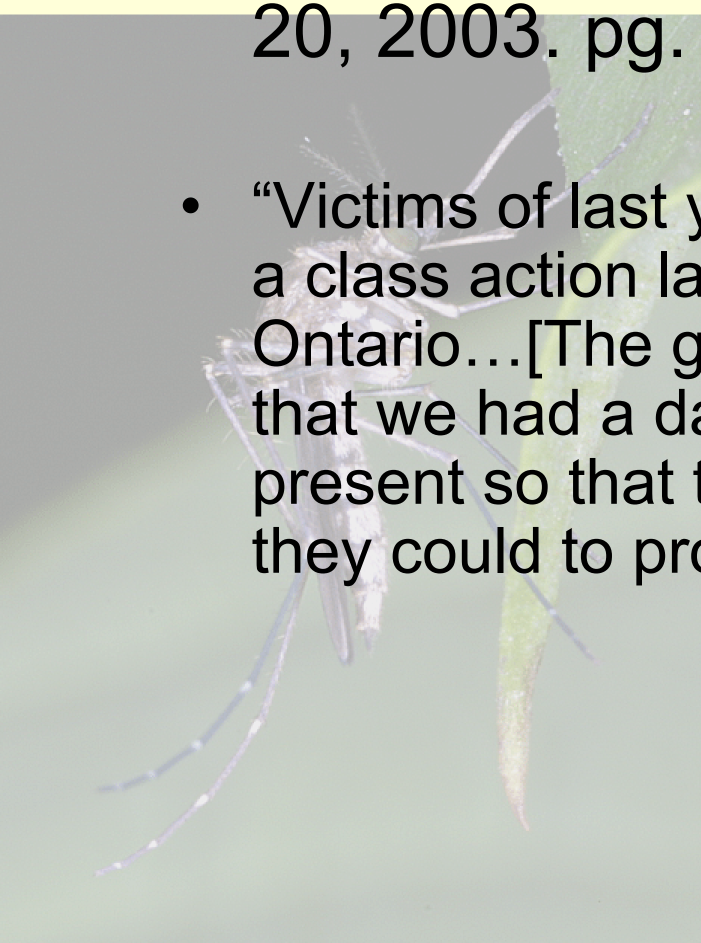
Notes:
*Source: Health Canada 2004. *http://www.phac-aspc.gc.ca/wnv-vwn/*
**One case in noted totals considered to be travel-related.

WNV Issues

- Human Health
  - 2004 – 29 cases; 2003 – 1388 cases in NS, NB, QC, ON, MB, SK, AB, BC, YT; 14 deaths.
- Socio-economic
  - Risk reduction strategies and measures.
  - Level of effort and coordination required for program implementation.
  - Preparedness on local government part to implement timely and rational controls.
  - Cost of program implementation - monitoring, data analysis, controls, evaluation of control efficacy.
  - Cost of no controls or perceived inadequate controls.
  - Public perception of the disease and the need to control it.
- Environmental
  - Wildlife disease possible impact from use of **pesticides**.

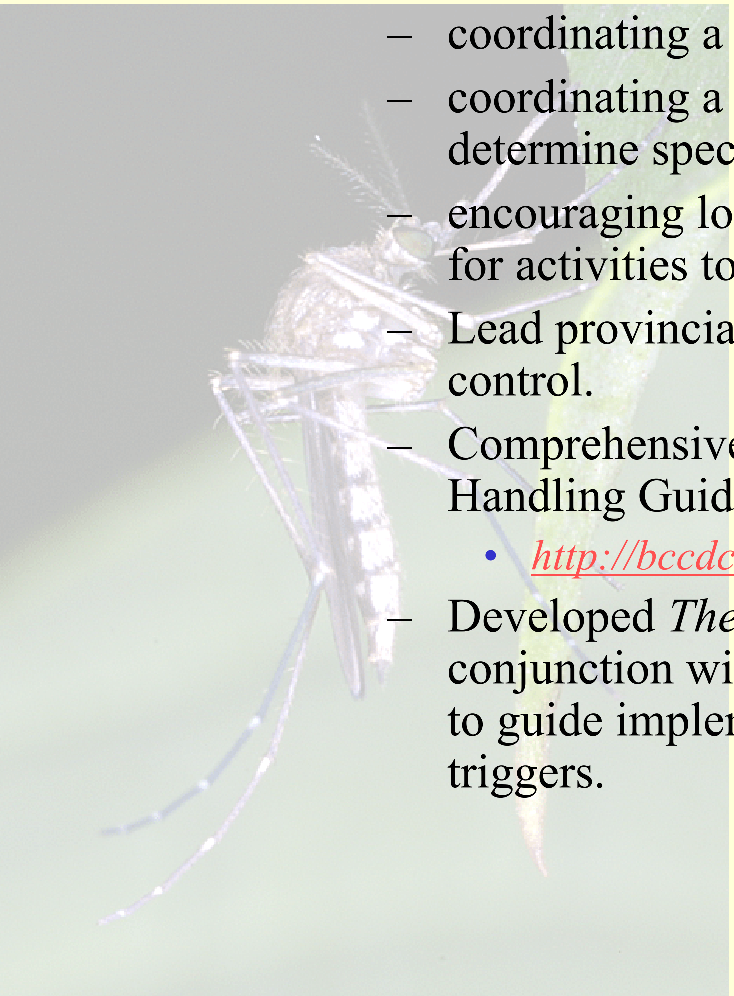
WNV Issues

Law suit over WNV



- *Alberni Valley Times*. Port Alberni, B.C.: Jun 20, 2003. pg. A.12
- “Victims of last year’s West Nile outbreak plan to file a class action lawsuit against the government of Ontario…[The government] failed to warn the public that we had a dangerous West Nile Virus epidemic present so that they could take whatever measures they could to protect themselves.”

WNV Activities in British Columbia

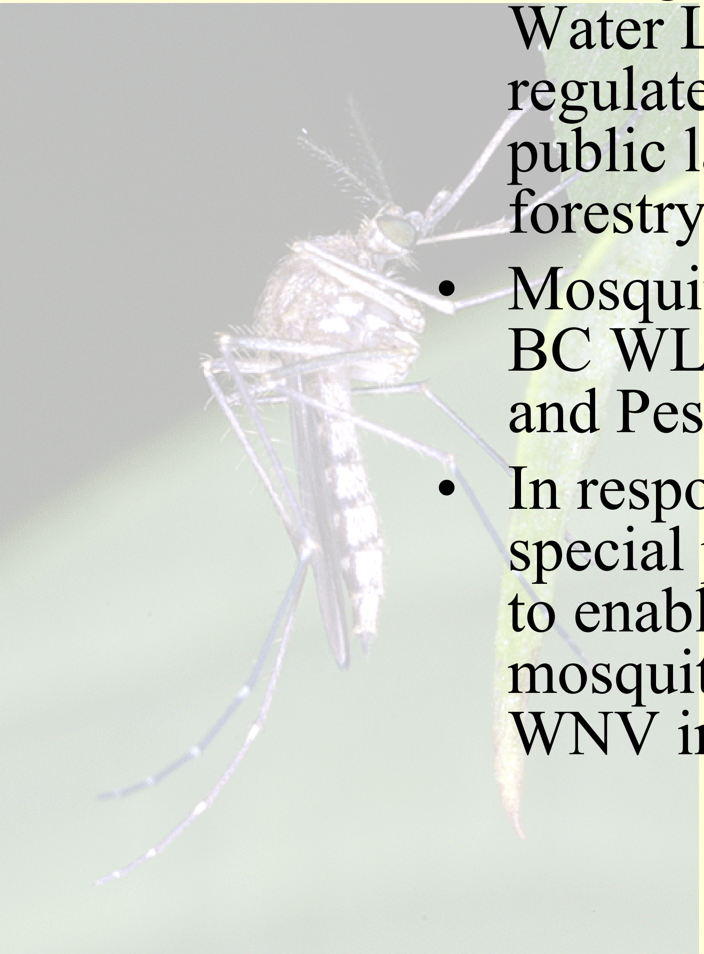


BC Centre for Disease Control leads WNV Surveillance program:

- notification of health care providers and to order diagnostic tests on probable cases.
- coordinating a monitoring/testing program for wild birds.
- coordinating a monitoring/testing program for adult mosquitoes to determine species distribution and presence of WNV.
- encouraging local governments to carry out preparatory work to plan for activities to prevent and control the spread of WNV.
- Lead provincial committees focused on WNV monitoring and vector control.
- Comprehensive web information (QAs, Press Releases, Bird Handling Guidelines, Surveillance Maps and Data, etc.)
  - *http://bccdc.org/topic.php?item=110*
- Developed *The Arbovirus Surveillance and Response Guidelines* (in conjunction with the Canadian National WNV Steering Committee) to guide implementation of control activities based on various triggers.

WNV Activities in BC *(Cont.)*

Provincial Role in Pesticide Use

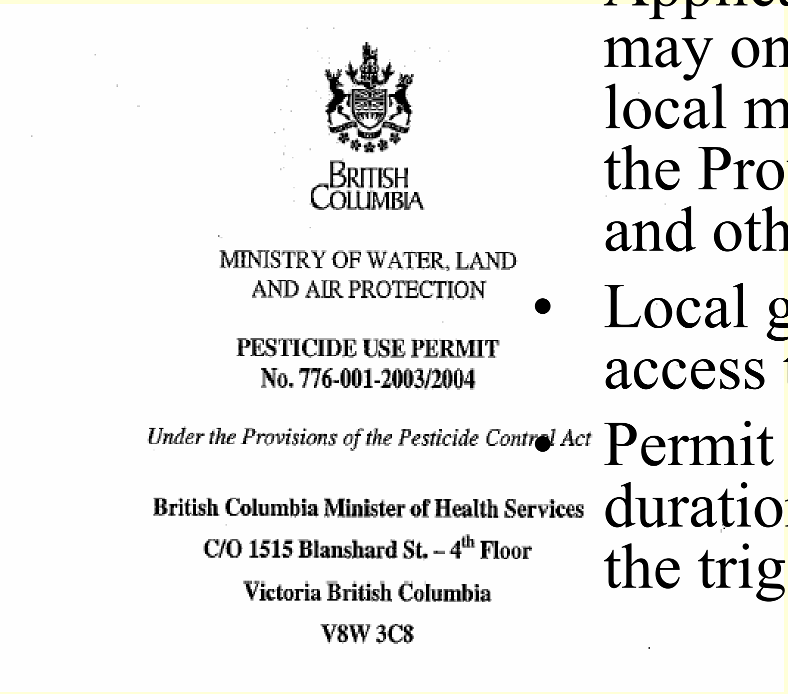


- BC Pesticide Control Act (now BC Integrated Pest Management Act) authorizes BC Ministry of Water Land and Air Protection (BC WLAP) to regulate some aspects of pesticide application to public land/certain types of private land (e.g., forestry, utility rights-of-way), etc.
- Mosquito control for nuisance in public areas via BC WLAP Pesticide Management Plans (PMPs) and Pesticide Use Permits (PUPs).
- In response to WNV threat, BC WLAP granted a special province-wide Pesticide Use Permit (PUP) to enable all regions to use pesticides to control mosquitoes to protect the general public from WNV in 2003.

WNV Activities in BC *(Cont.)*

Province Wide PUP for WNV Mosquito Control

- Authorizes the BC Minister of Health Services to administer WNV control activities using pesticides.
- Application of pesticides by local governments may only occur on the recommendation of the local medical health officer, in consultation with the Provincial Health Officer, local communities and other Ministries.
- Local governments must submit a request to access the permit.
- Permit amended on 25 June 2004 to extend the duration of the permit for one year and to revise the triggers and conditions for application.



BRITISH COLUMBIA

MINISTRY OF WATER, LAND AND AIR PROTECTION

PESTICIDE USE PERMIT
No. 776-001-2003/2004

Under the Provisions of the Pesticide Control Act

British Columbia Minister of Health Services
C/O 1515 Blanshard St. – 4th Floor
Victoria British Columbia
V8W 3C8

WNV Activities in BC *(Cont.)*

- Mosquito pesticides under BC PUP 776-001-2003/2005:
  - *Bacillus thuringiensis* subspecies *israelensis* (Bti)
    - larvicide, ground or aerial application
  - Methoprene
    - larvicide, ground application
  - Malathion
    - Adulticide, ground or aerial application
  - Synergized pyrethrins or synthetic pyrethroids
    - Adulticide, ground application
  - Other registered products available, but not authorized under this PUP.

WNV Activities in BC *(Cont.)*

Response Levels to Trigger Pesticide Application

- Level 0, Level 1 – Surveillance shows no evidence of WNV in bird, animal or mosquito.
  - Non-pesticide control measures (can do without this permit).
- Level 2a - Surveillance shows WNV in bird, animal or mosquito in previous year, or in neighboring jurisdiction in current year.
  - Non-pesticide controls and laviciding.
- Level 2b - Surveillance shows WNV in bird, animal or mosquito in current year.
  - Adulticide and/or larvicide.
- Level 3 - Surveillance shows one or more locally acquired cases of WNV humans in current year.

  – Larvicide and Adulticide programs to be considered.

BRITISH COLUMBIA

MINISTRY OF WATER, LAND AND AIR PROTECTION

PESTICIDE USE PERMIT
No. 776-001-2003/2004

Under the Provisions of the Pesticide Control Act

British Columbia Minister of Health Services
C/O 1515 Blanshard St. – 4th Floor
Victoria British Columbia
V8W 3C8

WNV Activities in BC *(Cont.)*

Some Other Environmental Considerations in under BC PUP 776-001-2003/2005

- Adulticiding to maintain 10 m Pesticide Free Zone (PFZ) and appropriate Buffer Zones (CCD- EC recommends 5 m ground based treatment, 100 m rotary aircraft, 200 m fixed-wing aircraft). No PFZ for larvicides.
- Larvicides only applied to water with confirmed mosquito larvae.
- Bti not to be used in fish-bearing waters unless WNV vectors present. Contact DFO or EC to determine potential for fisheries impact.
  - Want the opportunity to communicate ecological sensitivities in relation to a particular surface water, if there are any, so that an informed decision to apply can by made by the proponent.
- No adulticiding during daylight.
  - Want to limit impact to local honey bee populations.
- Prior to adulticiding, notify EC (J. Pasternak or M. Wan)
  - Where, when, what, how of application to be provided in case of inspection.

BRITISH COLUMBIA

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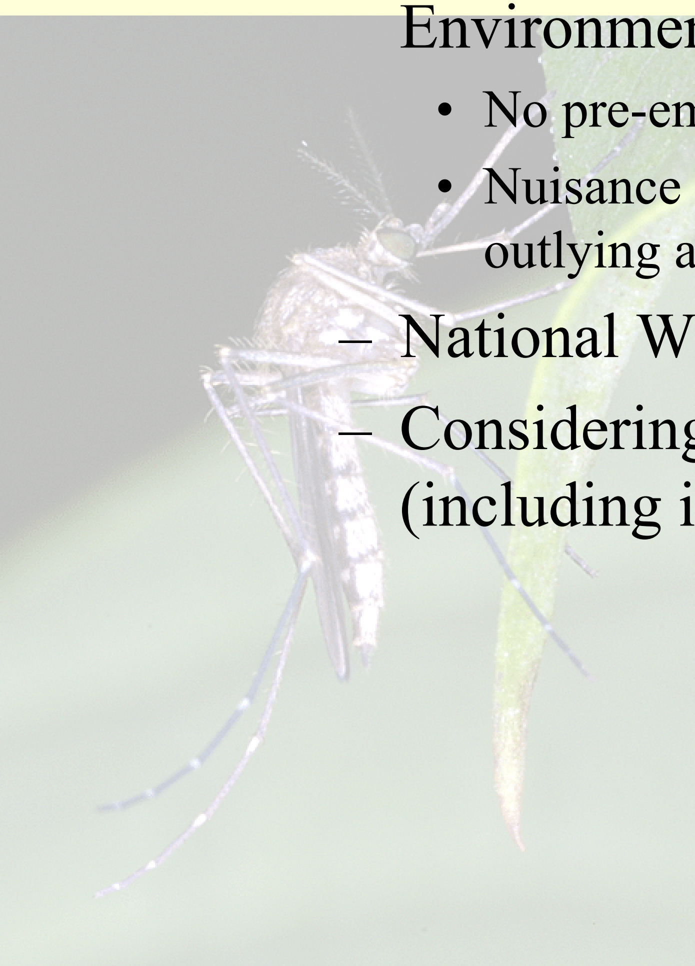
WNV Control Activities in BC

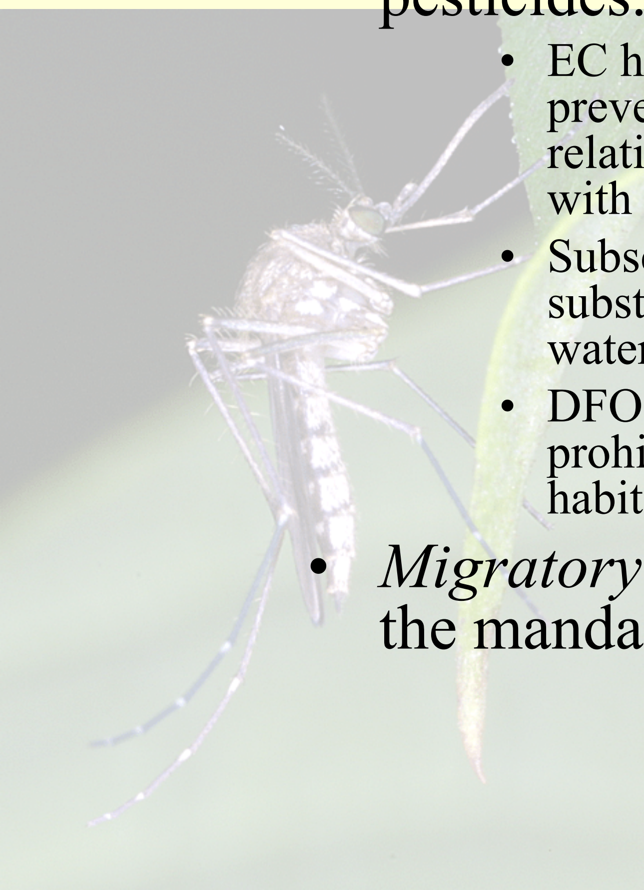
- 24 agencies in BC accessed the WNV PUP (17 agencies in the lower mainland, 2 in the northern interior, 2 in the southern interior, 3 on Vancouver Island) in 2004.
  - Lower Mainland: GVRD, Fraser Valley Regional District, Township of Langley, Langley City Surrey, District of Maple Ridge, District of Pitt Meadows, Burnaby, New Westminster, Richmond, Port Coquitlam, White Rock, Delta.
  - ~50% of the 24 agencies undertook preemptive larvaciding in 2004. No adulticides applied for WNV in 2004.
- 17 PUPs and 8 PMPs were approved for mosquito nuisance control throughout BC (including lower the lower mainland, southern/northern interior, Kootenay and Vancouver Island regions).
  - Adulticides and larvacides were applied.

WNV Control Activities in BC



- Yukon Territory
  - Pesticide Use Permits administered by Yukon Environment.
    - No pre-emptive larvaciding in 2004.
    - Nuisance control using methoprene (Whitehorse) and Bti (in outlying areas).
  - National WNV Steering Committee member.
  - Considering options for future WNV control needs (including interest in the BC model).

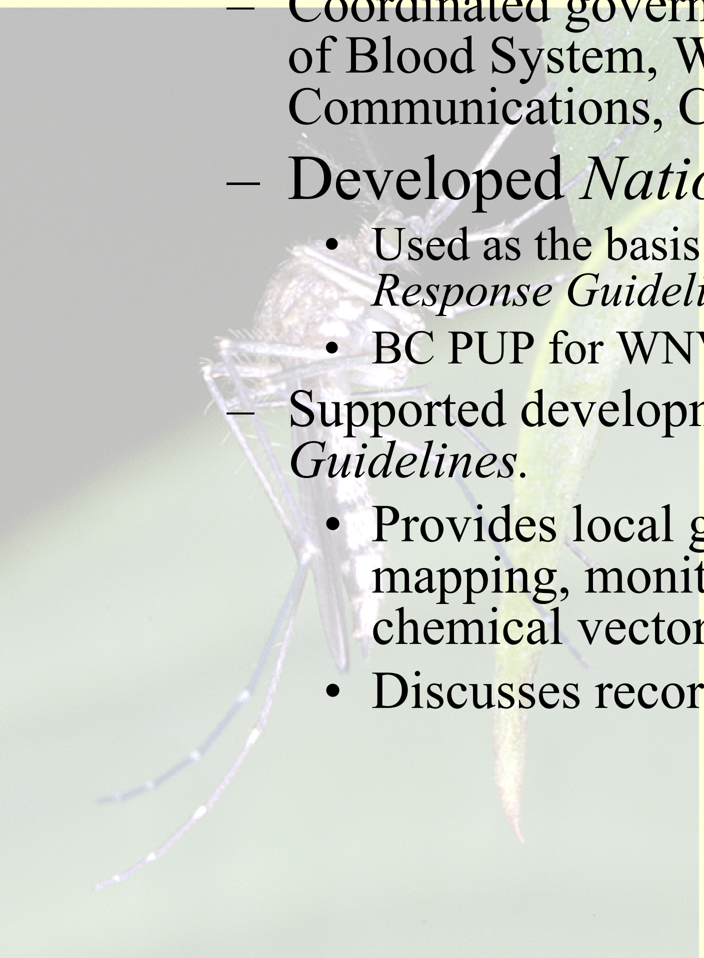
Environment Canada Mandate in Relation to Pesticides



- Responsible for the protection of non-target organisms and their habitats from the harmful effects of pesticides.
    - EC has responsibilities to promote and enforce the pollution prevention provisions of the federal *Fisheries Act* (FA) in relation to ss. 36(3) by way of an interdepartmental agreement with Fisheries and Oceans Canada (DFO).
    - Subsection 36(3) of the FA prohibits the deposit of a deleterious substance in water frequented by fish, or where it can enter such water.
    - DFO is responsible for Subsection 35(1) of the FA which prohibits the harmful alteration, disruption or destruction of fish habitat unless authorized by the Minister.
- *Migratory Birds Convention Act* Regulations give us the mandate to protect avian wildlife species.

National Environment Canada WNV Activities

- National coordination by the WNV National Steering Committee (HC Chair, DND, EC, DFO, CFIA, CCWHC, Provinces, Territories, Municipalities).
  - Coordinated government response to WNV – Surveillance, Safety of Blood System, WNV Testing, Pesticide and Repellent Use, Communications, Collaboration with First Nations.
  - Developed *National Guidelines for Response to WNV*.
    - Used as the basis to develop the *BC Arbovirus Surveillance and Response Guidelines.*
    - BC PUP for WNV is consistent with the National Guidelines.
  - Supported development of *Municipal Mosquito Control Guidelines*.
    - Provides local governments with direction on mosquito mapping, monitoring, larvaciding, adulticiding and non-chemical vector control.
    - Discusses record keeping, important government contacts, etc.



The Dilemma and the Need for a Balanced Approach

- EC in an awkward place since pesticides can be considered a deleterious substance under FA.
- Use of pesticides in areas considered to be waters frequented by fish, or fish habitat or in places where they are likely to enter waters frequented by fish or fish habitat can be considered a deposit of a deleterious substance under ss.36(3) of the FA.
- EC must uphold its mandate and at the same time make sure that its actions are not an obstacle to the protection of human health.

Federal Position on Use of Pesticides to Control Potential Vectors of WNV

- HC PMRA/EC/DFO.
- Still draft and unsigned, but has received extensive discussion so can be used as guidance.
- Supports the use of the *National Guidelines for Response to West Nile Virus* for the development of local response strategies.
- Supports Integrated Pest Management (IPM) approach for mosquito control.
  - Decisions be based on surveillance information.
  - Nonchemical control of mosquito populations must be considered, larvaciding is appropriate if needed based on monitoring, adulticiding only when warranted, often when source reduction and larviciding measures have not achieved an adequate level of control.

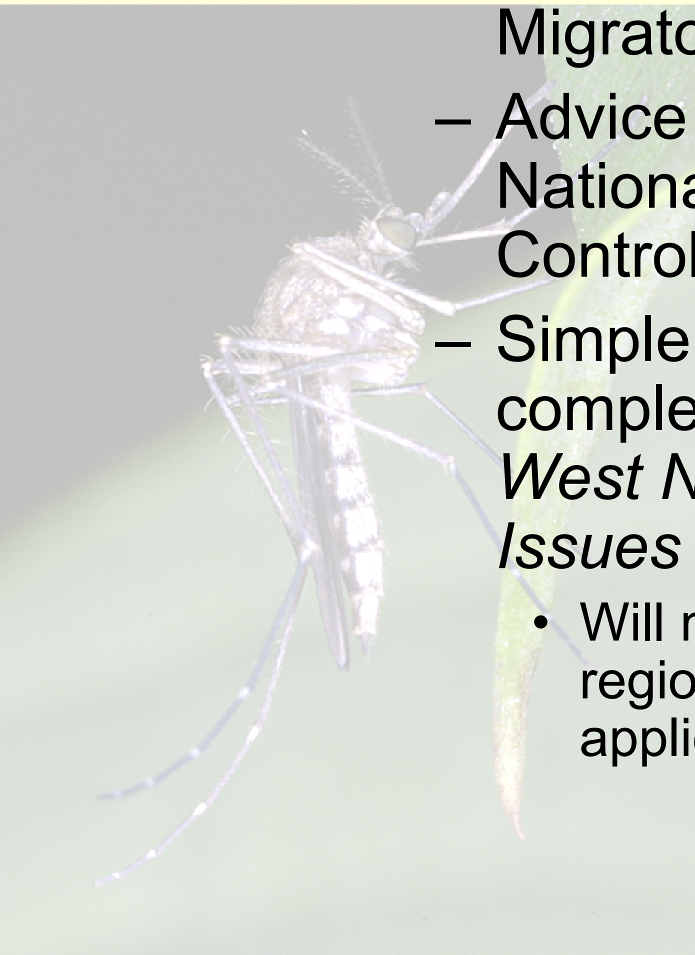
Federal Position on Use of Pesticides to Control Potential Vectors of WNV

- All available means to reduce negative impacts on fish and fish habitat must be taken to meet the legal requirements of the *Fisheries Act*. This could be done by:
  – consulting the *National Guidelines for Response to West Nile Virus* and the *Municipal Mosquito Control Guidelines* and choosing a pest control product currently registered under the *Pest Control Products Act*, and in accordance with recommended best practices;
  – applying such a pesticides in accordance with the product's label instructions; and
  – applying an IPM approach which includes reduced-risk chemical and biological pest control products (*i.e.*, products containing methoprene and *Bti*).

Commercial Chemical Division WNV Activities

- Scientific advice on BC MWLAP Pesticide Use Permits (PUPs) and Pesticide Management Plans (PMPs) for EC PYR (incl. CWS) and DFO.
  - E.g., province-wide WNV mosquito control PUP 776-001-2003/2005.
  - BC Pesticide Control Committee.
- Provide advice to other stakeholders to enable decision-making consistent with federal legislation.
  - BC CDC WNV Mosquito Control Committee.
  - Advice to local governments (e.g., GVRD, Thompson-Nicola, Okanagan, etc.).
- Extensive briefing to PYR Emergency and Enforcement personnel.
  - BC's WNV program, environmental risks due to pesticides.
  - Need to balance human health and environmental values

Pesticide Use for WNV Mosquito Control – Information & Guidance on Pesticides



- Information on pesticides to enable decision-making consistent with Fisheries Act and Migratory Birds Convention Act.
- Advice on pesticide use (following draft National Position on Pesticide Use for WNV Control).
- Simple evaluations of relative hazard completed by Environment Canada in 2003 in *West Nile Virus in Canada: Environmental Issues and Considerations.*
  - Will need to develop and tailor this advice further for regional stakeholders (e.g., chronic toxicity if applicable).

Physical Properties of Pesticides Used for WNV SOURCE

Pesticides	Physical Properties	Persistence
Bti	- Insoluble in water - Binds to sediment in water column	- t½ < 1d, UV sensitive - spores in sediment can remain viable and toxic up to 22d
Methoprene	-Water solubility = 0.76 mg/L Log Kow >6	- Water t½ = 2h to 3d - Water t½ = 7 to 150d (slow release formulation) - Soil biodegradation t½ = 10 d
Malathion	-Water solubility = 145 mg/L -Log Kow = 2.8	-Water t½ = 107 d (pH5), 6 d (pH 7), 0.5 d (pH 9) - Soil t½ = 1 – 25 d
Pyrethrins	Water solubility = 0.2 - 9.0 mg/L - log Kow = 4.3 – 5.9	- t½ in sunlight = 10-12 min. - stable (>10 years) in absence of light and at ambient temp.

Mosquito WNV Pesticides – Hazard to Aquatic Environment

B.t.i

Fish: Nontoxic,
Invertebrates: Little direct or indirect toxic threat to nontarget invertebrates or fish when applied at label rates.

methoprene

rainbow trout: 96h LC50 = 1,600 µg/L
water flea: 48h LC50 = 360 µg/L
Field studies show that invertebrate populations can recover.

malathion

rainbow trout: 96h LC50 = 170 – 200 µg/L
bluegill: 96h LC50 = 100 µg/L
water flea: 48h LC50 = 1.0 µg/L

Pyrethrins

rainbow trout: 96h LC50 = 5.2
water flea: 48h LC50 = 12 µg/L

INCREASING HAZARD >

Bti

- *Toxicity limited to Order Diptera, Suborder Nematocera, larval mosquitoes and black flies and some closely related insects.*
- *Xylene carrier in some formulations lethal to fish.*

SOURCE: USEPA 2004, British Crop Protection Council 2002; Macquarrie pers. Comm. 2004.

Mosquito WNV Pesticides – Hazard to Amphibians

Bti

LC50 > 10g/L

Malathion

Rana tigrina tadpoles
1 d LC50 = 2070 ug/L
6 d LC50 = 170 ug/L
96LC50 > 4000 ug/L for Indian Green Frog, Common Toad, Bullfrog

Methoprene

Northern leopard frog
6 d LC50 = 125 - 500 ug/L

< INCREASING HAZARD

Malathion

Teratogenic to embryos at 5000-10000 ug/L

Possible decreased disease resistance at 0.0011 mg/g bw

Methoprene

No firm developmental conclusions due to limited data.

Methoprene acid transformation product has produced frog deformities in lab tests. Results have not been reproduced or observed in the field. Not a typical phototransformation product.

Source: Pauli 2003; British Crop Protection Council 2002; Macquarrie pes comm. 2004.

Mosquito WNV Pesticides – Hazard to Birds

Bti

"Nontoxic"

Pyrethrins

Acute oral LD50 for mallard ducks >10 000 mg/kg

Methoprene

8 d LD50 >4640 mg/kg food

Malathion

bobwhite quail 5 d LC50 (5 d) = 3500 mg/kg food

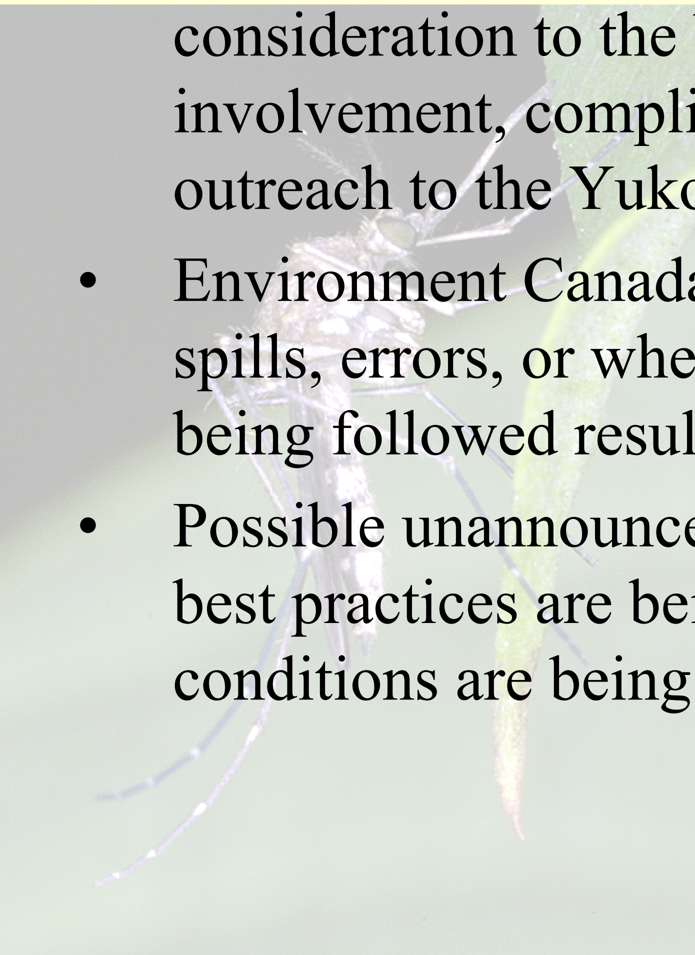
ring-necked pheasants 5 d LC50 (5 d) 4320 mg/kg food.

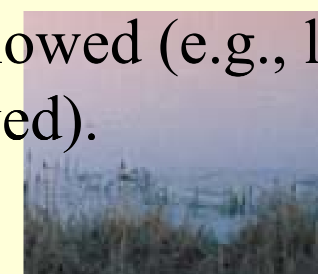
< INCREASING HAZARD

Source: Mineau et al. 2003; British Crop Protection Council 2002

Future Activities

- Approach is to promote a balance which protects both the environment and human health.
- Further advice to proponents on pesticides use and environmental consideration to the best of our abilities (workgroup involvement, compliance promotion to local governments, outreach to the Yukon Territory).
- Environment Canada will respond as appropriate in relation to spills, errors, or when PUP or product label instructions are not being followed resulting in violation of federal legislation.
- Possible unannounced inspections to ensure that environmental best practices are being followed (e.g., label directions and PUP conditions are being followed).





THANK YOU

A Preliminary Analysis of Pesticides as a Potential Causal Factor for Species at Risk

Valerie Hodge, Peter Delorme, Frank Wandelmaier
Pest Management Regulatory Agency, Health Canada, HQ

Abstract
Under the Pest Control Products Act (PCPA), Health Canada, through the Pest Management Regulatory Agency (PMRA), has a mandate to protect the Canadian environment and the health of Canadians from unacceptable risks from pesticides. In the past assessments have included consideration of potential for effects on species at risk when warranted. The introduction of the Species at Risk Act (SARA) brings attention to threatened and endangered species into a sharper regulatory focus and necessitates a consistent approach as part of the risk assessment framework. In order to better understand the contribution of pesticides as a factor that threatens wildlife species, the PMRA has examined the electronically available published scientific assessments and recommendations by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). In the analyses we have identified that pesticides are specifically identified as a causal factor resulting from direct exposure for 28 of 216 species listed as endangered, threatened or of special concern in Schedule 1; for 12 of these species, pesticide use was considered to be a major factor. Further analyses separated the species by status (endangered, threated, special concern) or by taxonomic group represented. In addition to those species for which pesticides were specifically identified as a factor, we identified a further 29 species, based on subjective criteria, for which pesticides use may result in indirect exposure or indirect effects. Analyses also included a subjective analysis of the potential for exposure of all species identified in Schedule 1 to pesticides and an examination of habitat types. This analysis and further detailed analyses will inform the development of our approach for assessing the risks of pesticides to species at risk through the identification of the relative potential for effects on different taxonomic groups and the relative effects by different use classes or use patterns of pesticides.

A Preliminary Analysis of Pesticides as a Potential Causal Factor for Species at Risk

Valerie Hodge, Peter Delorme & Frank Wandelmaier

Environmental Assessment Division, PMRA

Presented at Pacific & Yukon Region

Pesticide Information Exchange

November 25th, 2004

Presentation Outline

- Background & Purpose
- Methods & Analysis
- Results
- Conclusions
- Next Steps

Background & Purpose

- PMRA has responsibility (PCPA) to ensure that pesticides do not cause unacceptable environmental harm.

- There is an expectation and a responsibility to consider in assessments the potential harm to wildlife species as defined under SARA.

Purpose

- Goal of this work was to find out how important pesticides are as a causal factor for species at risk
- The present project was designed to:
  - (i) Conduct initial scan to assess the degree to which pesticides are implicated as causal factors for organisms.
  - (ii) Examine the relative proportions of different taxonomic groups potentially affected by pesticides.
  - (iii) Undertake a subjective analysis of exposure potential.
  - (iv) Examine spatial trends.

Purpose

- Through this analyses we hope to gain better understanding of which species and groups are at risk from pesticides

- Ultimately, want to be able to better assess the potential impacts of pesticides on wildlife and on species at risk.

Methods & Analysis

- A database was created with relevant data on the impacts and the potential exposure of species at risk to pesticides in Canada.
- Information extracted from either:
  - Electronic COSEWIC Status Reports (26 species)
  - Web based summaries from COSEWIC reports (190 species) found on the http//www.speciesatrisk.gc.ca website which has summarized data.

Methods – Database Info

Field	Description
Species name	Species are listed according to their English names with their scientific names in parentheses.
Taxonomic Group	Species are grouped under the 9 Taxonomic groups used under SARA which are: Mammals, Birds, Amphibians, Fishes, Molluscs, Lepidopterans, Plants, Mosses, and Lichens.
Status	Species status is identified as either (E)ndangered, (T)hreatened or (S)pecial concern. Extirpated species were not included in the database as their potential for pesticide exposure in Canada is nil.
COSEWIC report	Indicates source of the data used. Whether it was the actual status report or a web based summary. For Status reports, the author and year are included.
Threats & Limiting factor(s)	Categorization of the major threats and limiting factors.
Province(s)	Identifies the provinces where the species is currently resident.
Habitat type	Provides a brief description of the habitat used by the species.
Comments	Specific information pertaining to the different species particularly in regards to pesticide exposure threat.

Categorization of Threat Types

Threats Category	Description
(A) Agriculture Practices	habitat degradation, loss of habitat, loss of food source and any other disturbances
(F) Forestry Practices	habitat degradation, loss of habitat, loss of food source and any other disturbances
(P) Pesticide Use	those cases where pesticides were clearly identified
(O) Other	all other limiting factors (urbanization, climate change, etc...)

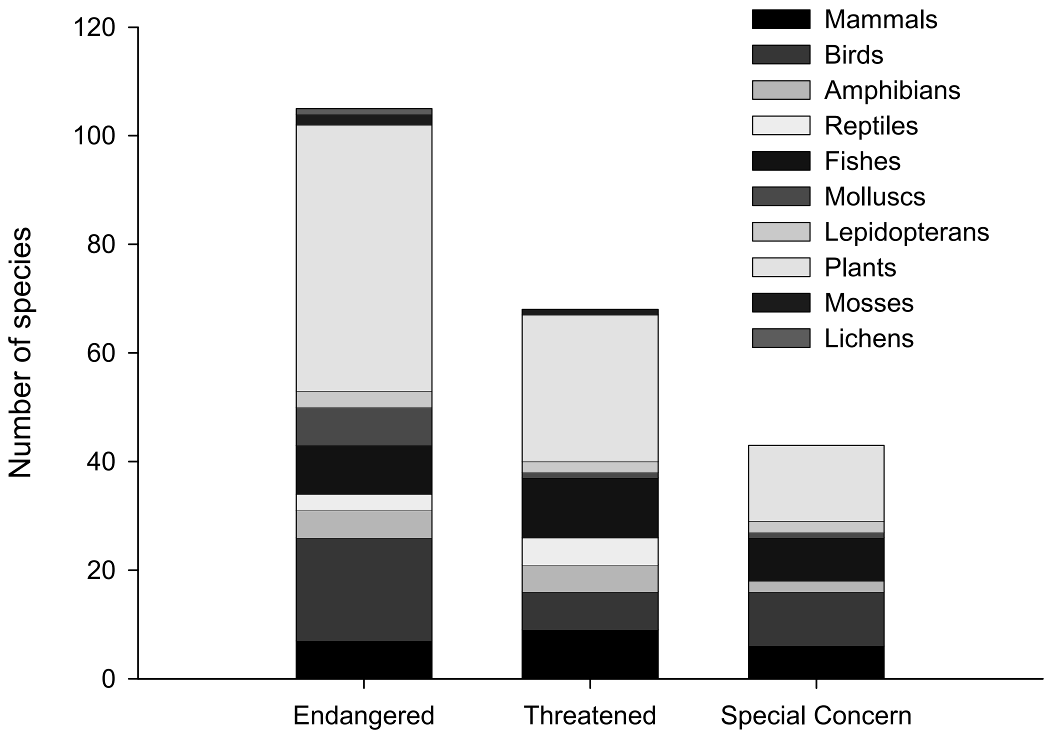
Categorization of Exposure/Effects Types

Exposure/Effects Type	Criteria
Direct	■ Pesticide ingestion as baits and/or contaminated food sources must be clearly identified ■ Species must potentially be in direct threat of pesticide exposure through either direct spray or spray drift (eg:non-target plants), or inhabiting areas of intense agriculture
Indirect	■ Species potentially exposed to pesticides through runoff (ponds, lakes, streams, rivers, wetlands, etc.) (indirect exposure) ■ Food sources and habitat may suffer from pesticide use which in turn threatens the listed species (indirect effects) ■ Bioaccumulation through the food chain threatens the listed species (indirect exposure)

Categorization of Exposure Potential

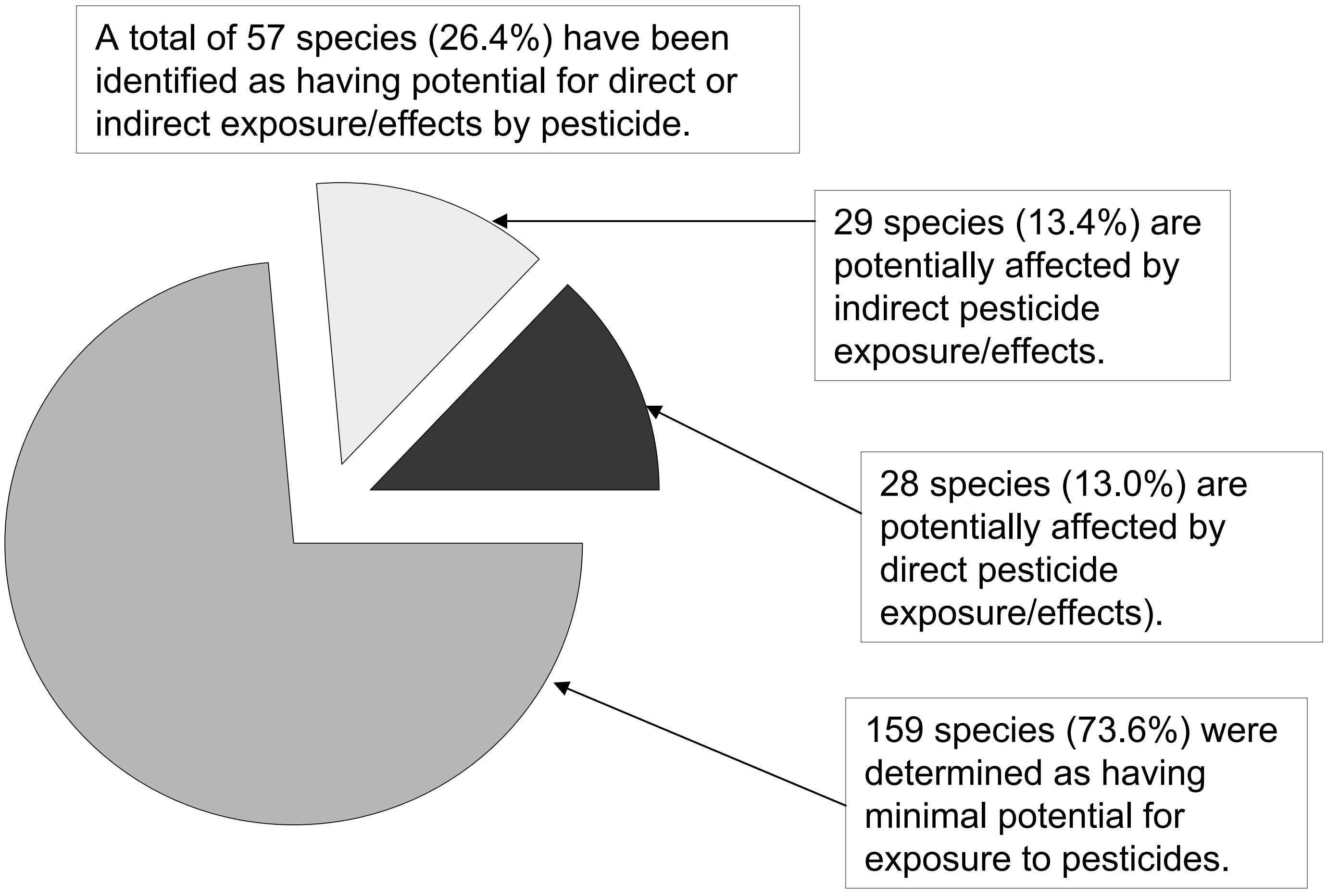
Exposure Potential	Criteria
High	■ Specific pesticide uses are clearly identified in the report as a major limiting factors for the species ■ The species habitat is either subject to pesticide treatment or exposed to pesticides ■ The species is found in an area of intense agricultural activity ■ The species food source is subject to pesticide treatment
Medium	■ Unspecified pesticide uses are mentioned as being one or a probable limiting factor for the species ■ The species is found in an area of intense agricultural activity or most of the species habitat is exposed to pesticides
Low	■ Agricultural activities are mentioned as being one of the limiting factors for the species (pesticides may not be directly mentioned) ■ The species habitat is located in or near an area of agricultural activity ■ The species is at the top of the food chain (bioaccumulation, reflects past uses ■ Inferred indirect pesticide exposure to low levels of pesticides
Not Expected	■ Species range occurs outside of areas where pesticide used ■ Species found in protected area.

Results

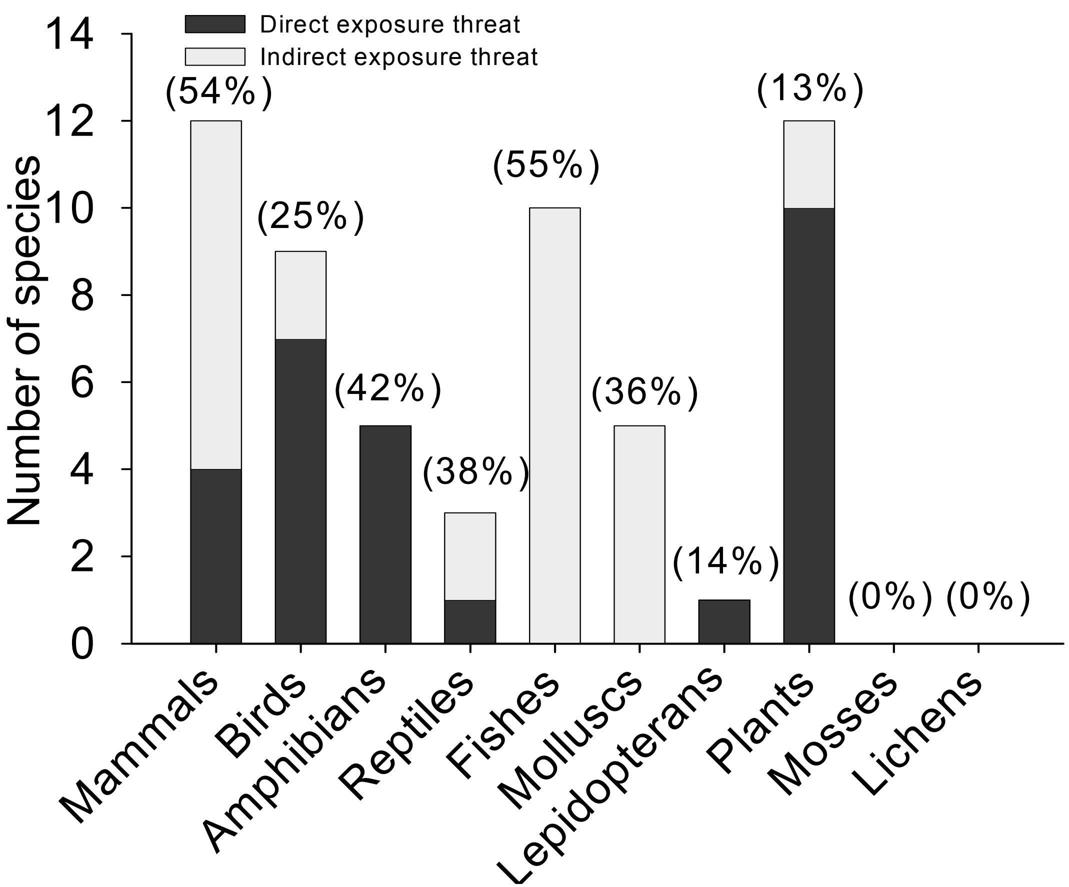


Distribution of Schedule 1 Organisms

Preliminary Results

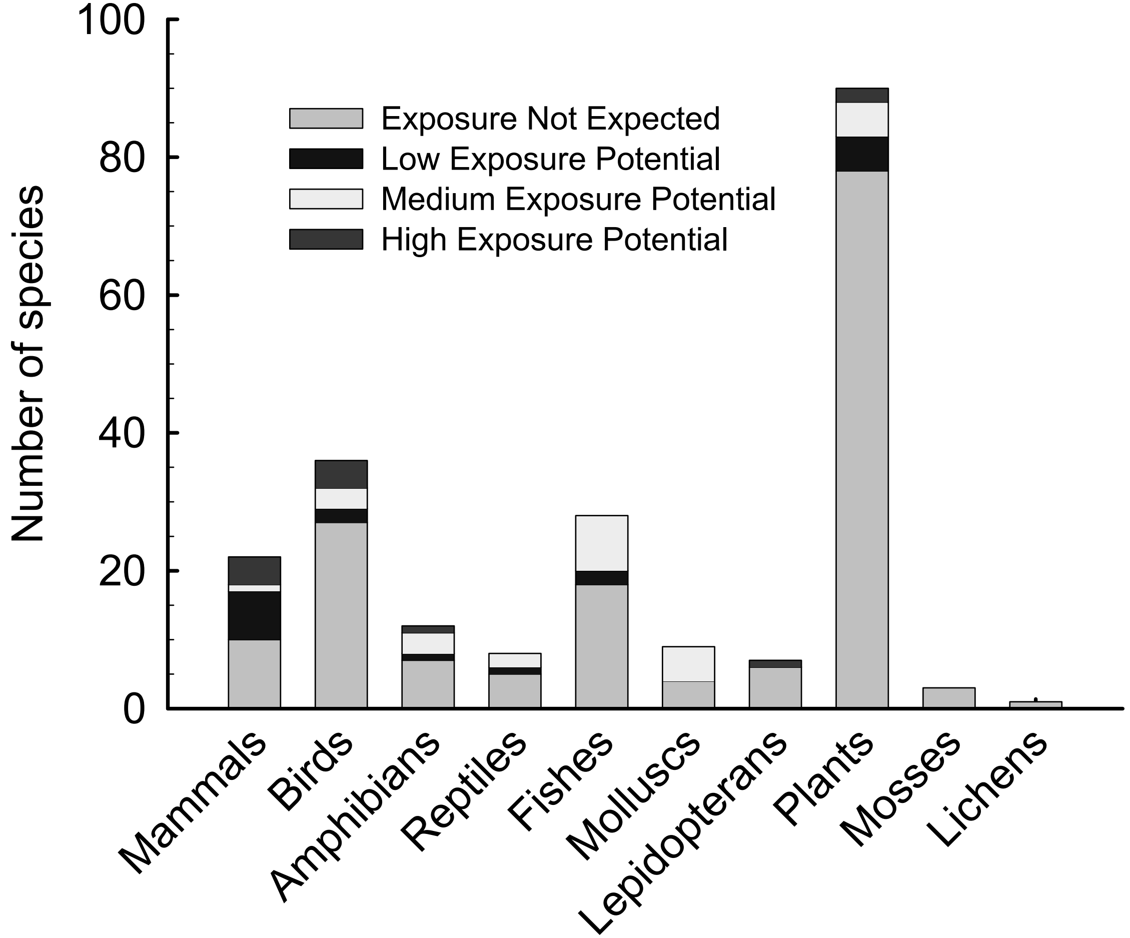


Exposure/Effects Type



*Percentages indicate proportion of total number in each taxonomic group determined to be potentially exposed

Results – Exposure Potential by Group



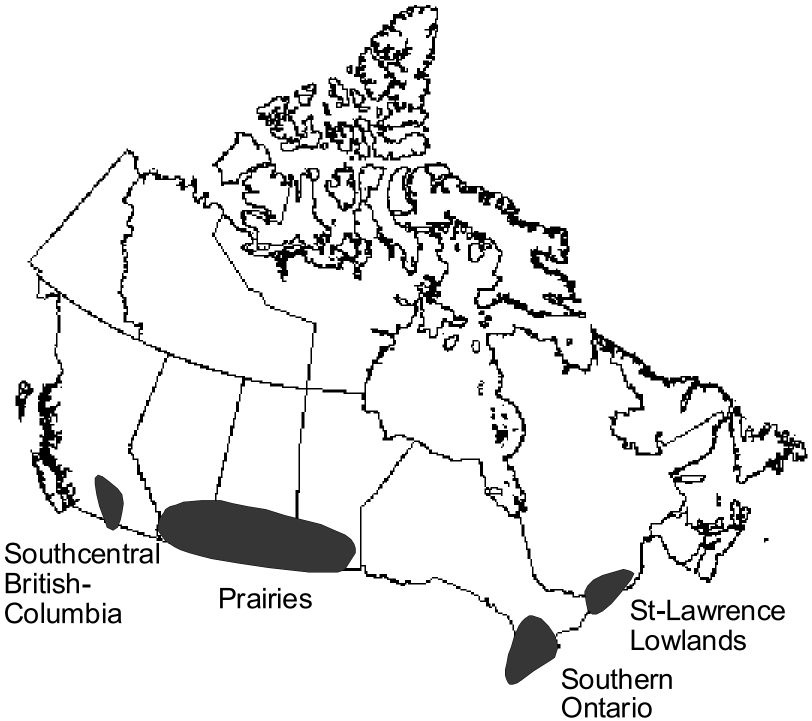
12 of 57 species (21.1%), were classified with high potential for pesticide exposure

Results – Potential Areas of Concern

These areas were identified where ecozones, provinces and similar habitats harboured more than one species with potential exposure/effects from pesticides.

Not surprisingly, these areas correspond to the areas of highest agricultural activity in Canada

When taken together, these areas harbour more than half of all the species listed on Schedule 1(58.8%) and almost every species at risk identified as being potentially at risk from pesticides (87.7%).



Conclusions

- The present analysis has led to the identification of 57 currently listed species at risk that are potentially affected by the use of pesticides.

- This number was based on available summary data and will likely change (increase) when access to full COSEWIC reports is obtained.

Conclusions

- The species identified have been categorized as having potential for exposure/effects by pesticides either directly (29 species) or indirectly (28 species).
- A subjective analysis has allowed identification of degrees (low, medium, and high) of potential for exposure/effects for the species threatened by pesticides.
- A total of 12 of the 57 species were identified as having a high potential for exposure to pesticides.

Conclusions

- In addition to pesticides, other major limiting factors identified were habitat loss/impacts due to agricultural and forestry practices.
- The analysis has led to the identification of four areas of concern for pesticide exposure threat in Canada, namely South-central British Columbia, the Prairies, Southern Ontario and the St-Lawrence Lowlands.
- These areas overlap with areas of high agricultural intensity, and by association areas with increased pesticide use.

Next Steps

- Obtain copies of full COSEWIC reports and refine initial analyses.

- Proceed with development of policy for species at risk.

Raptor and Waterfowl Exposure to Pesticides in Agricultural Ecosystems of Southwestern British Columbia

Laurie Wilson, Sandi Lee, John Elliott, Canadian Wildlife Service, Delta, British Columbia, Environment Canada

Abstract

The use of the organophosphate pesticide chlorpyrifos for wireworm control in potatoes in the Fraser Delta, British Columbia was studied for potential impact on over-wintering waterfowl and raptors.

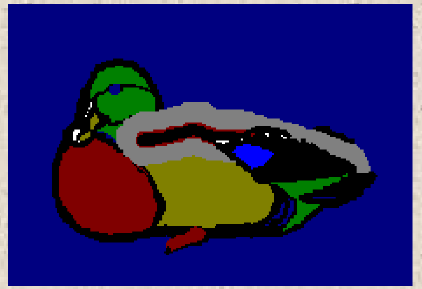
Twenty-four fields (251 ha) were surveyed for wildlife use and wildlife carcasses once per week (October - December 2003). There were three treatment groups: untreated, liquid and granular chlorpyrifos. Waterfowl were the most frequent users of the fields and accounted for the highest number of carcasses. A total of 131 wildlife remains were found; there was no significant difference between field treatments suggesting that wildlife mortality is not related to pesticide use. The majority of wildlife remains (n=106, 81%) were scavenged and therefore unsuitable for further testing. Twelve remains were suitable for necropsy (6 from granular treated fields, 6 from untreated fields). Causes of death varied (gunshot, trauma, ruptured colon, infection, starvation) but none were suspected of pesticide poisoning based on clinical symptoms. Brain cholinesterase levels were measured in 23 specimens. All values were within normal range except for two birds which had lower activity levels (one mallard from a liquid treated field was 21% inhibited & one dunlin from an untreated field was 37% inhibited). No tissues were available to further investigate these two specimen.

Fifty-nine raptors admitted to rehabilitation centres and government agencies were tested for anti-cholinesterase pesticide exposure (results pending). Of the eight raptors from the Delta, three were suspected of pesticide exposure based on clinical symptoms. One red-tailed hawk from Richmond was admitted on 18-Nov-03 (brain cholinesterase and pesticide residue testing pending). One bald eagle from Ladner and admitted on 17-Jan-04 was confirmed pesticide poisoned (29 ppm fensulfothion & 3.2 ppm sulfotep were detected in stomach contents). A second bald eagle from Ladner admitted on 24-Jan-04 did not have residues detected in the crop contents (plasma and brain cholinesterase pending).

Preliminary results of this study show no evidence of waterfowl exposure to anti-cholinesterase pesticides. This suggests that use of chlorpyrifos for wireworm control in potatoes does not seem to be poisoning waterfowl wintering in the Fraser Delta. However, the sample size of waterfowl mortalities in suitable condition for testing was small & there were several raptors suspected of pesticide poisoning whose causative agent has not yet been identified. Therefore, additional study is required before completing our assessment of potential adverse impact to wildlife from use of chlorpyrifos for wireworm control in potatoes.

Raptor & waterfowl exposure to pesticides in agricultural ecosystems of southwestern BC

Laurie Wilson, Sandi Lee, John Elliott
Canadian Wildlife Service
Delta, British Columbia



Fraser Delta

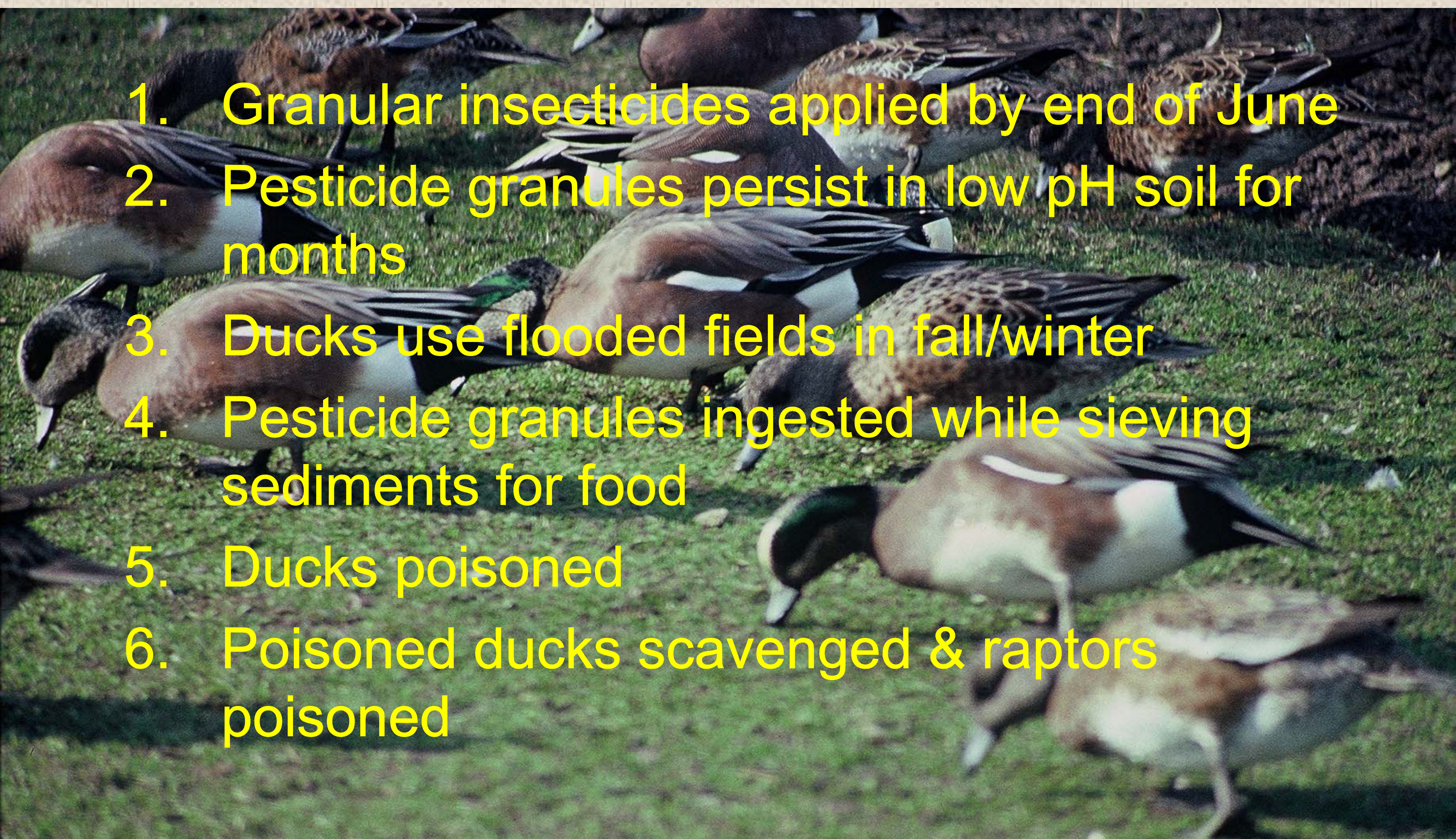
Wireworm

Wireworm Control – granular pesticides

- Granular anti-ChE pesticides
  - most effective control
- But cause 2ndary poisoning of raptors & removed from local market (e.g. phorate, fonofos)

Elliott et al. 1996, 1997

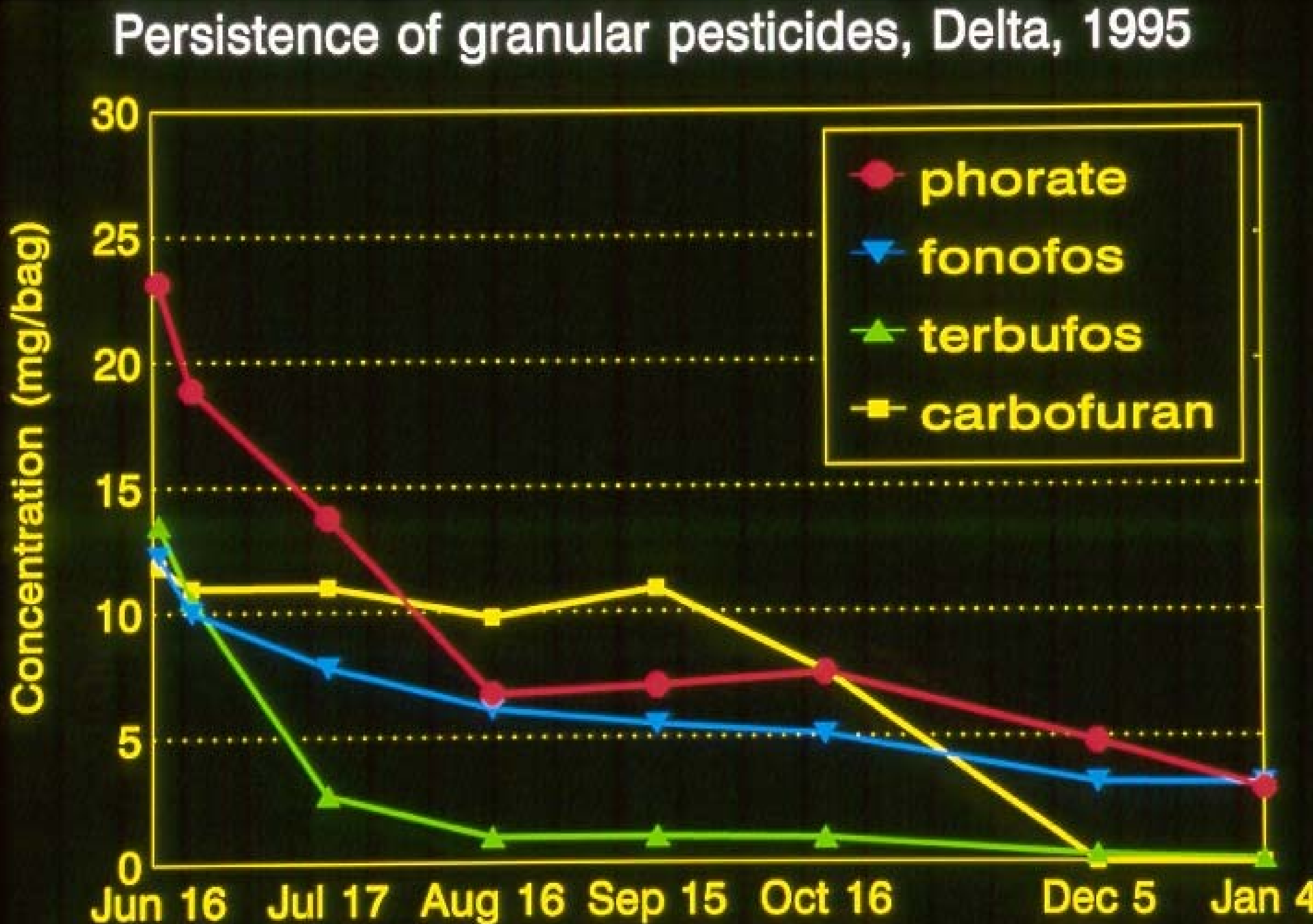
Hypothesis – Pesticide Poisoning of Birds of Prey



1. Granular insecticides applied by end of June
2. Pesticide granules persist in low pH soil for months
3. Ducks use flooded fields in fall/winter
4. Pesticide granules ingested while sieving sediments for food
5. Ducks poisoned
6. Poisoned ducks scavenged & raptors poisoned

Components

- Granular persistence (Wilson et al., 2002)
- Intensive field searches for dead wildlife
- Scavenging behaviour (Peterson et al 2001)
- Causes of death / debilitation
  (Elliott et al, 1996; 1997)
- Telemetry study of eagle winter activities
- Bald eagle population dynamics
- Diet of wintering raptors
- Bald eagle behaviour at landfill



Wilson et al. 2002. ETC

Waterfowl Mortality in Agricultural fields treated with Dyfonate G (fonofos), 1996-98

- Waterfowl poisoned by anti-ChE pesticides used at recommended rates in ag fields in Delta
- 28% (5/18) waterfowl carcasses suitable for toxicology testing acutely poisoned
  - Granular entire field treated – 3
  - Granular perimeter only treated – 1
  - Untreated – 1
- Fonofos residues confirmed
  - 1 mallard from treated fields (GI-tract 49 ppm)
  - Other 4 poisoned waterfowl – not tested (no GI-tract)

BC Wireworm Task Force (since 1999) (“Killing wireworms without killing wildlife”)

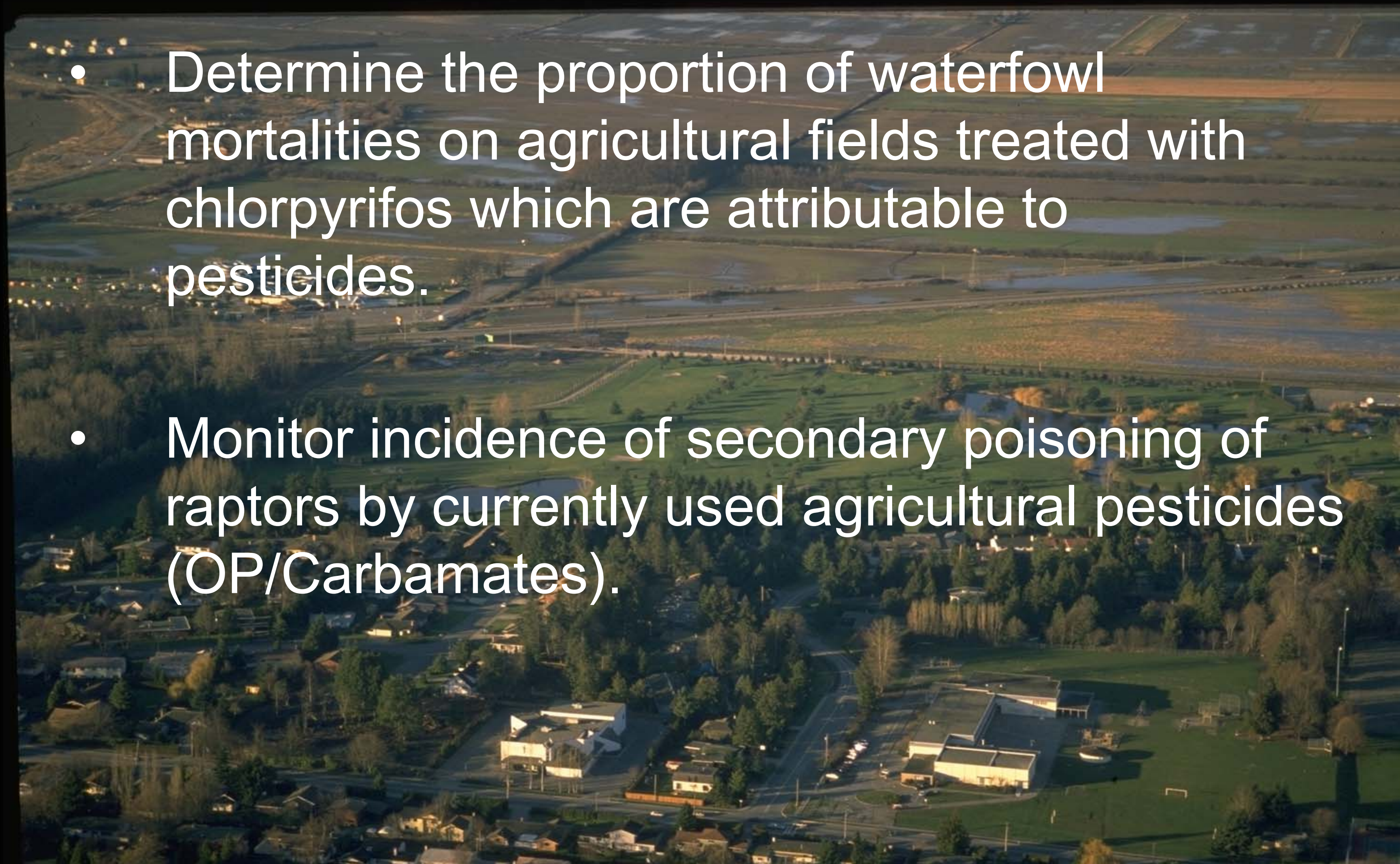
- Environment Canada - EP & EC Branches
- Agriculture and Agri-food Canada
- Dept of Fisheries & Oceans
- Pest Management Regulatory Agency
- BC Ministry of Water, Land and Air Protection
- BC Ministry of Agriculture Food and Fisheries
- Ducks Unlimited
- Delta Farmland Wildlife Trust
- Delta Farmers’ Institute
- Potato Industry Development Corp.
- Fraser Valley Strawberry Growers’ Association
- ES CropConsult
- Pertech
- Individual Growers
- UBC

* co-chaired by AgCan & EP

Chlorpyrifos – Emergency Registration

Chlorpyrifos – only effective chemical control remaining
Recent years – reported sales in LM doubled

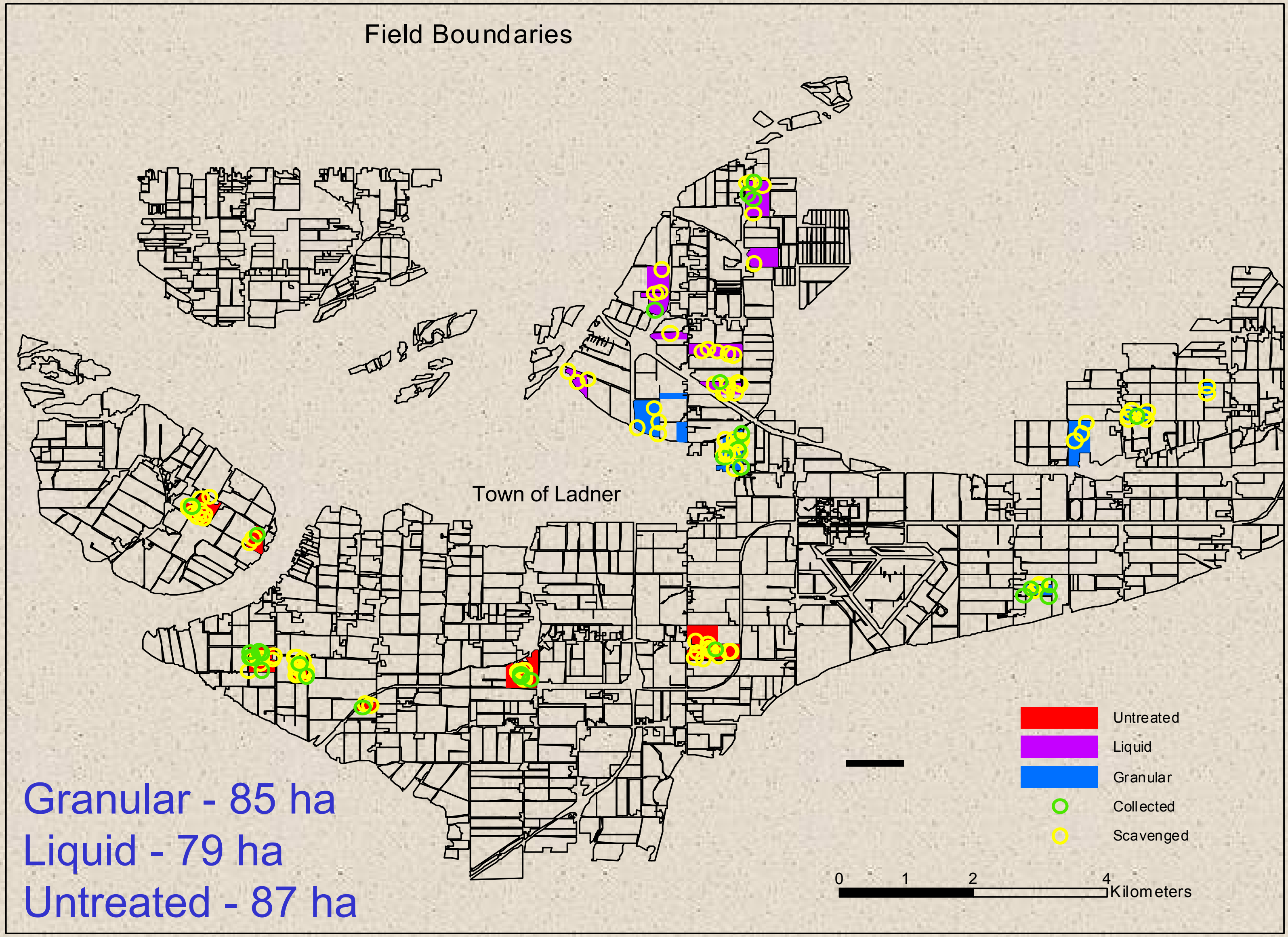
Pesticide Science Fund – Objectives



- Determine the proportion of waterfowl mortalities on agricultural fields treated with chlorpyrifos which are attributable to pesticides.

- Monitor incidence of secondary poisoning of raptors by currently used agricultural pesticides (OP/Carbamates).

Waterfowl mortality 2002-03 – Methods
Survey fields (N=251 ha)



Granular - 85 ha
Liquid - 79 ha
Untreated - 87 ha

Waterfowl Mortality 2002-03 - Methods

1. Field surveys

Wildlife Counts

* Roadside survey - # & species of wildlife in fields

Wildlife Remains

* Survey for wildlife remains – transects 30m apart
* 1x / wk , 7 wk (Oct-28 – Dec-15)
* ID & rank (1-5) remains, collect suitable specimen

2. Toxicology

* Post-mortem exam – Cause of death & tissue collection
* Brain ChE, suspects GI-tract pesticide scan

3. Search efficiency audit

* 31 adult waterfowl carcasses intentionally placed in fields during study (15 females, 16 males)
* Search efficiency = 89% carcasses successfully located (females 85%, males 93%)

Results - Wildlife Counts

Taxonomic Group	Field Treatment			Total	
	Granular	Liquid	Untreated		
Waterbirds	636 (36%)	2965 (89%)	283 (20%)	3884	(60%)
Shorebirds	713 (41%)	199 (6%)	949 (68%)	1861	(29%)
Seabirds	374 (21%)	155 (5%)	119 (9%)	648	(10%)
Raptors	6	13	25	44	(<1%)
Other birds	25	8	10	43	(<1%)
Mammals & Amphibians	1	2	0	3	(<1%)
Total	1755 (27%)	3342 (52%)	1386 (21%)	6483	

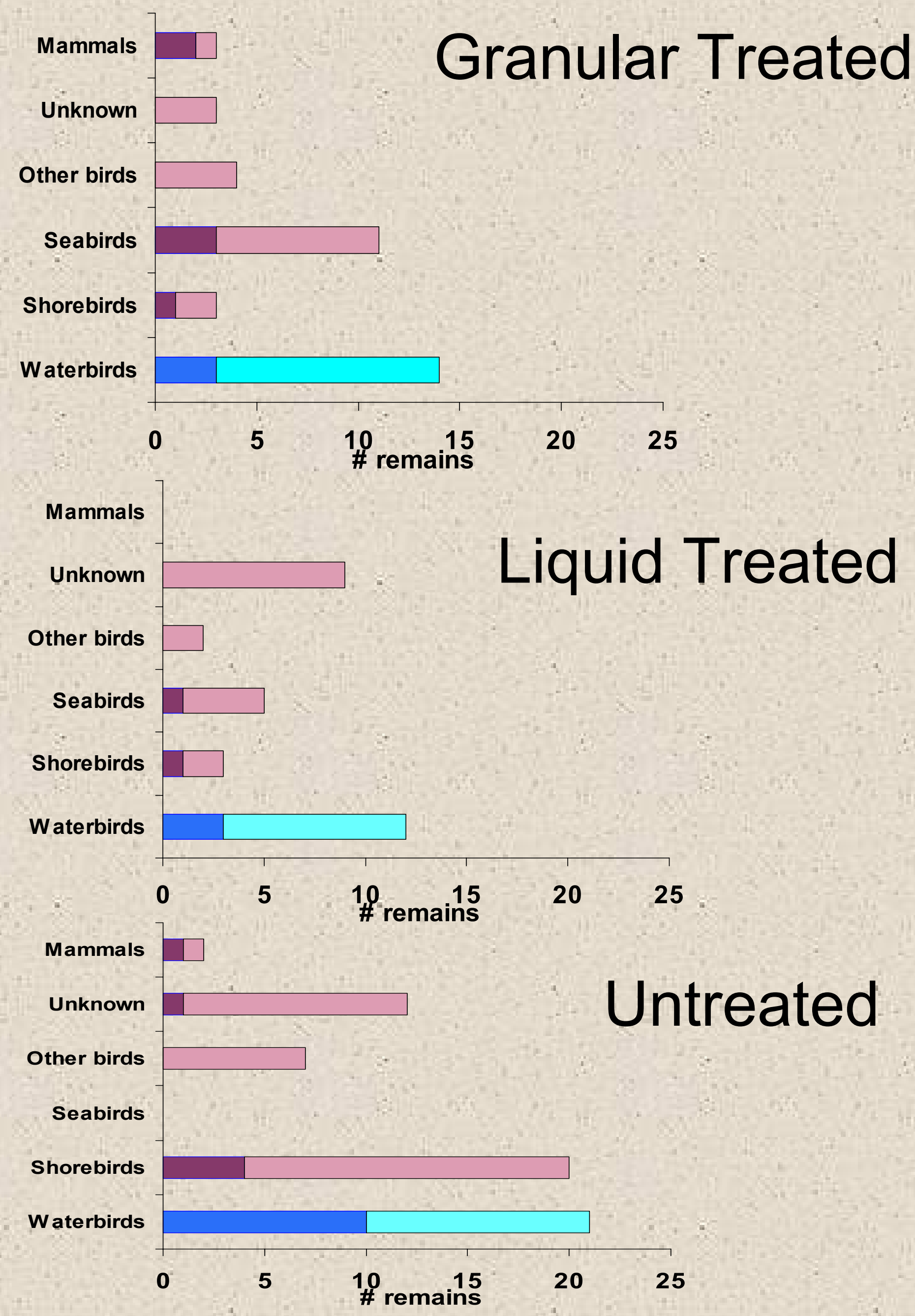
Results - Wildlife Remains

Carcass Condition	Field treatment			Total
	Granular	Liquid	Untreated	
Scavenged	30	28	48	106 (81%)
Intact **	8	3	14	25 (19%)
Total	38 (29%)	31 (23%)	62 (47%)	131
Findings/ ha searched	0.063	0.056	0.102	

** Includes:
- intact carcasses &
- partial remains suitable for pm-exam and/or brain ChE measured

Results
Wildlife Remains

Collected
Scavenged



Results - Wildlife Remains – Cause of death

		Granular treated (n=6)	Untreated (n=6)
Waterfowl	Gunshot		1
	Trauma		1 (fx leg)
	Ruptured colon		1
	Infection	1	
	Undetermined	1	1
Shorebird	Trauma	1 (fx leg)	1 (fx liver)
Gull	Renal coccidiosis	1	
	Starvation	1	
Mammal	Trauma	1 (head)	1 (crushed)

Results - Wildlife Remains – brain ChE

	Granular treated	Liquid Treated	Untreated	Total
Waterbirds	3	3	9	15 (65%)
Shorebirds	1	-	4	5 (22%)
Seabirds	3	-	-	3 (13%)
	7 (30%)	3 (13%)	13 (57%)	23

* All within "normal" range… except 2 with lower activities levels:
- 1 mallard – liquid treated - bChE 14.7 (normal 18.6 umol/min/g)
- 1 dunlin – untreated - bChE 18.8 (normal 29.85 umol/min/g)
* No tissues available for testing, only heads collected
* Caution against labeling as 'exposed'

Waterfowl Mortality - Summary

- Waterfowl extensively used agricultural fields (all treatments)

- Most wildlife remains
  - Scavenged (81%)
  - Waterbirds (36%)

- brain ChE activities within “normal” levels
  - except for 1 mallard (liquid treatment) & 1 dunlin (untreated) with lower levels; no tissues to confirm exposure

Raptor Poisoning - Methods

Wildlife Network

- rehab centers, BCWALP (Biologists & COs), taxidermists, public
- BAEA, RTHA, GHOW, accipiters, swans, any other species suspected of poisoning or unusual condition

Live birds

- plasma ChE
- if suspected – crop pesticides

Carcasses

- post-mortem exam, brain ChE
- if suspected - GI-tract pesticides

Raptors etc collected 2003-04 (N=73)

	Delta (LM)	V.Island	Other	Total
BAEA	5 (2)	43	1	51
RTHA	3	2		5
GHOW		2		2
BNOW	1			1
Accipiters	1	1		2
Swans	1 (1)	8		10
Other		2		1
	11 (3)	58	1	73

Raptors*, BC, 2003-04
Cause of death/debilitation (N=59)

	Delta (LM)	V. Island	Other	Total
Disease		3		3
Starvation	1	5		6
Infectious Dis.	1	3		4
Pesticides	3	1		4
Electrocution		5		5
Veh. Collision		7		7
Trauma	2 (2)	15	1	20
Undetermined	1	8		9
Other		2		2
	8 (2)	48	1	59

* BAEA 51, RTHA 5, GHOW 1, GOEA 1

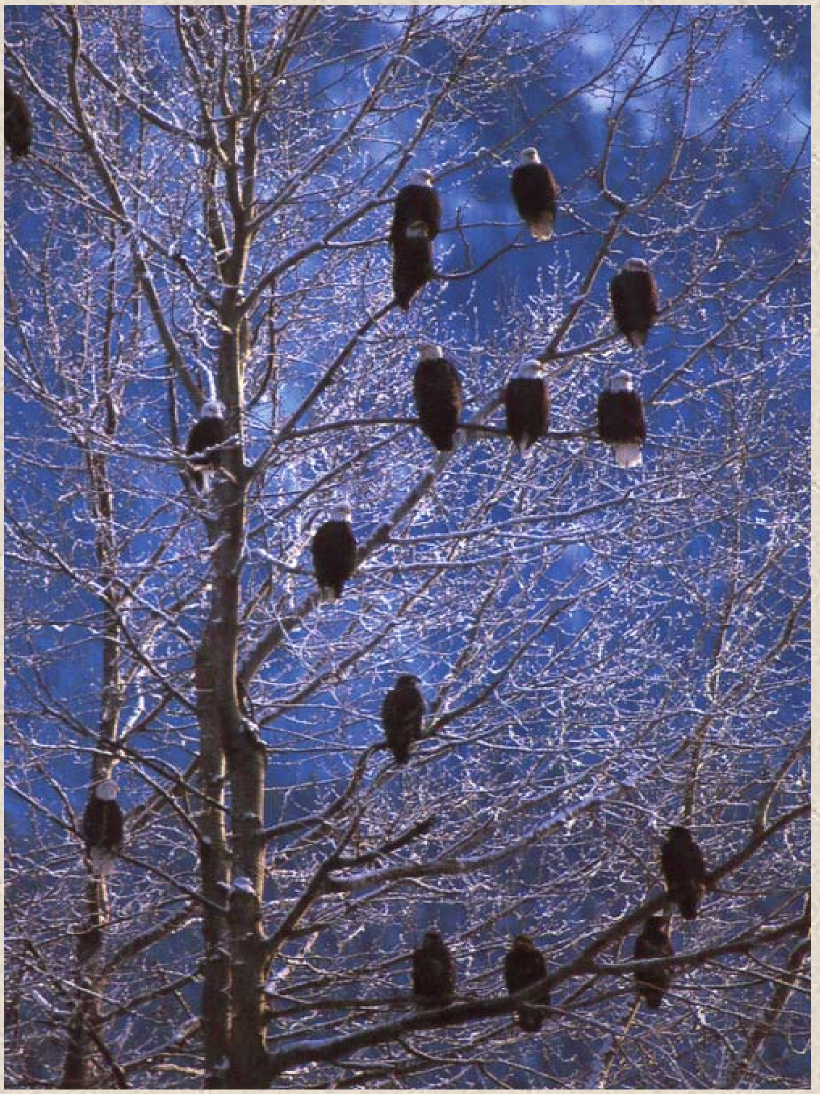
Raptors, BC, 2003-04
Pesticide poisonings (n=4)

Species	Date	Location	Plasma ChE	Brain ChE	Pesticide
RTHA	18-Nov-03	Richmond	NT	TBA	TBA
BAEA	17-Jan-04	Ladner	NT	TBA	Fensulfothion 29ppm, Sulfotep 3.2ppm (stom)
BAEA	24-Jan-04	Ladner	TBA	TBA	ND
BAEA	3-Apr-04	Campbell R	TBA	NT	Pyrethrins? * (feather)

* Piperonyl butoxide
N-(2-ethylhexyl)-norbornene-2,3-dicarboxamide
Cyclopropanecarboxylic acid 2,2,-dimethyl-3-(2-methyl-1-propenyl)

Raptor Poisoning - Summary

- Raptor collections:
  - V. Island: most
  - Delta: few
- Delta - pesticides poisoning prevalent (38%, 3/8)
- 4 Pesticides poisonings:
  - V. Island: pyrethrins?
  - Delta: Fensulfothion/Sulfotep, ND, TBA
- No poisonings directly attributed to chlorpyrifos



Conclusions

- No evidence of waterfowl exposure to anti-ChE pesticides
- Suggests use of chlorpyrifos for wireworm control in potatoes does not seem to be poisoning waterfowl wintering in the Fraser River Delta

- But..
  - Waterfowl – small sample size of intact carcasses
  - Raptor - 2 suspect poisoning (1 unknown, 1 TBA)

- Therefore, need to repeat study in 2004-05 before completing assessment

Assessing avian exposure to monosodium methanearsonate (MSMA) as used for bark beetle control in British Columbia forests

Christy Morrissey, Patti Dods, Courtney Albert, Laurie Wilson, William Cullen, Tony Williams and John Elliott, Canadian Wildlife Service, Delta, British Columbia, Environment Canada

Abstract

Recent and historical outbreaks of the mountain pine beetle (*Dendroctonus ponderosae* Hopkins) have caused significant damage to forests in British Columbia through destruction of thousands of hectares of large diameter, mature lodgepole pine, ponderosa pine and white pine. Management strategies employ a variety of techniques to reduce timber losses from beetle outbreaks including the use an arsenic based insecticide monosodium methanearsonate (MSMA). Given that insectivorous birds, particularly woodpeckers, are attracted to beetle outbreak areas in forests due to increased food availability, they may be subsequently exposed to elevated concentrations of organic arsenicals through ingestion of wood boring insects from MSMA treated trees. We assessed the risk to avian predators through analysis of bark beetles from different life stages and in trees with MSMA treatment (4 weeks and 1 year after treatment) to determine levels of total arsenic and organic/inorganic arsenic speciation. MSMA metabolites were highest in adult mountain pine beetles relative to larval and pupal stages and other insects collected from trees at both 4 weeks and 1 year post treatment. Concentrations of total arsenic in mountain pine beetles from treated trees ranged from 0.22- 354.1 µg/g dw with the organic metabolite monomethyl arsine (MMAA) contributing over 90% to the total arsenic extracted. Mountain pine beetles from reference trees had low concentrations that averaged 0.11 µg/g dw total arsenic. Debarking indices and radio telemetry methods were used to identify woodpecker foraging on beetle infested trees with and without MSMA treatment. Debarking indices indicated woodpecker foraging of MSMA treated trees was significantly lower than non treated trees. However, approximately 30% of MSMA trees had some evidence of woodpecker foraging (5%-100% debarked), while focal observations and surveys confirmed woodpeckers use MSMA stands. Given the extent of mountain pine beetle infestation and the increasing use of MSMA in British Columbia forests, this study addresses important knowledge gaps on woodpecker exposure to MSMA.

Assessing avian exposure to MSMA (*monosodium methanearsonate*) as used for bark beetle control in B.C. forests

Christy Morrissey, John Elliott, Laurie Wilson
Canadian Wildlife Service, PYR- Delta

Mountain Pine Beetle (MPB) Outbreak in B.C.

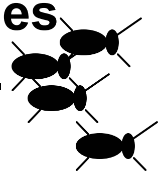
- MPB attacks and kills large mature lodgepole pine, ponderosa pine and white pine.
- B.C.'s MPB infestations have increased exponentially in past 5 years.
- MPB red attack doubled in 2003 over 2002 (Approx. 4.2 million ha attacked in 2003).

Mountain Pine Beetle Infestation

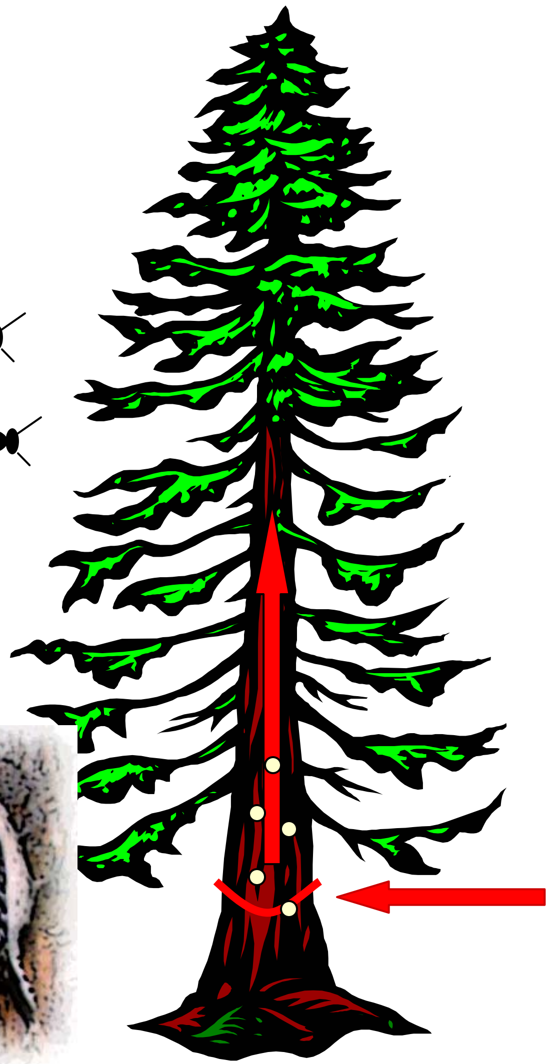
Control Measures

Treatment of MSMA *(monosodium methanearsonate)*, an organic arsenical, in B.C. Forests

Target stands are baited with pheromones to attract adult beetles in late summer.



Treated MSMA trees are left standing allowing wildlife to forage on surviving bark-boring insects.



MSMA causes death of the tree and kills MPB (~60% effective)

MSMA is translocated up xylem into phloem

Cut frill into base of tree & apply MSMA

Study Objectives

- To assess As concentrations and speciation (organic and inorganic) in MPB and other wood boring insects.
- To determine woodpecker use of MSMA treated trees.
- To determine the degree of MSMA uptake, elimination and target tissues in model songbirds (lab dosing study).

Methods: As in Bark Beetles

2002-2004: Merritt Forest District

- Collected composite MPBs (adult, larvae, pupae) & other insects from MSMA trees (4 weeks and 1 yr after trt) and reference trees.

- Measured total As and As speciation: MMAA, DMAA, As(V), As(III).

- Other data collected: level of debarking, collection height, beetle mortality, tree dbh, etc.

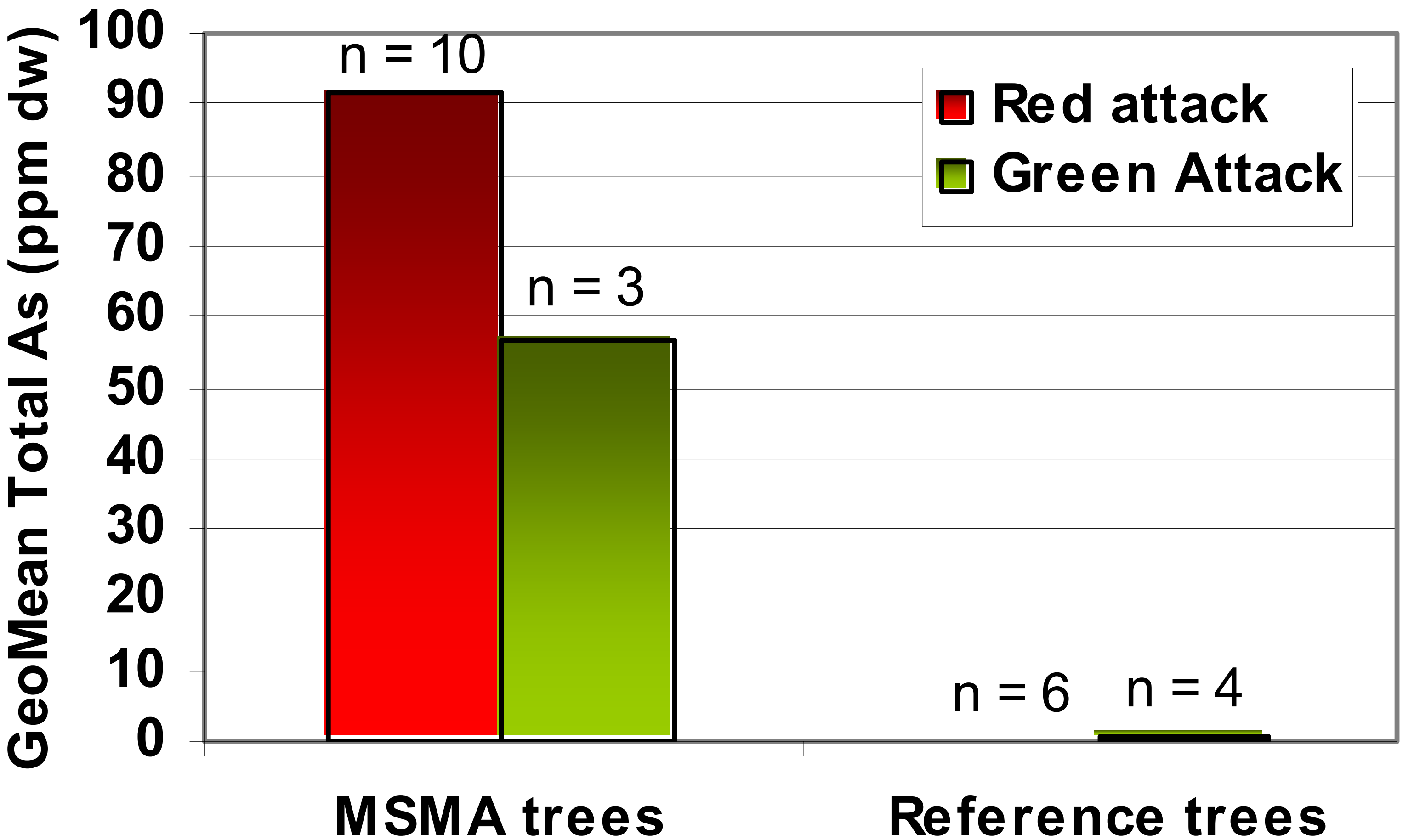
Methods: Woodpecker exposure

- 2002-2003: 402 reference & 449 MSMA trees were scored for debarking (0 - 100% = index 0 - 7) immediately after treatment and 1 year after attack.

- 2004: blood and feather sampling of woodpeckers (Hairy, 3-toed, Red-naped).

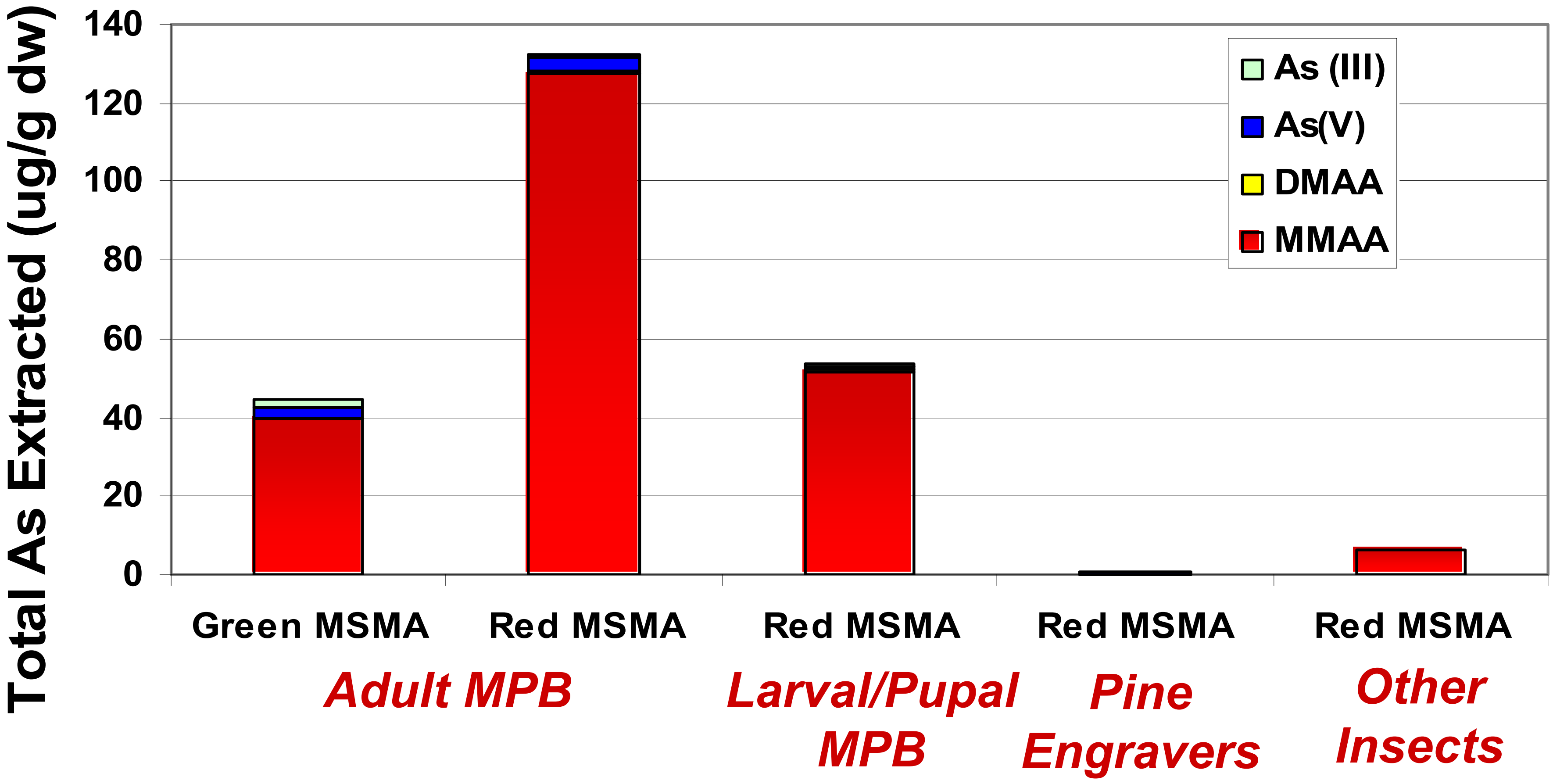
- 2004: radio-telemetry and focal observations of woodpecker foraging (n = 8).

Total Arsenic in Adult Mountain Pine Beetles



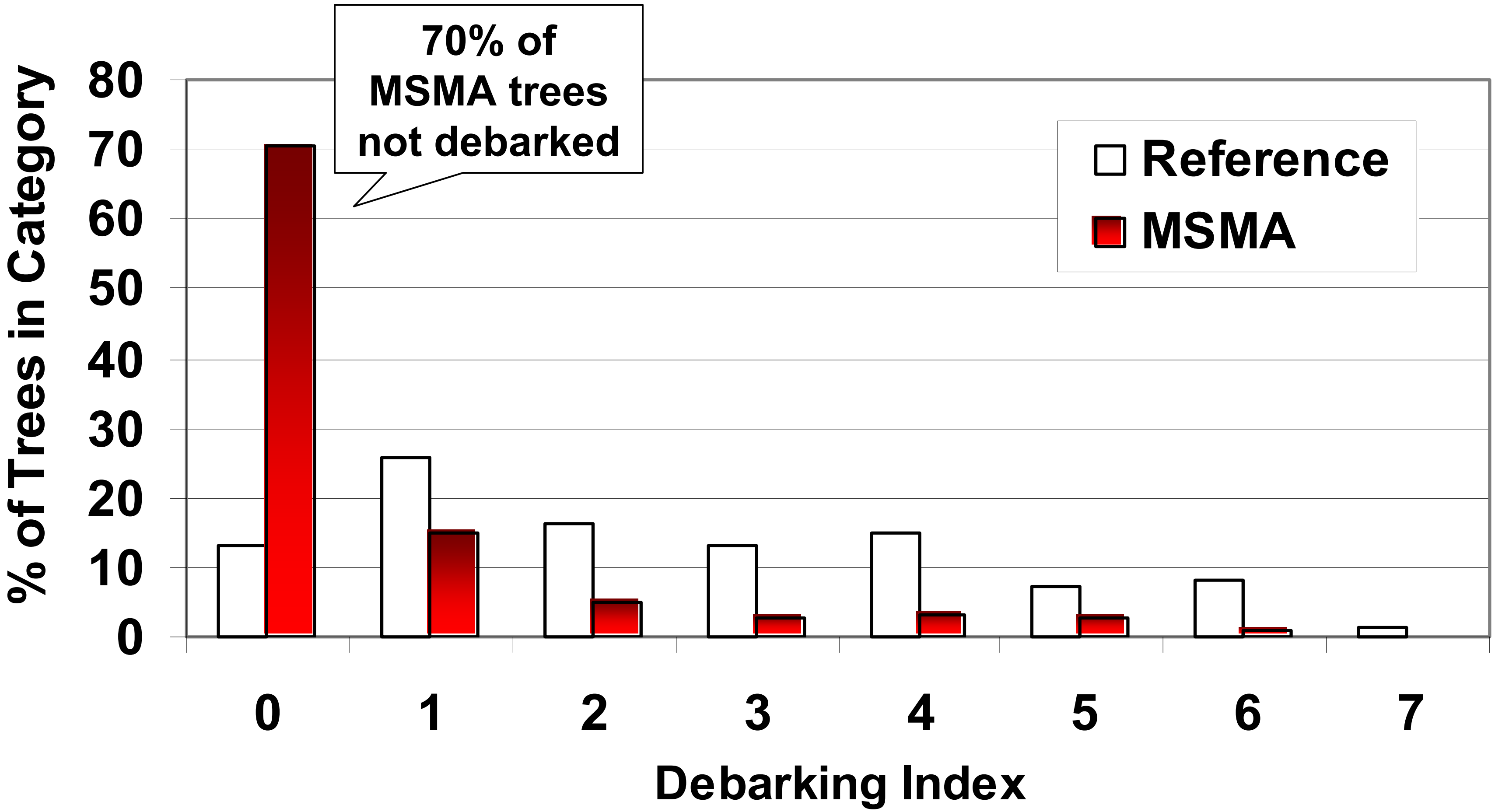
►**Note:** Some dead adult beetle samples contained up to 354 µg/g dw.

Arsenic Speciation in Beetles



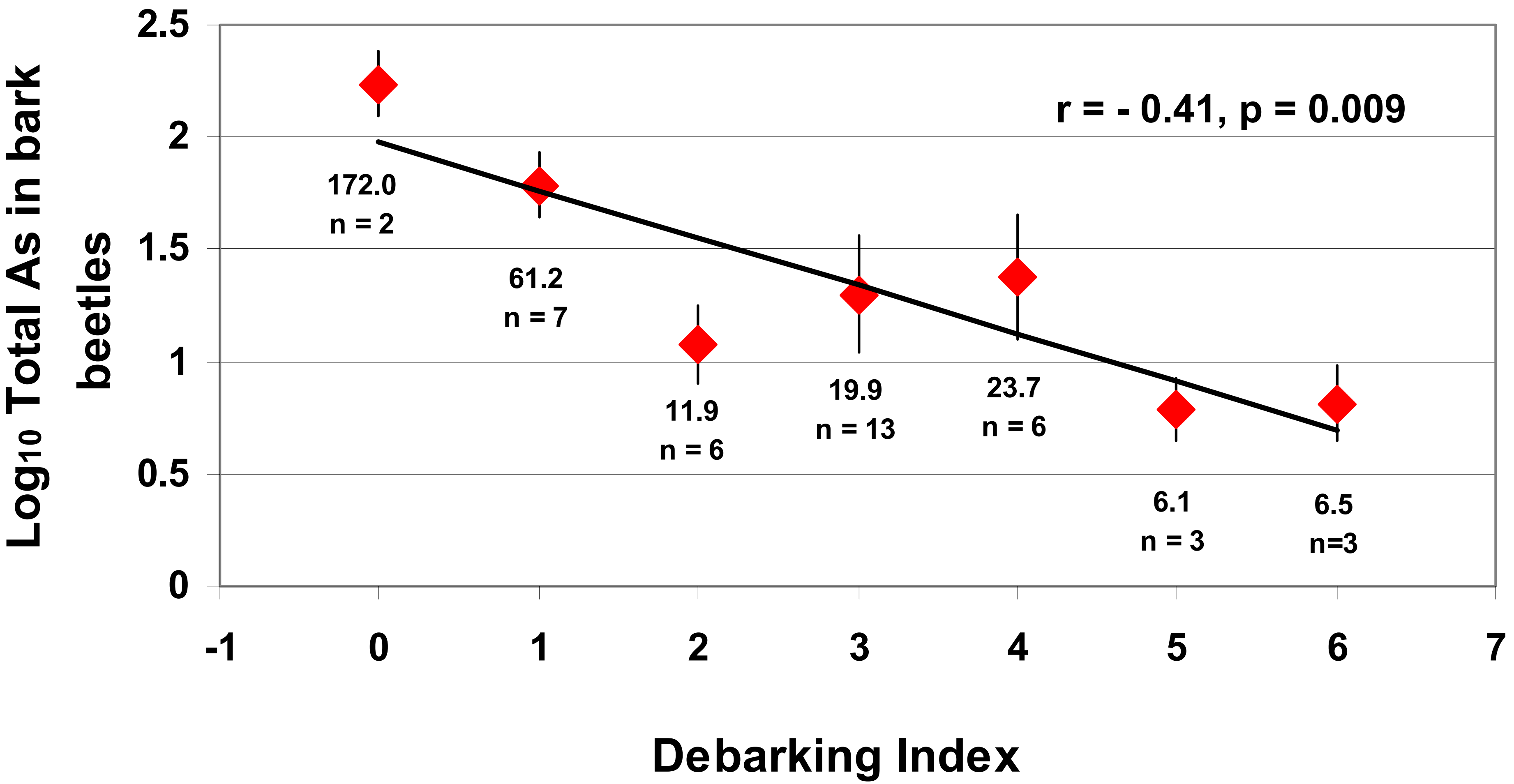
► Regardless of life stage or insect species- MMAA form predominates

Woodpecker foraging of Red Attack Trees (1 year post infestation)

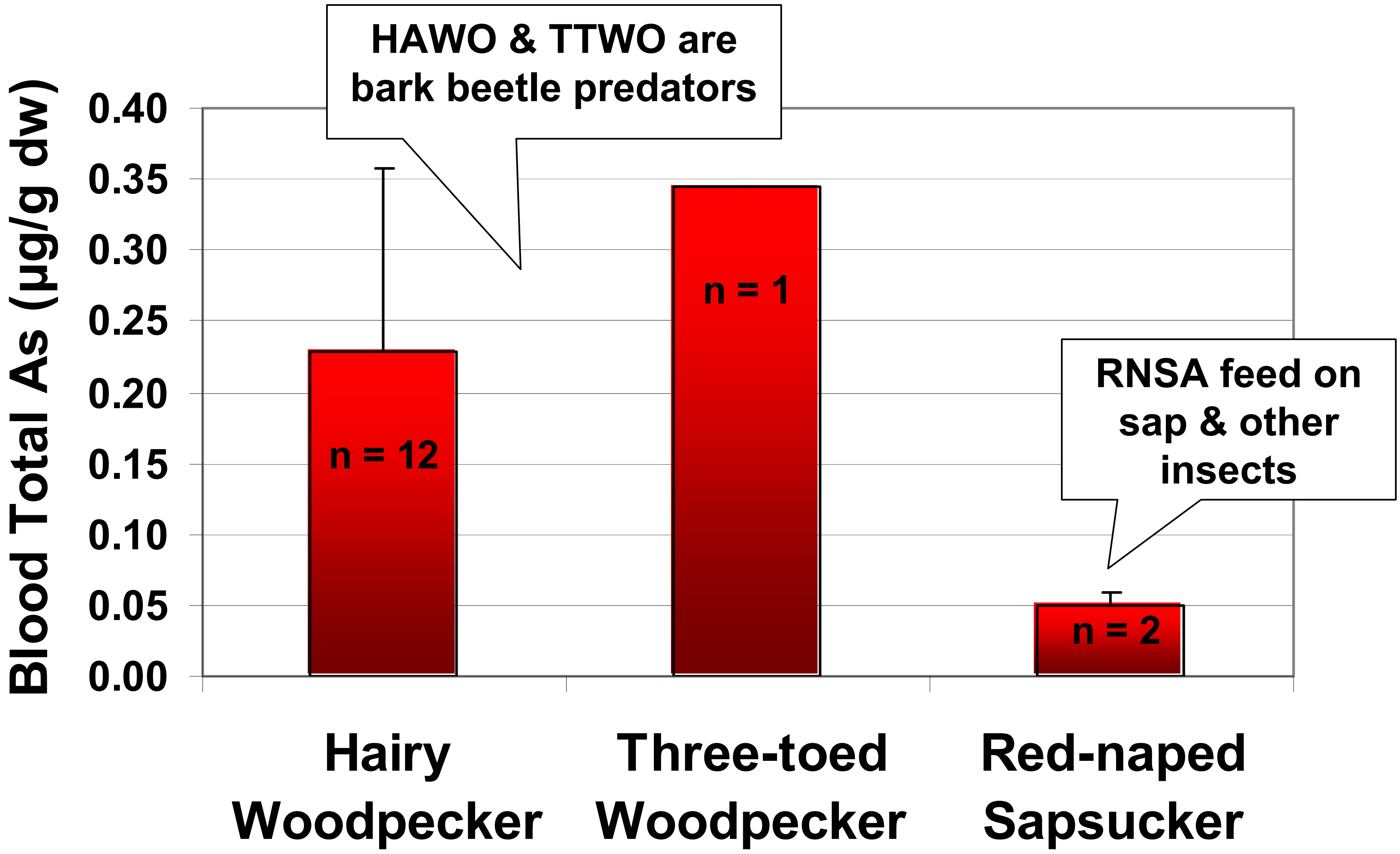


► Data for 2002-2003 combined

Total [As] in beetles from trees with different levels of debarking



Total [As] in woodpecker blood



Lab dosing study

To determine the degree of uptake (bioavailability) of MSMA, elimination rates and its potential toxicity to birds.

- **14 days dosing MMAA at 0, 8, 24, 72 µg/g bw/day (6 birds/grp).**
- **Collect feces daily.**
- **Collect blood on day 15 and euthanize.**
- **Analyze blood, liver, kidney, brain and feces for total As and As speciation.**

Summary

Availability

- MSMA metabolites (primarily MMAA) present in bark beetles from treated trees – As rarely detected in reference trees.
- [As] highest in MPB adults (range 0.22 to 354 µg/g).

Exposure

- Evidence of woodpecker feeding on MSMA treated trees from debarking indices, telemetry focal observations & blood samples.
- Birds do not seem to be preferentially selecting MSMA trees.

Toxicity

- Only few studies of MSMA toxicity in captive birds- low risk for acute toxicity (e.g. LD50 = 834 mg/kg for 17 wk old Bobwhite).
- Sublethal or chronic toxicity of MSMA to birds is unknown.
- No studies of toxic effects of MSMA in wild birds.
- Current lab dosing study on zebra finches to look at uptake, elimination and toxicity.

Acknowledgements

Field data collection: Patti Dods, Sandi Lee, Courtney Albert, Sheila Carroll, Jason Berge

Lab study: Courtney Albert, Tony Williams (SFU)

Chemistry: Bill Cullen, Vivian Lau (UBC)

Funding: PSF (PMRA), PWRC (Can. Wild. Serv.)

Logistical Support: Ministry of Forests (Merritt office), BC Timber Supply, Tolko Industries, Weyerhauser Ltd.

2003 Surveillance of Current Use Pesticides in Waters of the Lower Fraser Valley

Taina Tuominen, Mark Sekela, Melissa Gledhill, Andrea Ryan and Basil Hii
Aquatic and Atmospheric Sciences Division, Environmental Conservation Branch, Environment Canada, PYR

Abstract
In Fall 2003, 14 surface water and 10 groundwater sites were sampled in the Lower Fraser Valley for current-use pesticides, as part of a Canada-wide Environment Canada surveillance of current-use pesticides in water. Sites were located in areas where we expected pesticide application, at locations exposed to urban, agricultural or both urban and agricultural activities. We also sampled at reference streams, in relatively undisturbed watersheds. Forty-three current-use pesticides or their transformation products were detected in the Lower Fraser Valley waters. Each site had several pesticide detections, usually at low concentrations (picograms to nanograms per litre). Fewer detections and lower concentrations were measured at the reference sites. In general, sites exposed to agricultural activity had the greatest number of pesticide detections and the highest total pesticide concentration compared to the reference and urban sites. Groundwater samples usually had lower number of detections and lower total pesticide concentrations.

2003 Surveillance of Current-use Pesticides in Waters of the Lower Fraser Valley

Taina Tuominen, Mark Sekela, Melissa Gledhill, Andrea Ryan and Basil Hii

ECB, Environment Canada, PYR

Environment Canada Environnement Canada

Background:

- project funded by Environment Canada's ***Pesticide Science Fund***
  - nationally-coordinated departmental science program
  - Objectives:
    - to improve our understanding of the environmental presence and effects of priority pesticides in Canada for enhanced decision-making
    - identify pesticides that pose a significant environmental risk & support PMRA in making scientifically sound risk assessment & risk management decisions

Pacific and Yukon Region:

- part of national surveillance of pesticide presence in water
- conducted by ECB (surface waters, groundwaters) & EPB (runoff)
- focus on areas in province with most pesticide use–Lower Fraser Valley, Okanagan

Objective:

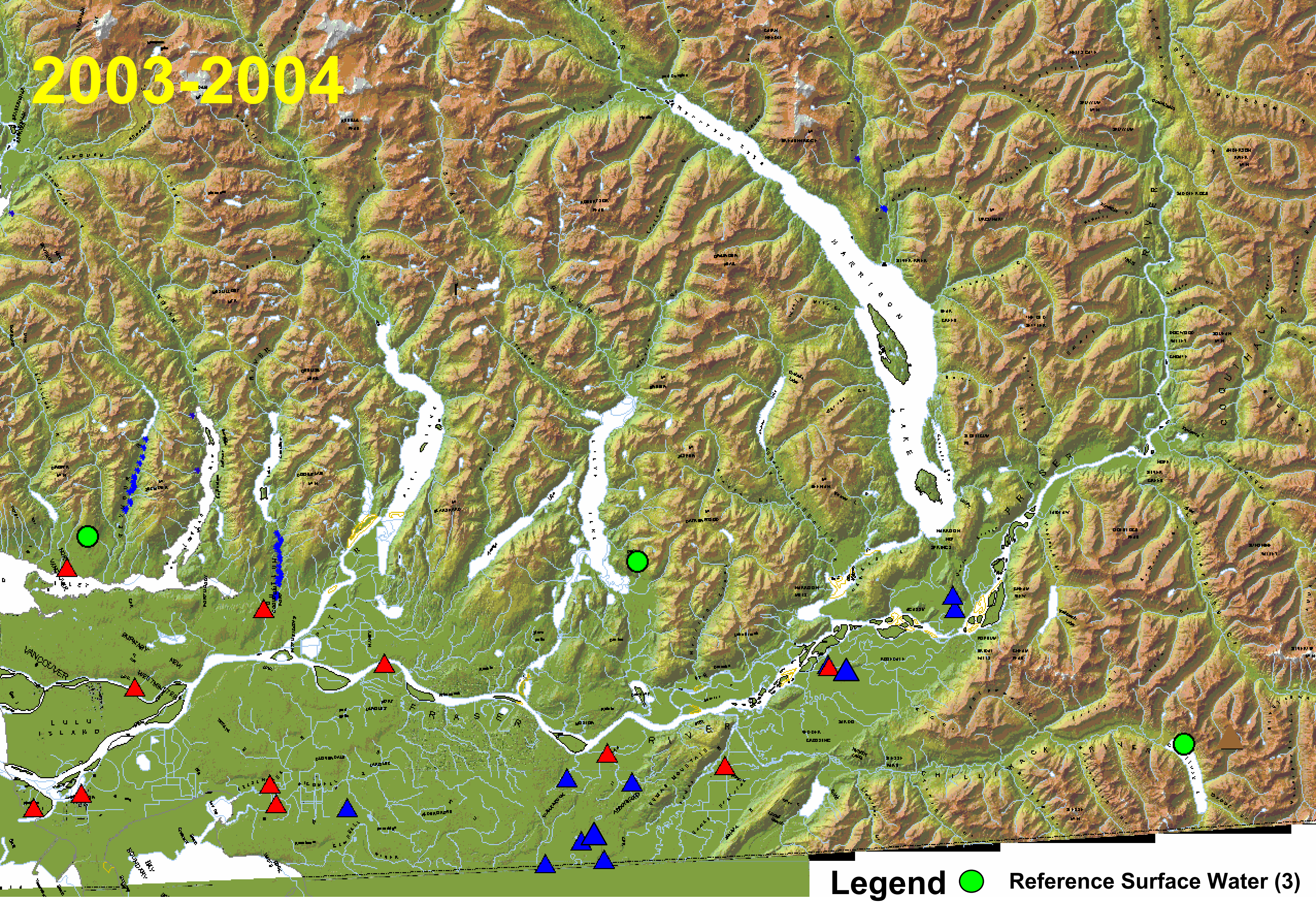
Obtain information on the presence of current-use pesticides in the Canadian environment within this region.

Focus of this presentation: receiving surface and ground waters of the Lower Fraser Valley

Methods:

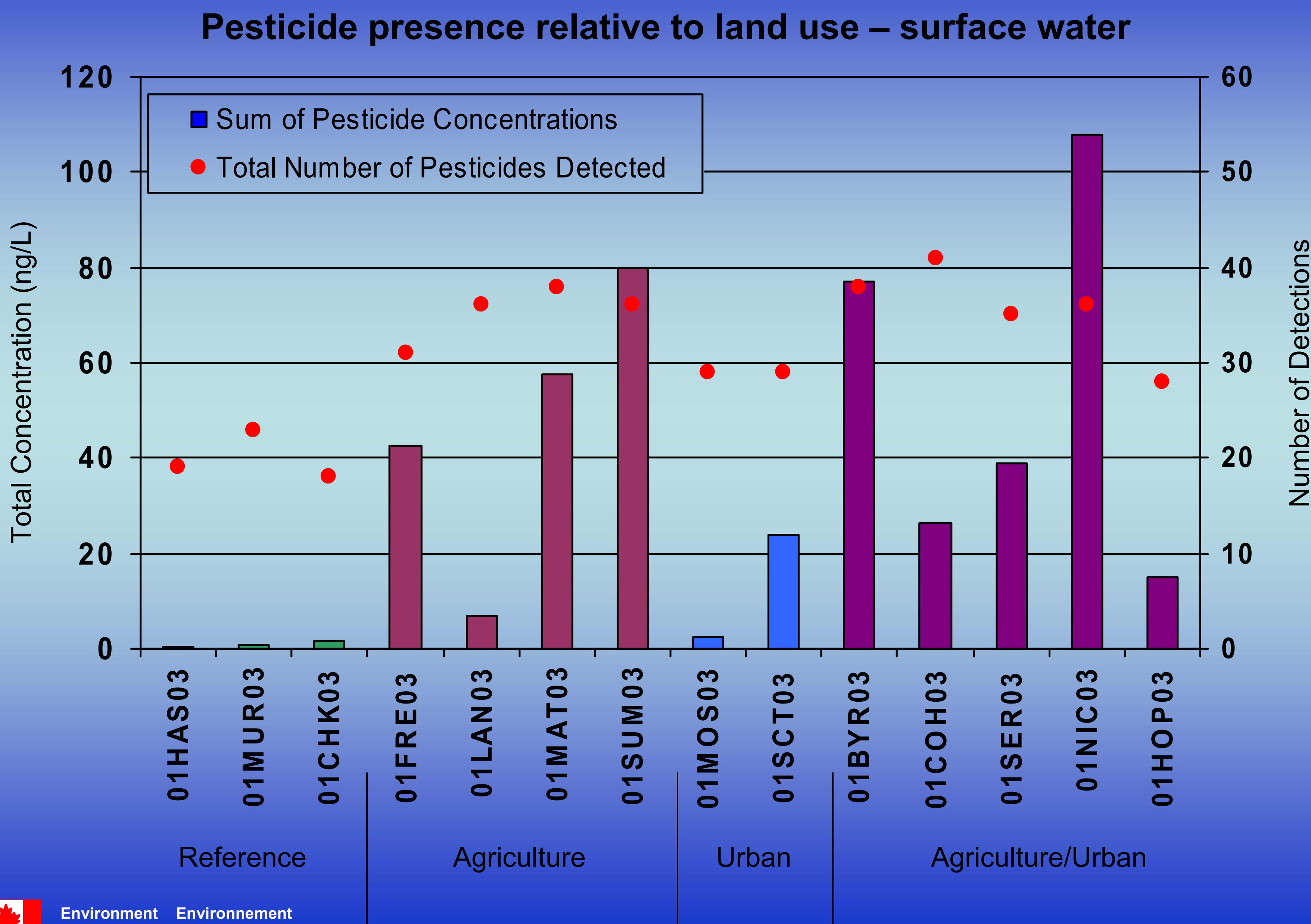
- Sampling – in fall after rain event
- Collected with submersible pump
- 2 – 1L samples
- 2 – 20 L samples
    - filtered and processed at lab through XAD resin

- Analysis: AXYS Analytical
- Target analytes based on:
    - 2001 Enkon sales data report
    - Toxicity
    - Persistence in environment
    - Analytical capabilities

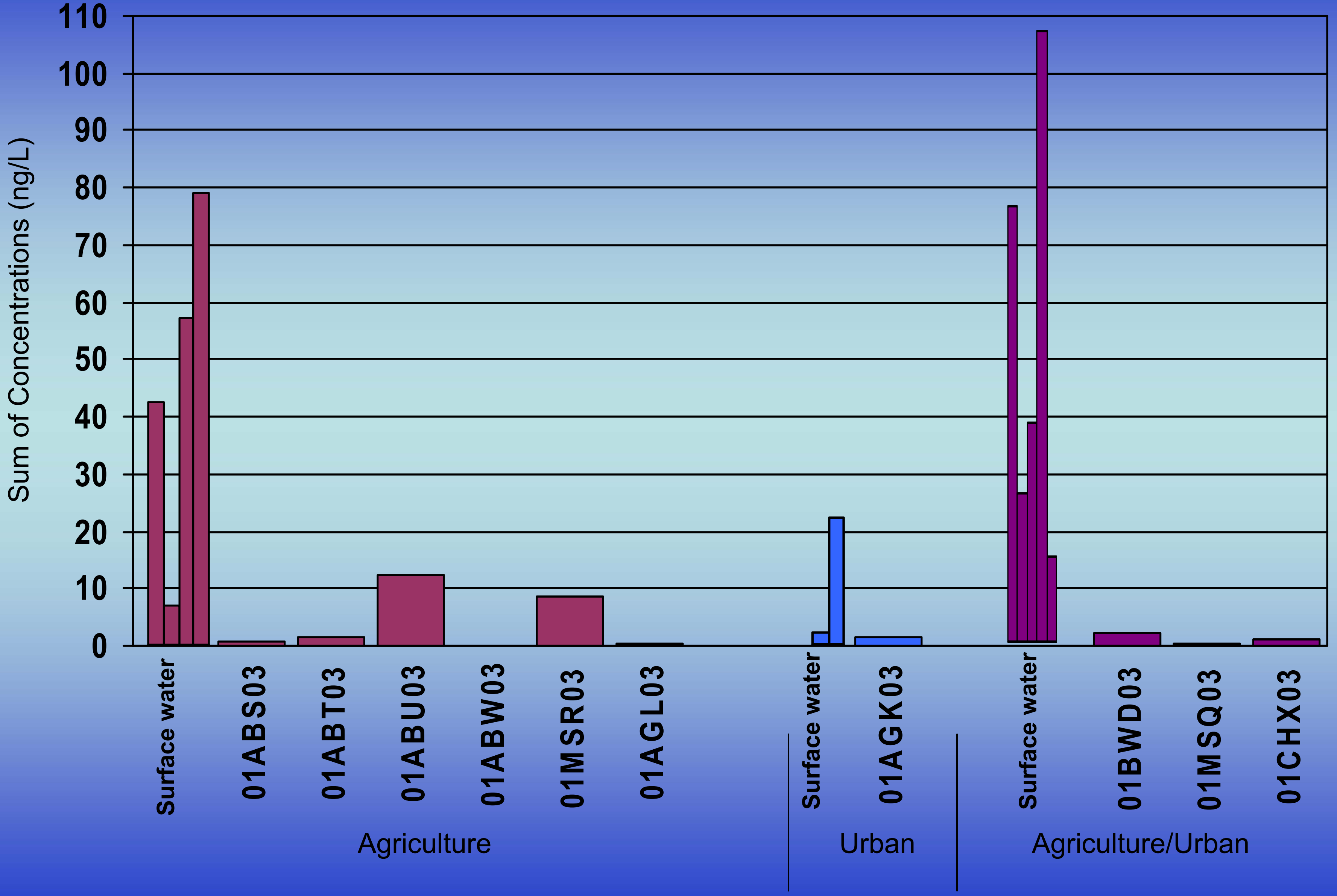


Sampling Sites in Lower Fraser Valley

Results:

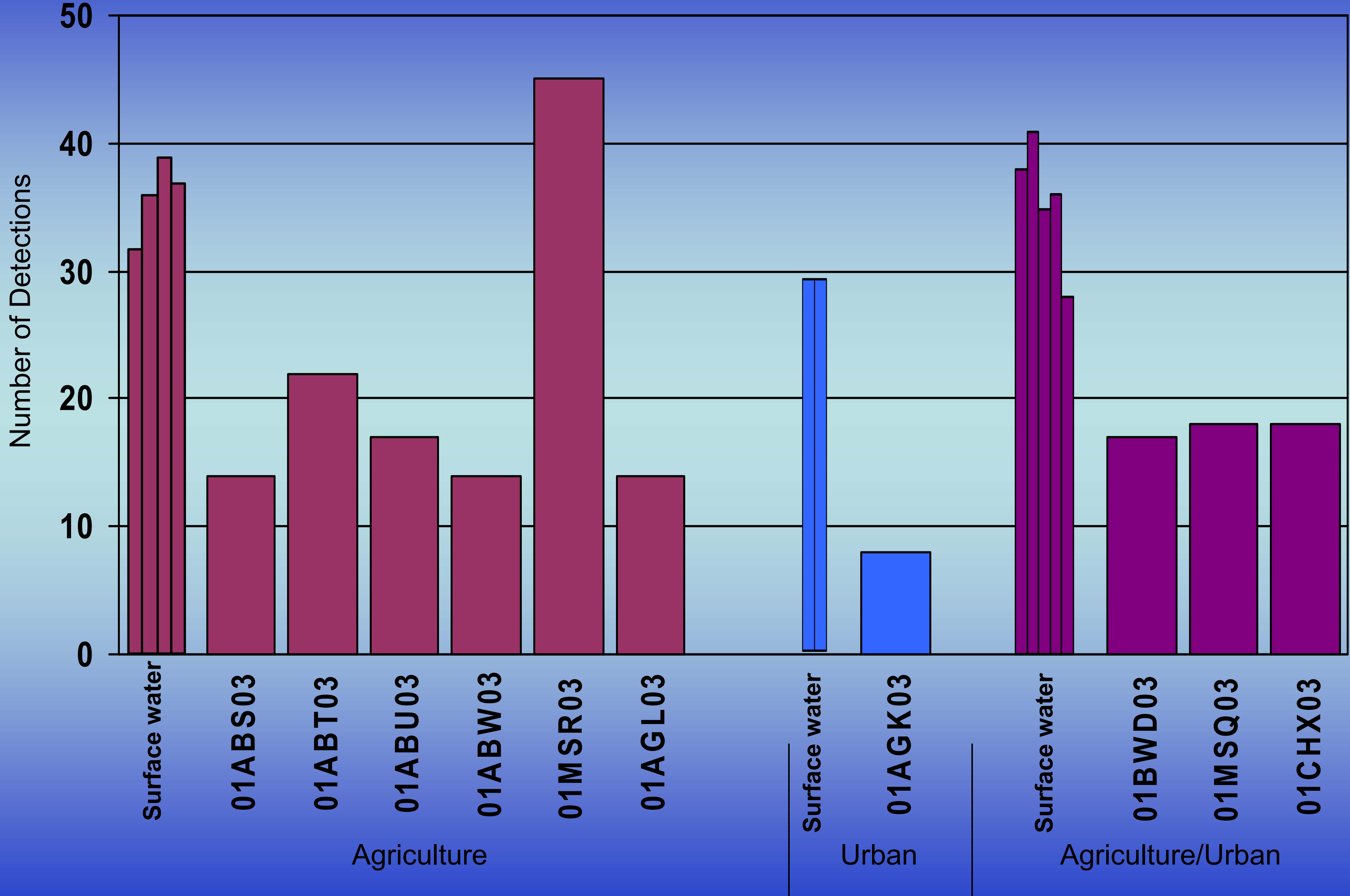

Pesticide presence relative to land use – surface water
Sum of Pesticide Concentrations
Total Number of Pesticides Detected
Total Concentration (ng/L)
Number of Detections
120
100
80
60
40
20
0
60
50
40
30
20
10
0
01HAS03
01MUR03
01CHK03
01FRE03
01LAN03
01MAT03
01SUM03
01MOS03
01SCT03
01BYR03
01COH03
01SER03
01NIC03
01HOP03
Reference
Agriculture
Urban
Agriculture/Urban

Comparison of Pesticide Concentrations in Surface Water and Groundwater

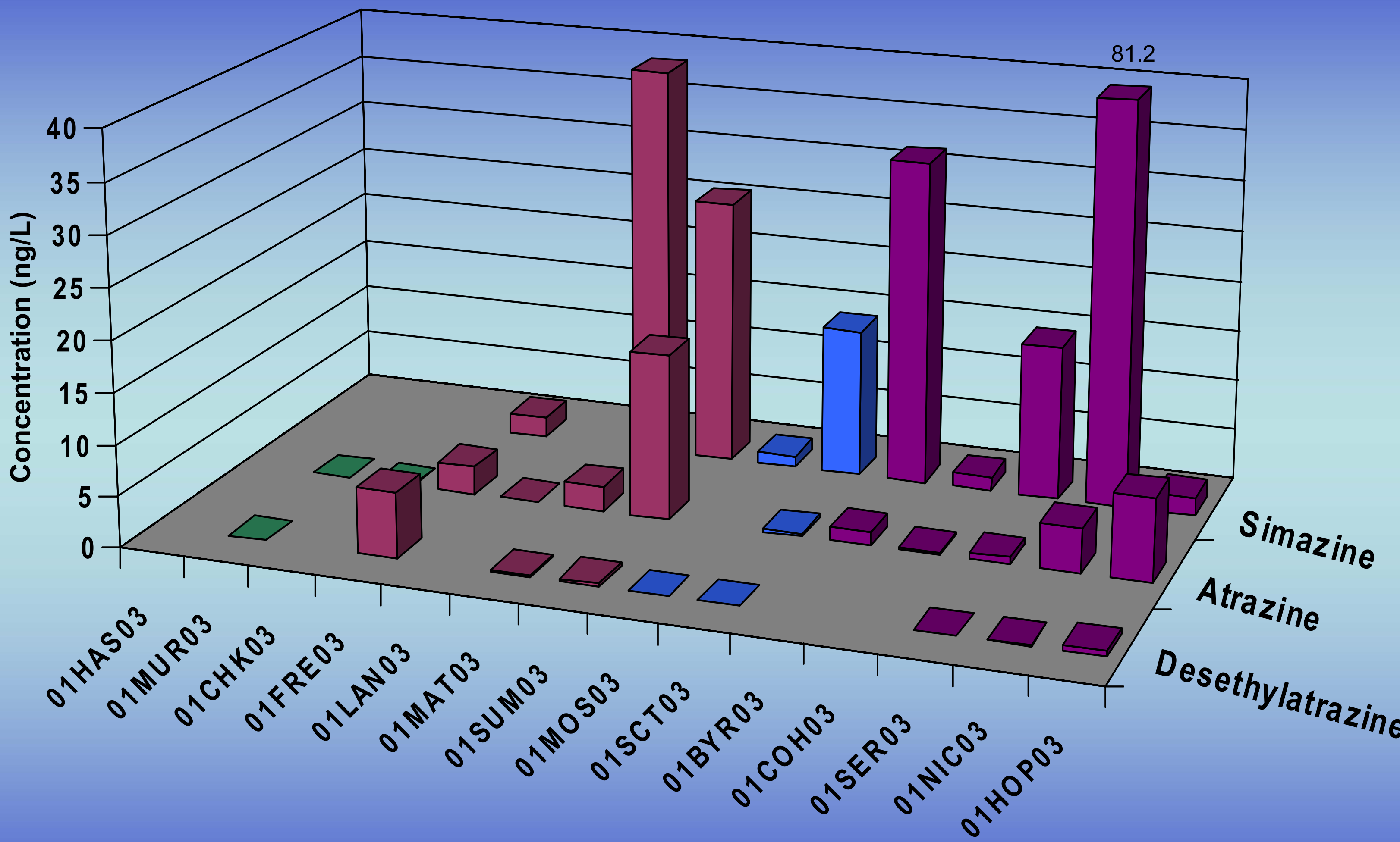


Environment Canada
Environnement Canada

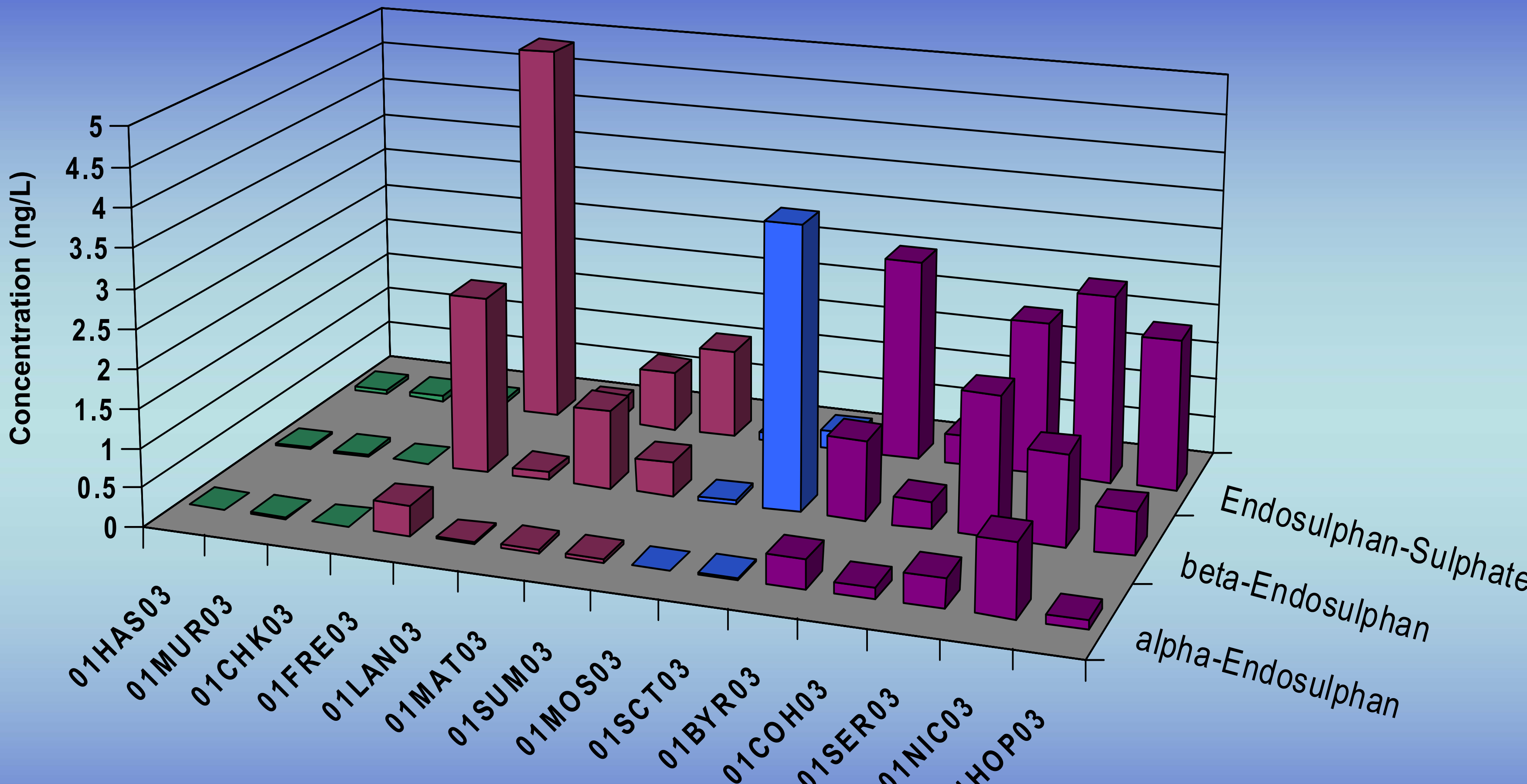
Comparison of Pesticide Detections in Surface Water and Groundwater



Concentrations of Triazine Herbicides in Surface Waters

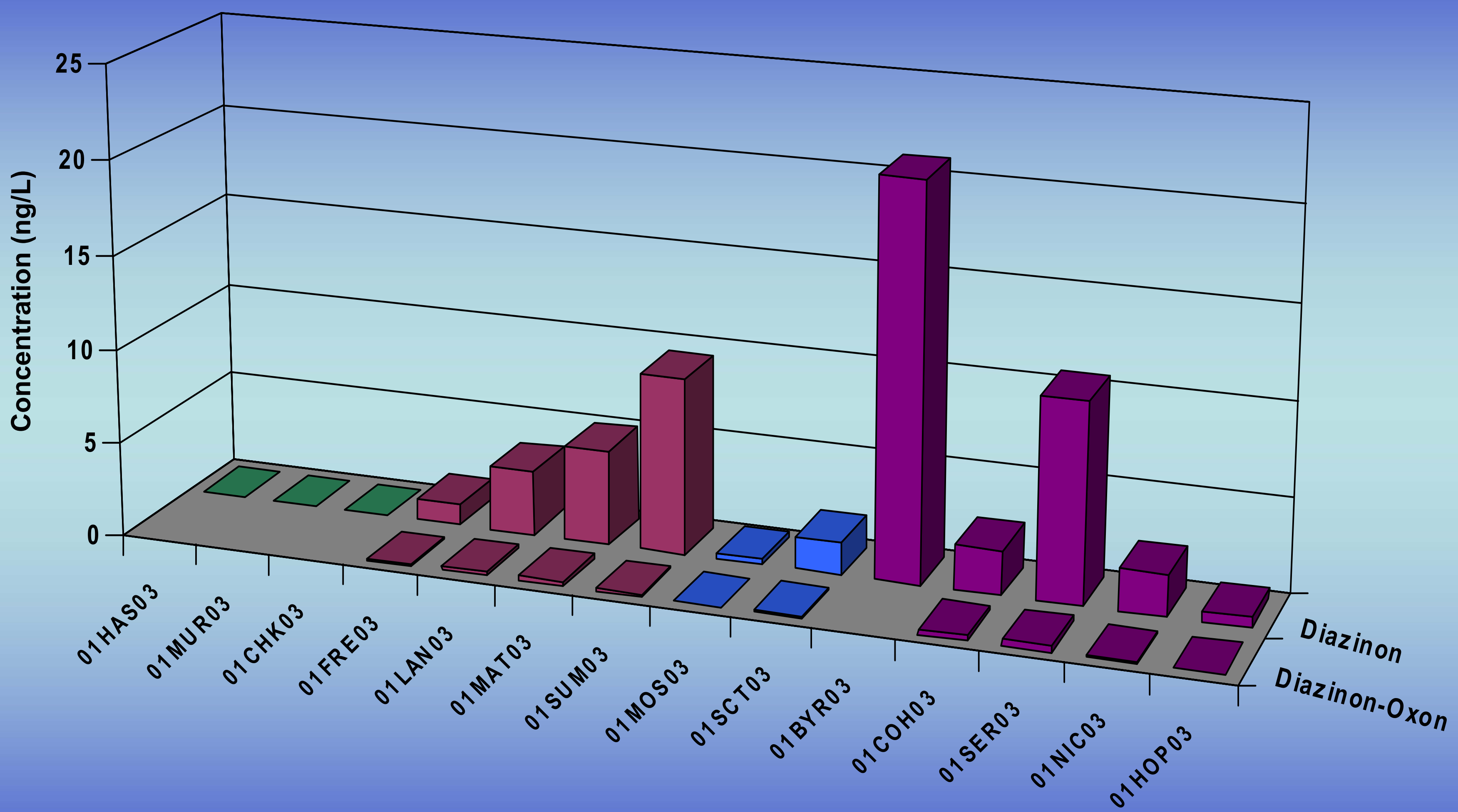


Concentrations of Endosulphans in Surface Waters



Environment Canada Environnement Canada

Concentrations of Diazinon in Surface Waters



Study Observations to date:

- data on the presence of current-use pesticides in the Canadian environment were obtained for the PMRA
- 43 current-use pesticides and/or their transformation products were detected in the waters of the Lower Fraser Valley
- several pesticides detected at most sites – concentration ranges from pg/L to ng/L
- considerable variability among sites in detections
- fewer detections and lower concentrations at reference sites
- sites with agricultural activity appear to have greater number of detects and higher total concentration
- number of pesticide detections and total pesticide concentration lower in the groundwater samples than in surface water samples
- for most of the pesticides we measured, the parent compounds are present at higher concentrations than the transformation products that we looked at

Next Steps:

- Data are needed on the presence of several current-use pesticides that we were unable to analyse in this study (eg. Metam, paraquat, etc.)

- Based on our results, aquatic organisms in the LFV are exposed to low concentrations of several pesticides. Information is needed on the cumulative effect of this exposure on aquatic organisms

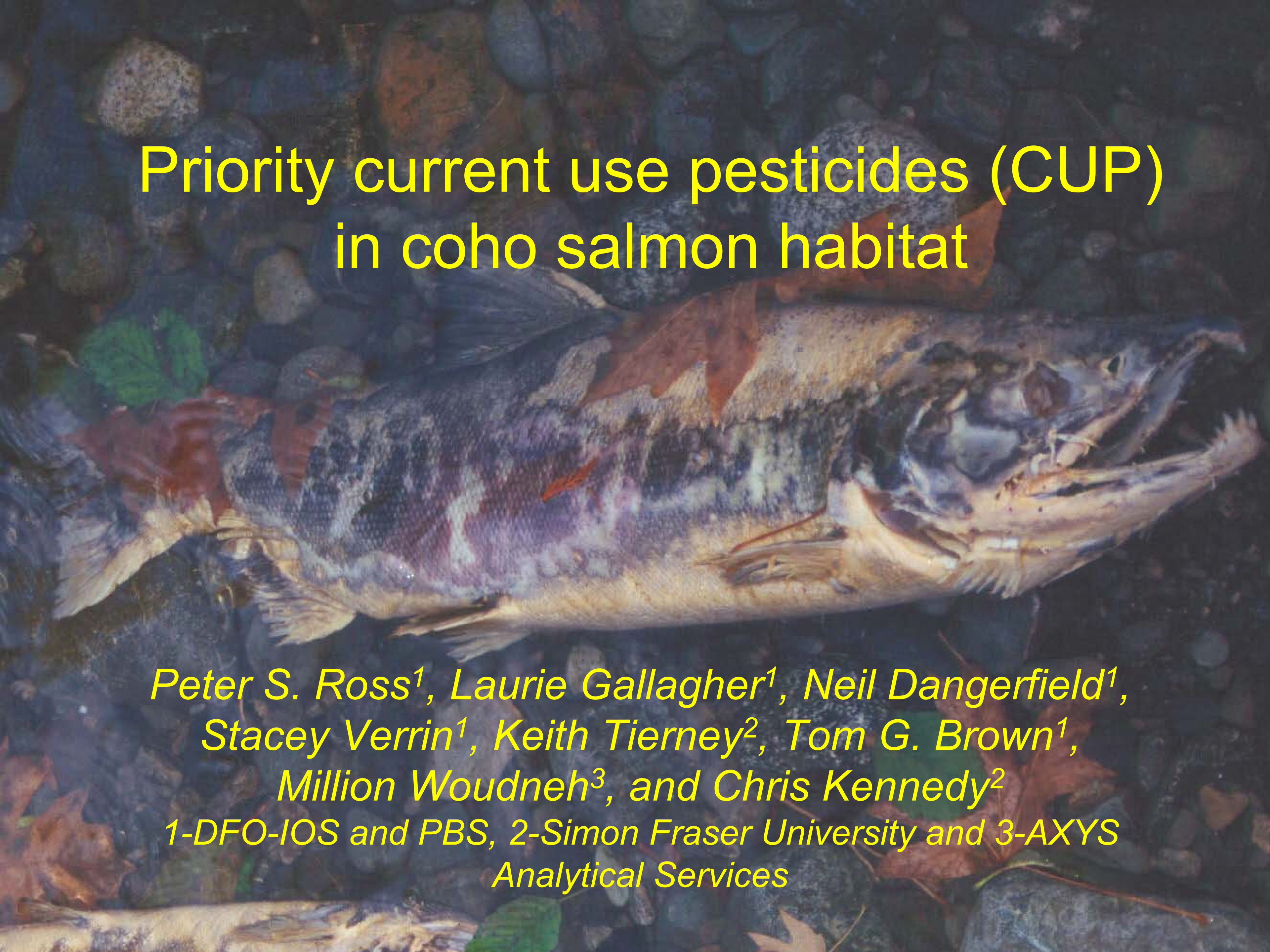
Priority current-use pesticides (CUP) in coho salmon habitat

[1]Peter S. Ross, [1]Laurie C. Gallagher, [1]Stacey Verrin, [1]Neil Dangerfield, [2]Keith Tierney, [1]Tom G. Brown, [3]Million Woudneh, [2]Chris Kennedy

[1]Fisheries and Oceans Canada
[2]Simon Fraser University
[3]AXYS Analytical Services

Abstract

The widespread use of pesticides to control and eliminate pests, fungi and weeds can present a risk to non-target organisms, including sensitive aquatic species such as salmonids. Despite this concern, little is known about the fate and effects of the approximately 300 pesticides currently registered for use in British Columbia. We are carrying out a watershed-based study of pesticides in two salmon-bearing tributaries of the Fraser River and one remote site in the Koeye River, Central Coast. Samples of air, water, sediment and coho salmon (*Oncorhynchus kisutch*) smolts were collected from three sites, representing urban, agricultural land use, and a remote location. New analytical methods were developed in order to extract and analyze those pesticides that we had identified as a concern to salmon health. Forty-four percent of the pesticides identified on our list of concern were detected at the agricultural site, while 35% of the pesticides analyzed were detected at the urban site. Total pesticide concentrations in water were > 28 ng L^{-1} at the agricultural site, and > 7 ng L^{-1} at the urban site. The presence of these reportedly non-persistent pesticides in British Columbia`s waterways may adversely affect salmon health. We are attempting to determine whether these concentrations and/or types of priority Current Use Pesticides are having an effect on the olfactory system and behaviour of coho salmon smolts using laboratory and in situ approaches.

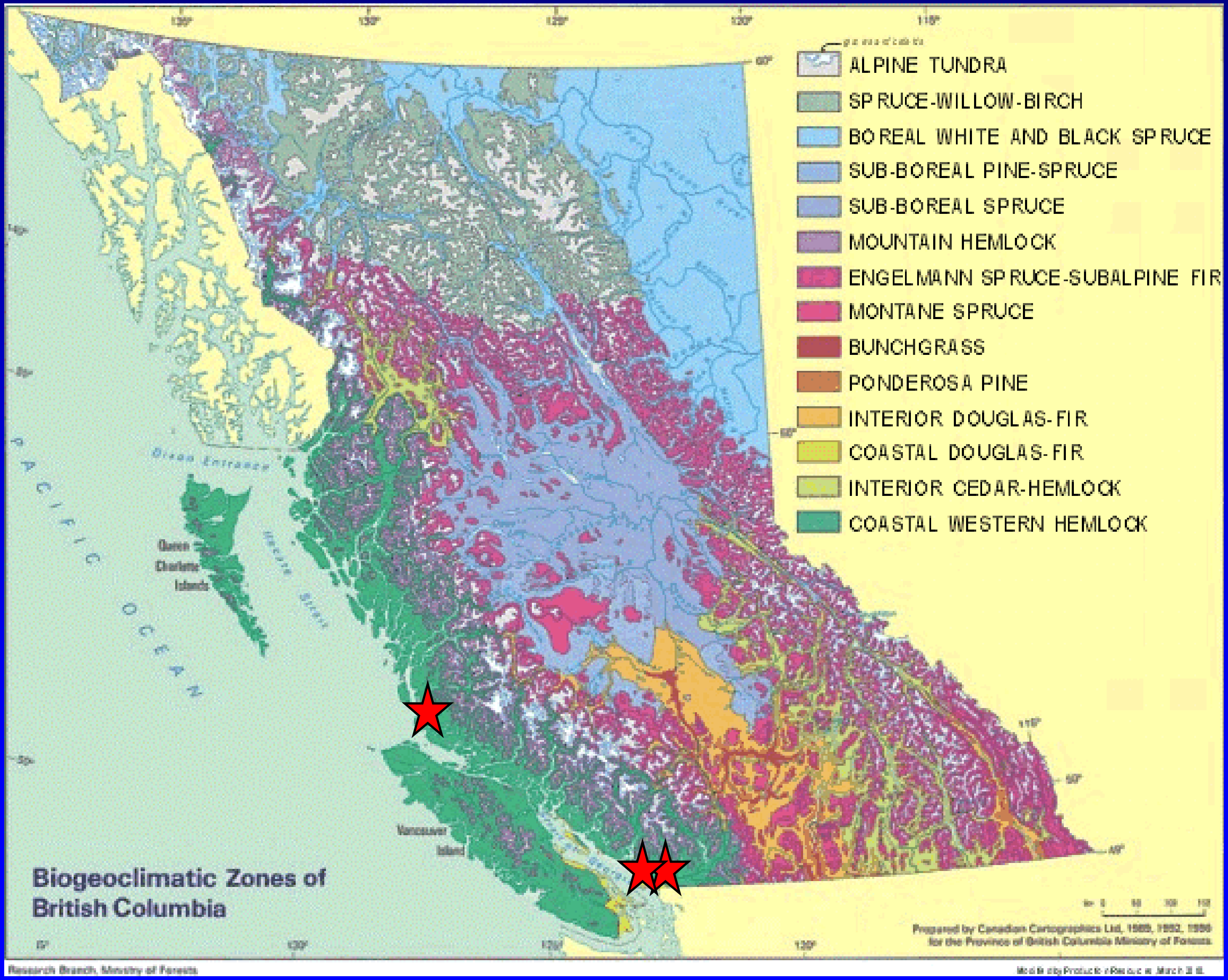


Priority current use pesticides (CUP) in coho salmon habitat

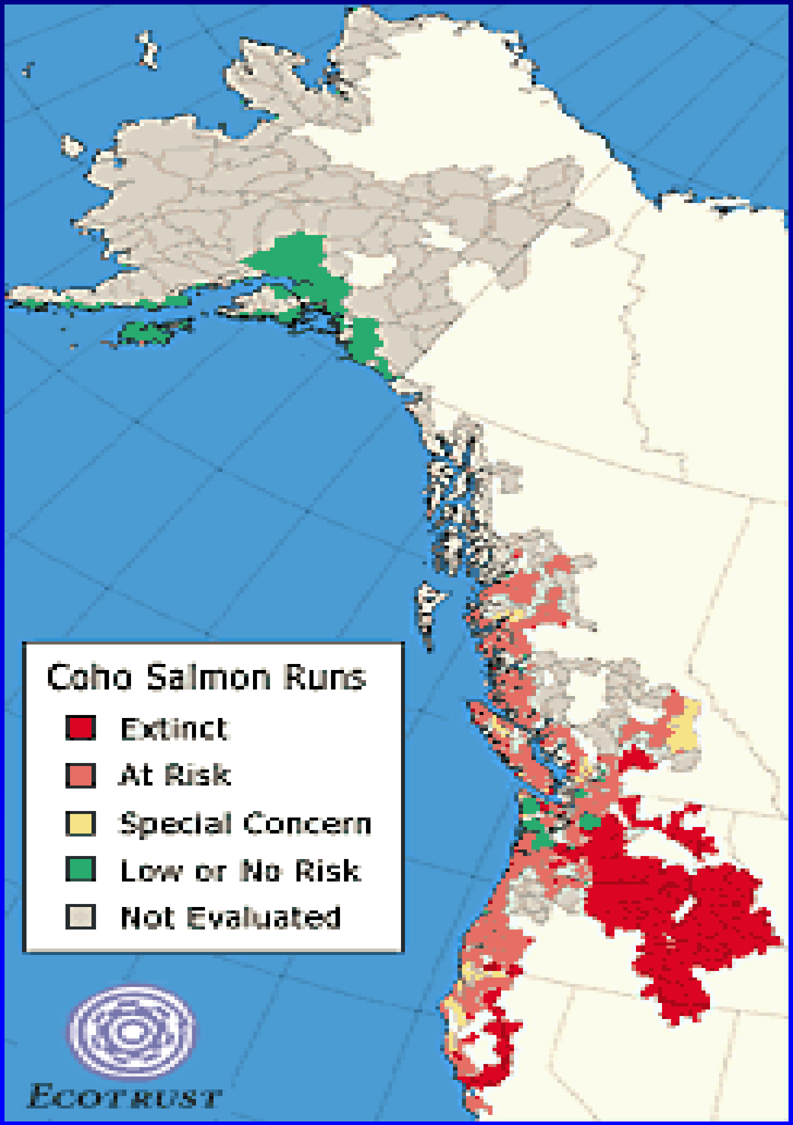
Peter S. Ross[1], Laurie Gallagher[1], Neil Dangerfield[1], Stacey Verrin[1], Keith Tierney[2], Tom G. Brown[1], Million Woudneh[3], and Chris Kennedy[2]

1-DFO-IOS and PBS, 2-Simon Fraser University and 3-AXYS Analytical Services

CUP in coho salmon habitat: how to tackle 27,000 km of coastline, 143.2 million hectares and 14 biogeoclimatic zones…?



Coho at risk?



- Spawning time – October to late February.
- Primary rearing/spawning location - Very small tributaries in Lower Fraser. Scattered distribution. Natal tributaries include sloughs and tidal channels of Fraser River estuary
- Rearing duration/location - 1-2 years; migrate to sea April-July.
- Age of migration to freshwater -2-3 years.

286 pesticides used in Pacific Region: *DFO priority list of 23 CUP by sector*

Urban	2,4-D; Carbaryl; Chlorothalonil; Diazinon; Diuron; Glyphosate; Malathion; MCPA; Quintozene; Triclopyr
Forestry	Carbaryl; CCA; Creosote; Fenitrothion; Glyphosate; PCP; Surfactants in *Bacillus thuringiensis*; Triclopyr
Agriculture	2,4-D; Atrazine; Captan; Chlorothalonil; Chlorpyrifos; Diazinon; Endosulfan; Ethalfluralin; Glyphosate; Pendimethalin; Simazine; Trifluralin

Urban salmon streams vulnerable to a variety of pesticide inputs

(Musqueam River, Vancouver)

Salmon-bearing streams or ‘agricultural drainage ditches’…?

(Nathan Creek, Lower Fraser Valley)

Three-year CUP project to characterize CUP in coho salmon habitat, and effects on olfaction and behaviour

- **Phase One: *habitat***
  - ✓ Establish PAC DFO priority CUP list (23)
  - ✓ Work with EC on priority list
  - ✓ Develop analytical methods (AXYS Analytical Services)
  - ✓ Assess CUP in coho salmon habitat: air, water, sediments
  - ❑ Assess CUP in juvenile coho
  - ❑ Assess in invertebrate prey/ sticklebacks?

- **Phase Two: *effects***
  - ✓ Establish PAC DFO CUP shortlist to assess effects (<12)
  - ✓ Set up methods to measure effects of CUP on olfaction and neurological responses in lab (SFU)
  - ✓ Conduct experiments in laboratory exposure setting
  - ❑ Compare effects thresholds to ‘real world’ levels measured in Phase One
  - ❑ Conduct study of effects of CUP on salmon *in situ*

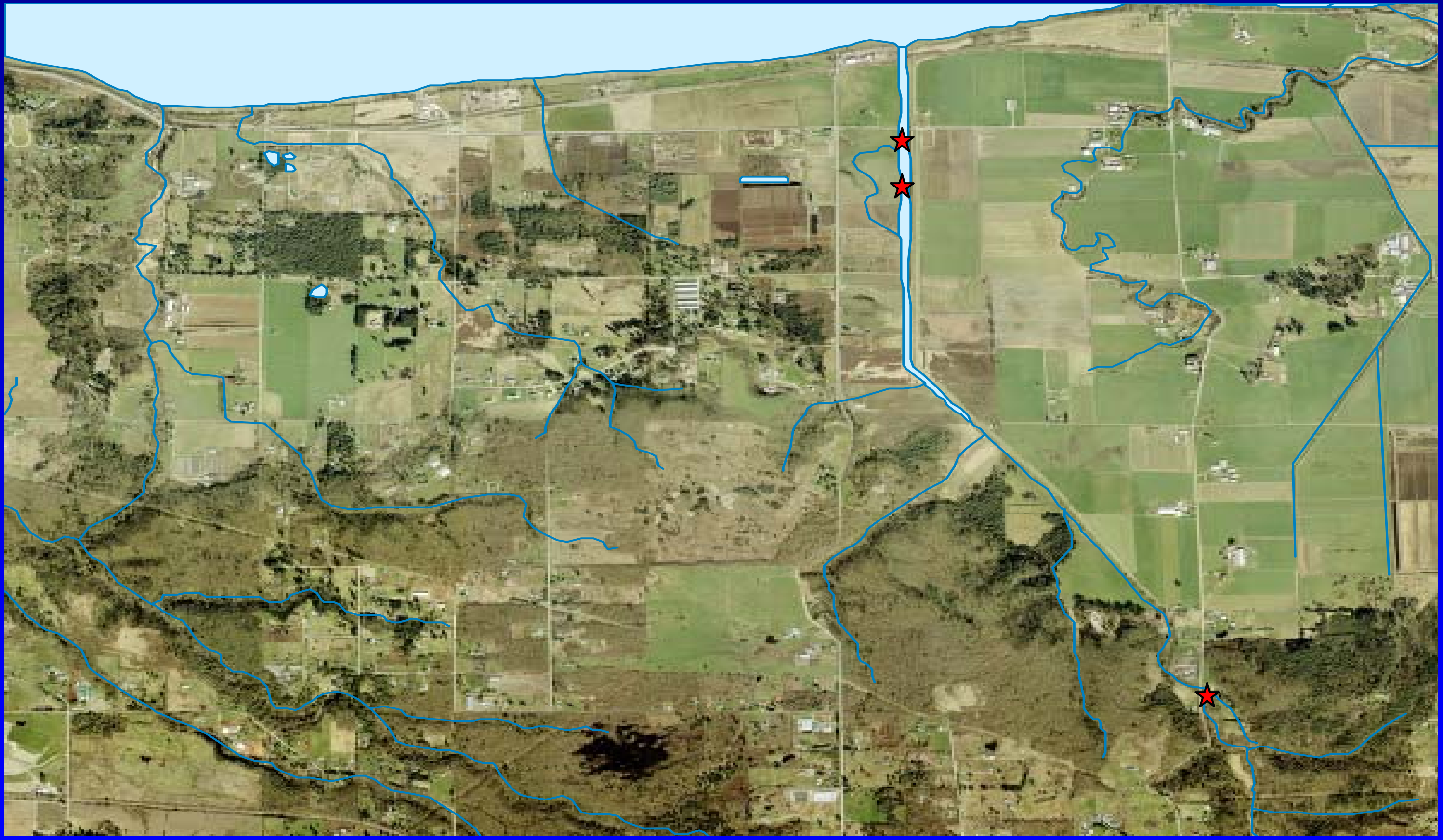
2003-04 CUP characterization in Coho habitat

- Samples collected in fall 2003 and spring 2004 from two streams: agriculutral and urban;
- Samples collected from reference site (CC Koeye R.) in fall 2004;
- Three sites per coho stream: upstream (‘reference’), near-field, and downstream of ‘impact’ site:
  - Water: 40 L carboys + 4 L amber bottle using submersible pump;
  - Sediments: modified bilge pump to remove 1 cm sediment or grab;
  - Fish: seine net or baited minnow trap (coho fry or sticklebacks);
  - Physical parameters measured: DO, turbidity, pH, conductivity, nitrates, temperatures.

- Preserved by:
  - sediments frozen (-20C);
  - Bulk water: 4 L water -> DCM; 4L-> DCM + acidifed; 40 ml frozen for glyphosate;
  - XAD extracted water: 20-40 L filtered at 0.7 um; neutral vs H_2SO_4 extracted, XAD-2 resin captured;
  - Filtrate frozen (particulate; -20C): POC.

- Analysis per site:
  - Pooled coho (1) + sediments (2) + water (2 bulk).

2003 'coho sites': agricultural influences (cranberry, blueberry, hobby farms)

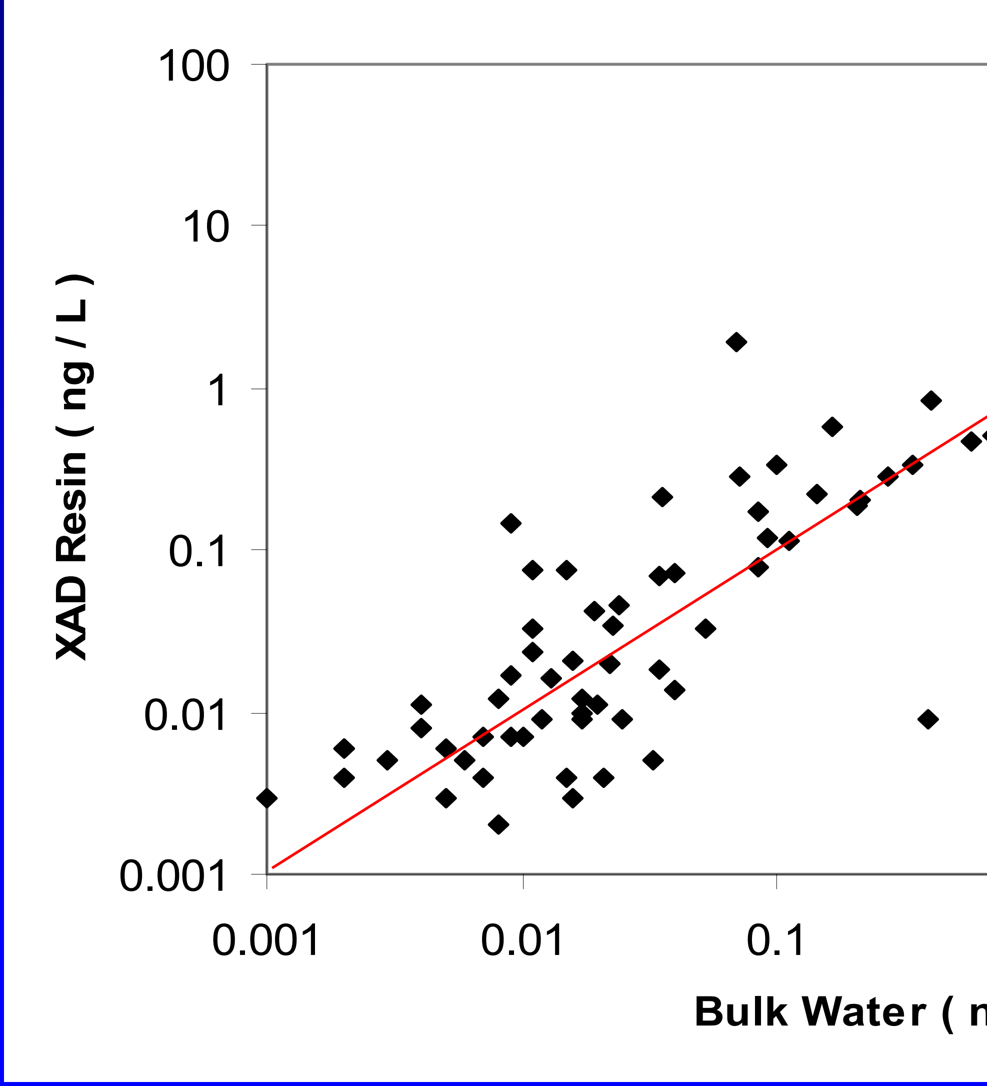


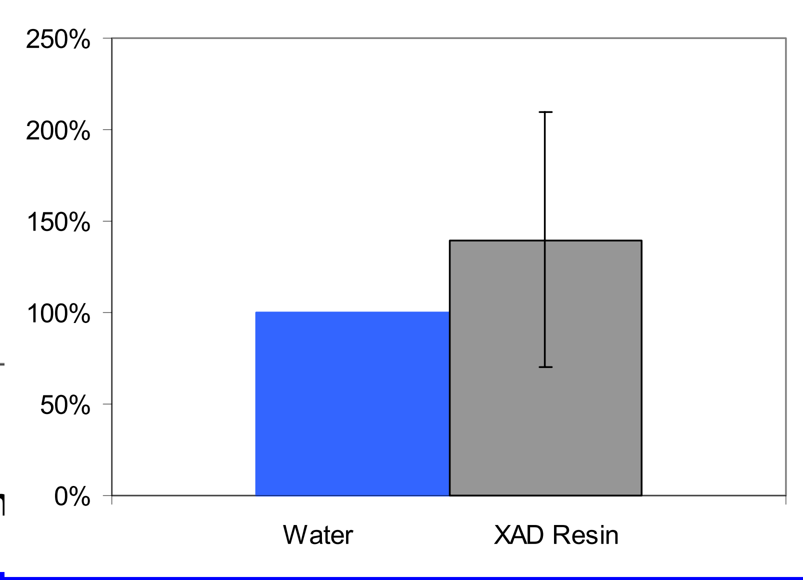
(Nathan Creek, Langley)

2003 'coho sites': urban influences (residential, golf)

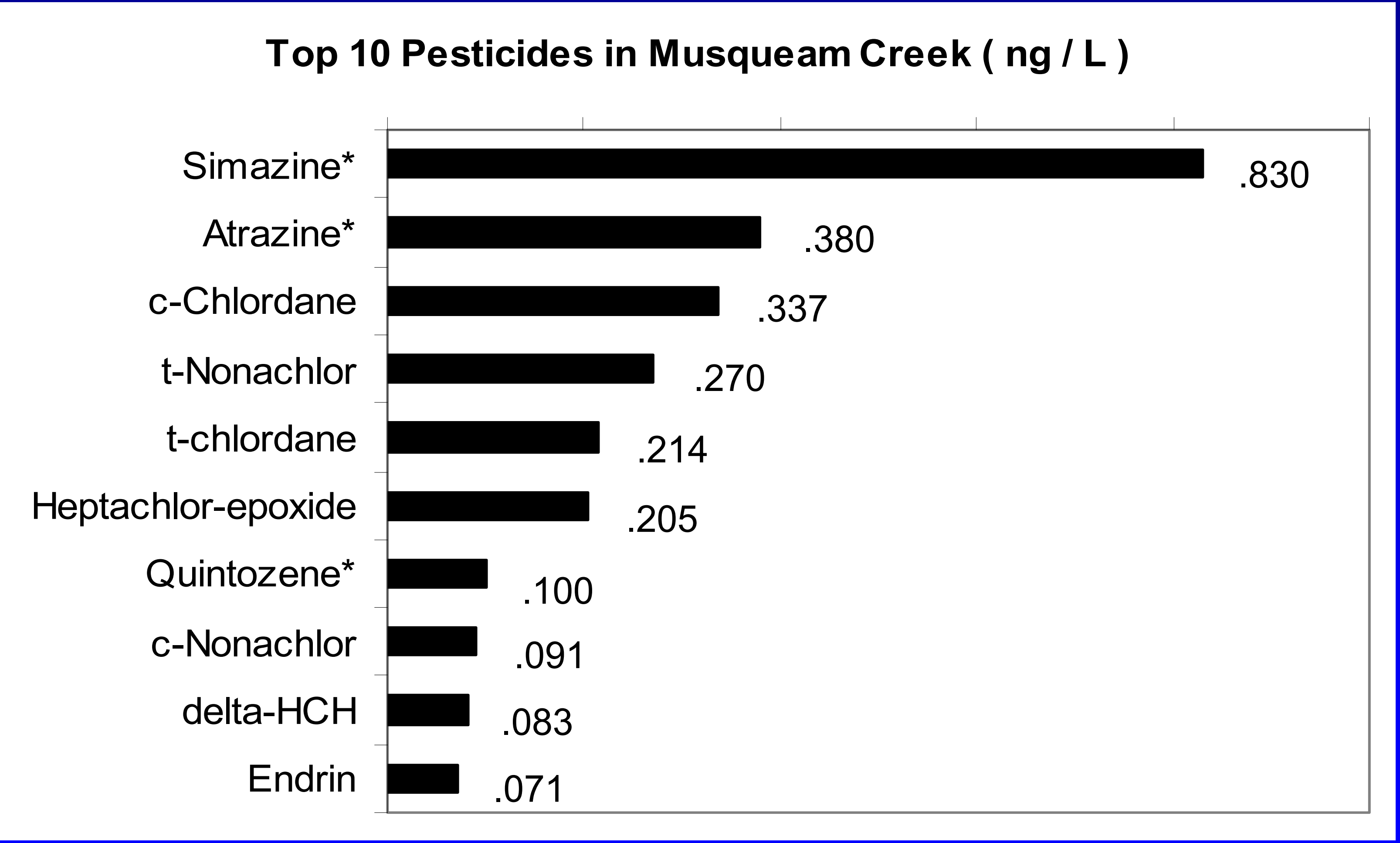
(Musqueam River, Vancouver)

Pesticide sampling: XAD extraction vs bulk water collection

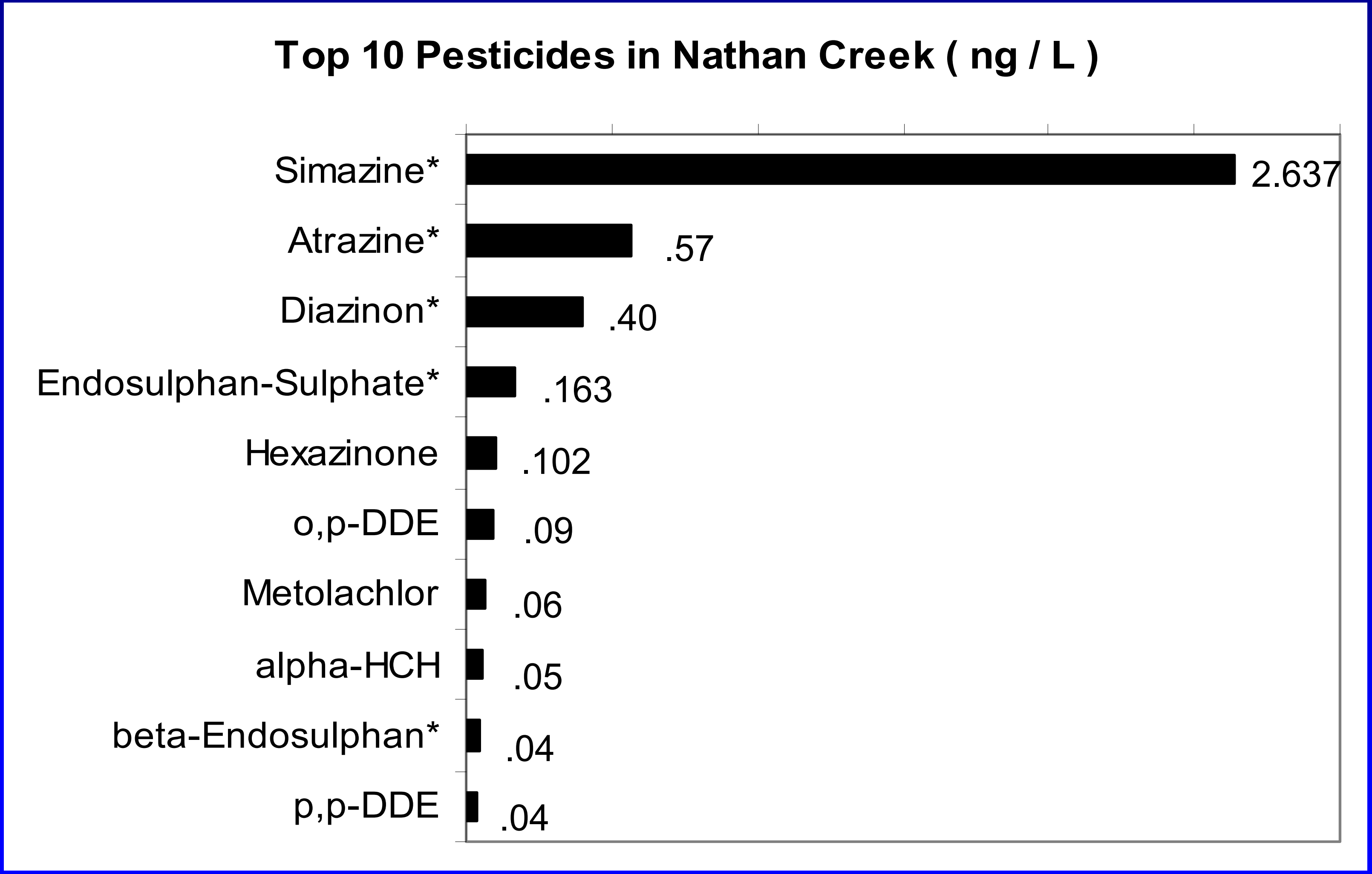




Top ten pesticides in urban coho stream water



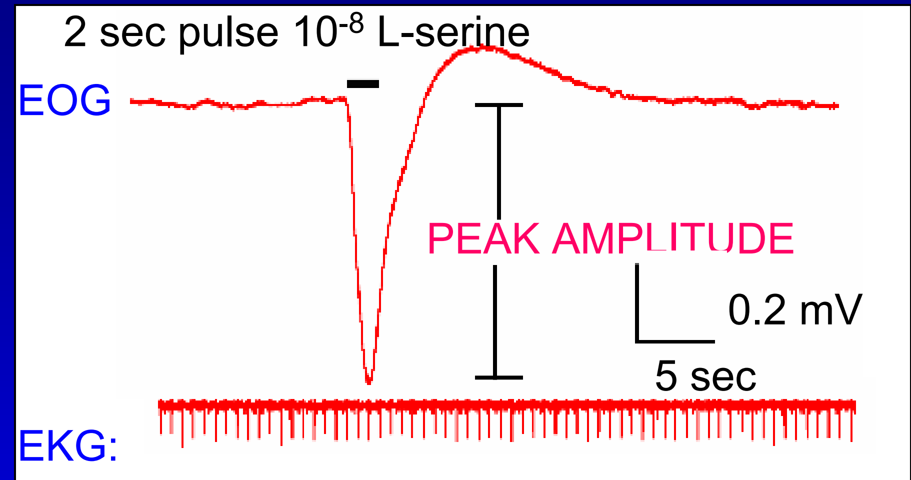
Top ten pesticides in agricultural coho stream water



SFU collaboration: Pesticide effects on olfactory responses in coho salmon

- Electro-olfactogram (EOG) measurements in coho salmon parr in combinations of single CUPs;
- Y-maze and avoidance of odorants following exposure to CUP;
- Risk assessment evaluation of field CUP measurements vs laboratory results (thresholds);
- Exposure of coho to complex (‘real world’) CUP mixtures extracted from candidate salmon streams.

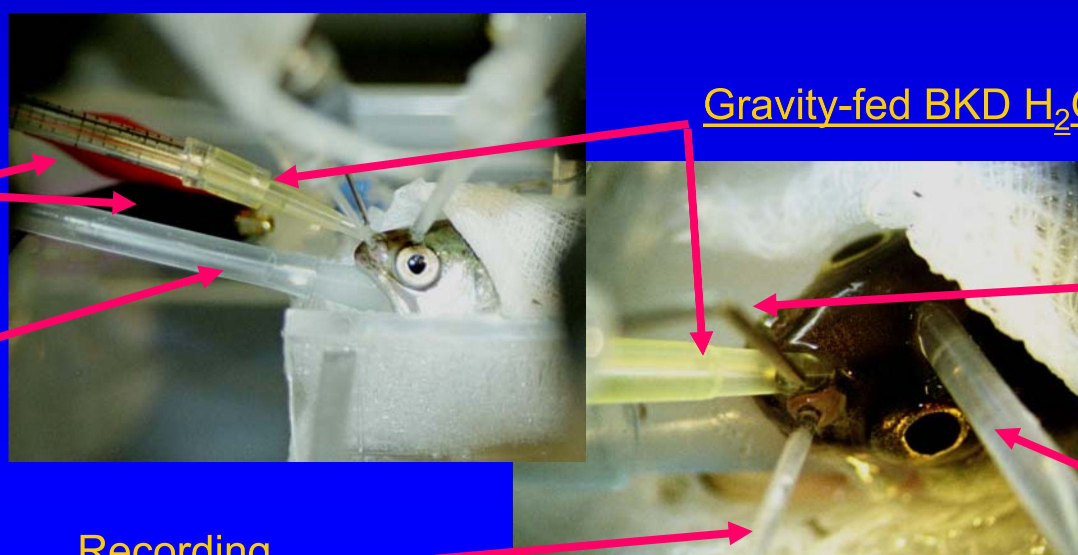
Carbamate Effects on Olfactory Periphery



The Electroolfactogram (EOG):

a multiunit voltage potential produced in response to odorant stimulation

Apparatus:



EKG Electrodes

Gravity-fed BKD H_2O/Serine Inflow

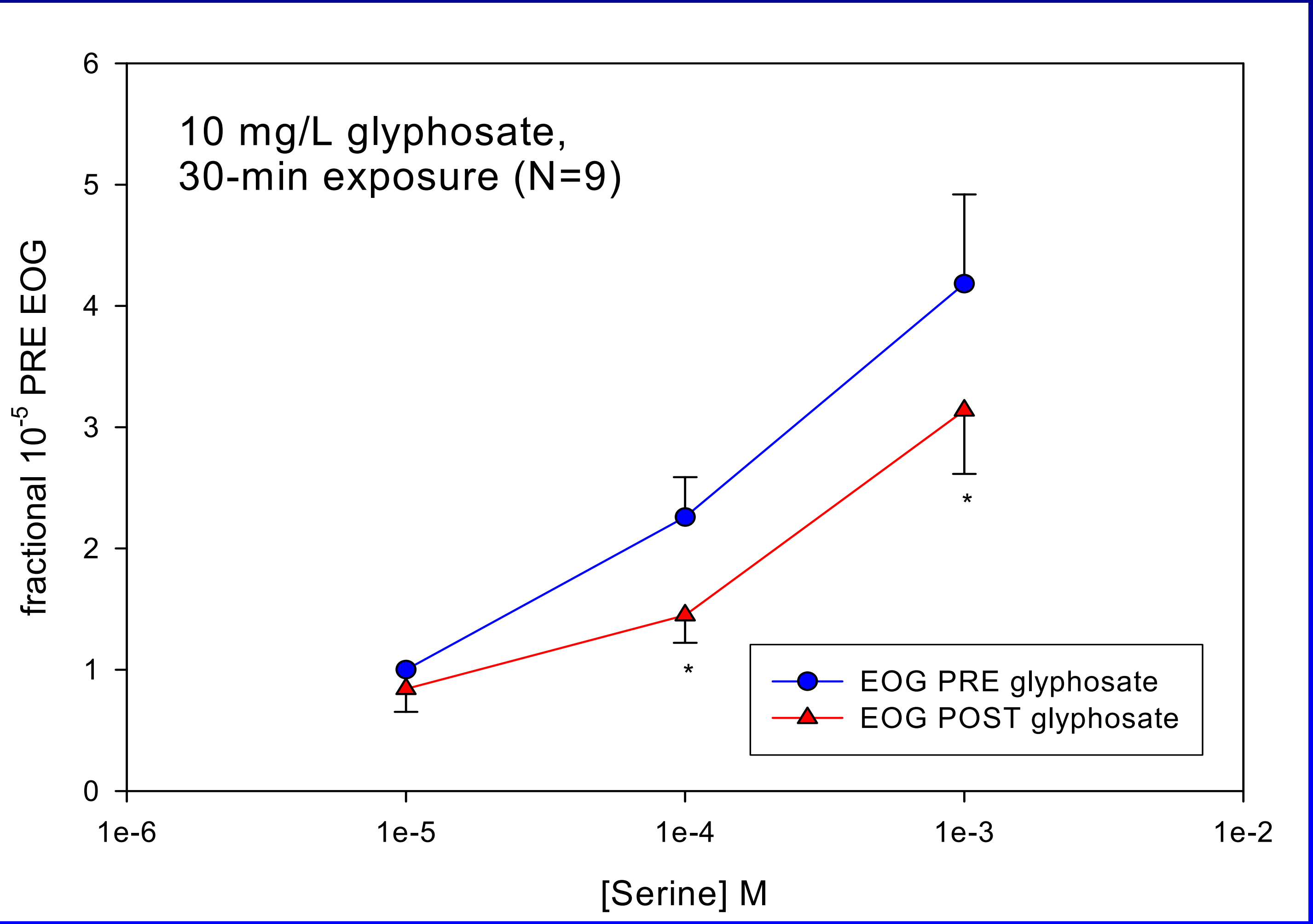
Chilled Anaesthetic

Pesticide Inflow

Ground Electrode

Recording Electrode

Glyphosate reduces EOG responses to odorant



(Tierney et al, SETAC 2004)

Collaborations

- *Environment Canada:* surveillance of surface and groundwater at 50+ locations in BC; seasonal samplings at our DFO 'salmon sites'.
- *Simon Fraser University:* Effects of 12 priority CUP on coho olfaction and behaviour (lab), risk assessment based on field results, and exposure to 'real world' mixtures of CUP.
- *AXYS Analytical Services:* development of methods to detect CUP in collaboration with DFO, EC and US sources.

Pesticides are relevant to terrestrial, freshwater and marine biota

Challenges (opportunities?) for DFO pesticide research

- How to assess interactive effects of pesticides used (‘real world’ mixtures);
- How to incorporate pulses associated with sporadic temporal uses;
- How to address aspects of pesticide behaviour in the aquatic environment (half-life, partitioning, bioaccumulation, fate, acute vs chronic toxicity);
- How best to develop and apply analytical techniques;
- How to assess impacts on different species (invertebrates, fish, marine mammals, species at risk);
- How to assess impacts in different habitat types (freshwater, brackish, marine);
- How to characterize behaviour and toxicity of degradation products of parent pesticides;
- How to address toxicity and fate of adjuvants (‘inert ingredients’) which are proprietary information.

Acknowledgements

- CERP/NPRF
- Terry Shortt
- HEB: Pat Lim, Brad Mason, Bonnie Antcliffe
- EC: Mark Sekela, Taina Tuominen, John Pasternak
- AXYS: Laurie Phillips and Corinne Hamilton

Well water analysis in Brookswood Aquifer

Vesna Furtula*, Heather Goble, Ken Hall*****

*Pacific Environmental Science Centre, Environment Canada
**Dept. of Civil Engineering, Environmental Engineering Group, UBC
***Institute for Resources, Environment and Sustainability, UBC and Dept. of Civil Eng, UBC

Abstract
The Brookswood aquifer, located in the Fraser Valley, is largely unconfined and considered highly susceptible to pollutants due to its large storage capacity and high infiltration / percolation rates.

Nitrate contributes to nutrient loading and subsequent water quality degradation. In general nitrate is becoming a widespread problem due to agricultural activities and development of rural areas that utilize sewage disposal systems.

One hundred wells within the Brookswood aquifer were tested for nitrate-nitrogen. Six percent of sampled wells exceeded the Guidelines for Canadian Drinking Water Quality (GCDWQ) of 10 mg/L nitrate-nitrogen. Nitrate concentrations above 10 mg/L carry an increased risk of methaemoglobinaemia in infants.

Five of the six wells with GCDWQ exceedances were clustered within a one-kilometre radius along with five clusters of large-scale greenhouse operations. Since high nitrate concentrations indicate contamination by domestic sewage or agricultural practices all well waters exceeding 10 mg/L were analyzed for Caffeine as well as general Gas Chromatography/Mass Spectrometry identification analysis.

Metalaxyl, a fungicide used on seedlings, was detected in one of drinking water wells located within 100 metre of a large greenhouse operation. The presence of Metalaxyl was confirmed and quantitated in two subsequent samplings of the same well. The analyses of pesticides in other well water in the area showed no presence of any pesticides.

Well Water Analysis in Brookswood Aquifer

Vesna Furtula*, Heather Goble**, Ken Hall***

*Pacific Environmental Science Centre, Environment Canada
**Dept. of Civil Engineering, Environmental Engineering Group, UBC
***Institute for Resources, Environment and Sustainability, UBC; and Dept. of Civil Eng, UBC

Environment Canada Environnement Canada

- **This project originated at UBC as part of Heather Goble's Master's degree.**
- **Idea:**

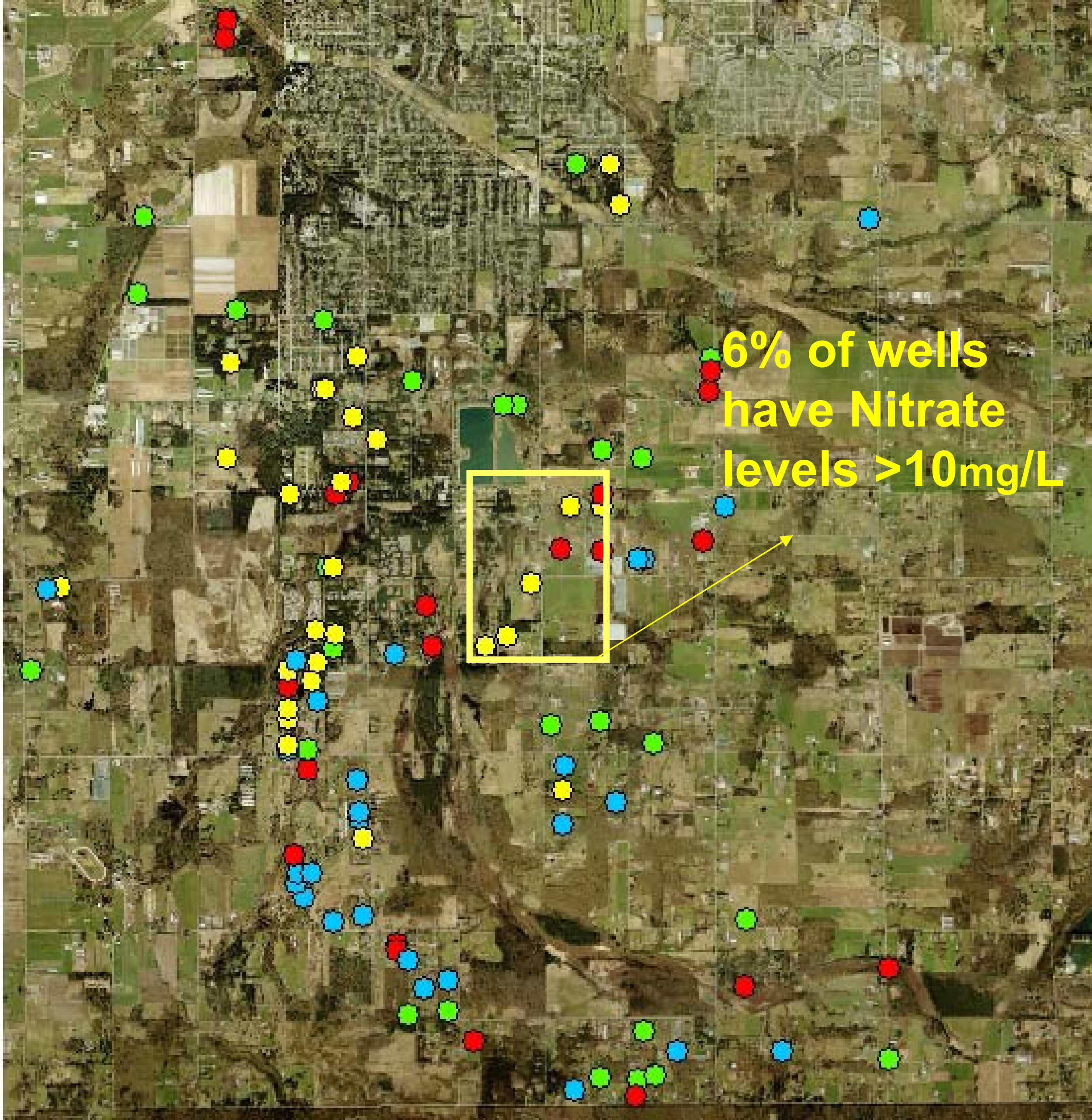
  Groundwater molecular tracers/contaminants that can be used to distinguish the contribution of sources for well water with high nitrate levels.

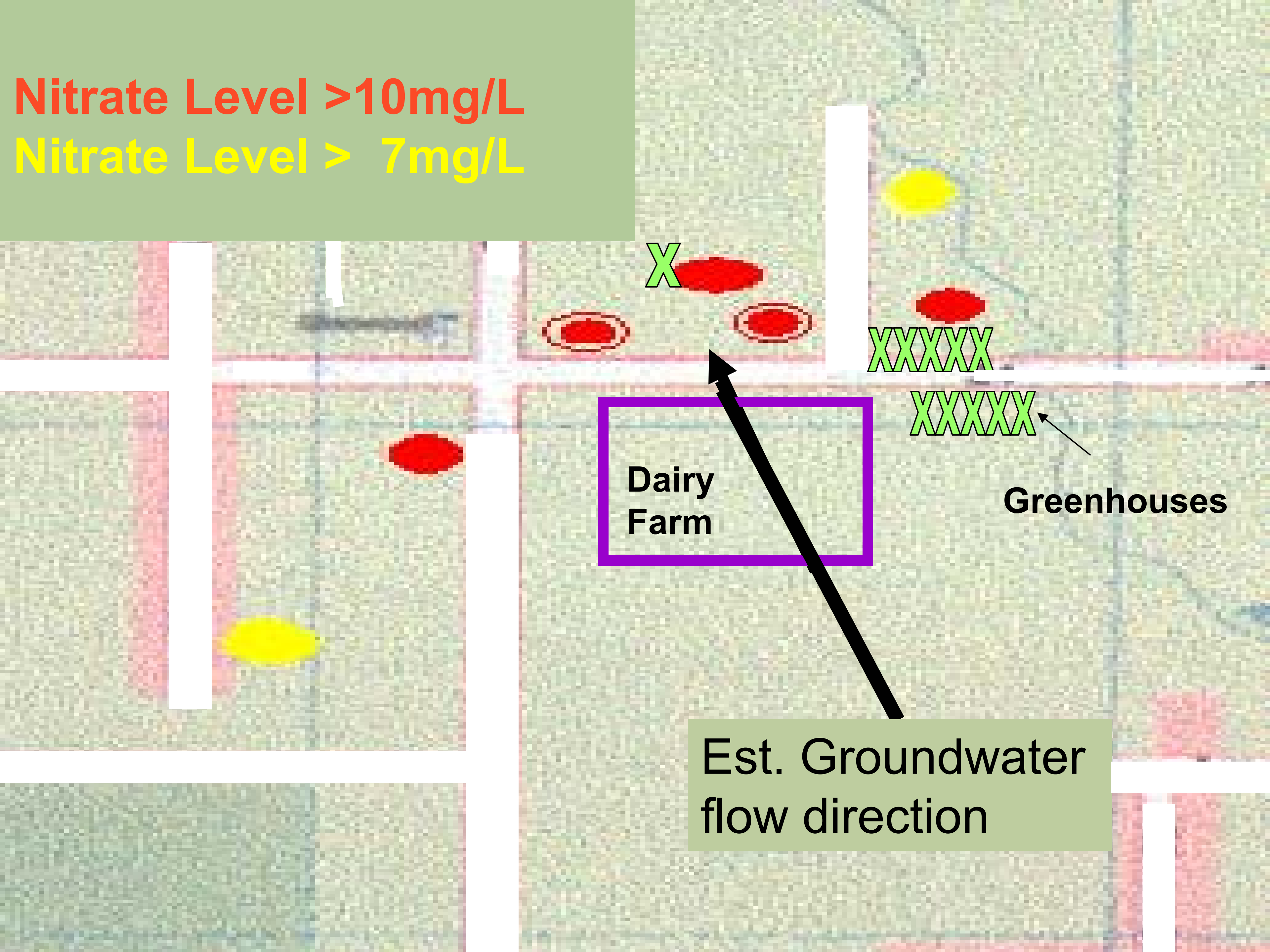

West Vancouver
North Vancouver
Port Moody
Port Coquitlam
Coquitlam
Pitt Meadows
Maple Ridge
Vancouver
Burnaby
1
7
New Westminster
Richmond
Fort Langley
Surrey
1A
Langley
10
99
Delta
17
White Rock

103 WELLS

Well Depths

0 – 30 ft
30 – 60 ft
60 – 140 ft
> 140 ft




Nitrate Level >10mg/L
Nitrate Level > 7mg/L
X
XXXXX
XXXXX
Dairy Farm
Greenhouses
Est. Groundwater flow direction


well

Period of Study: September 2003 to September 2004

Primary Parameters:

- **Nitrate**
- **O-Phosphate**
- **Chloride**
- **Electrical conductivity**
- **Total metals**
- **Microbial count**

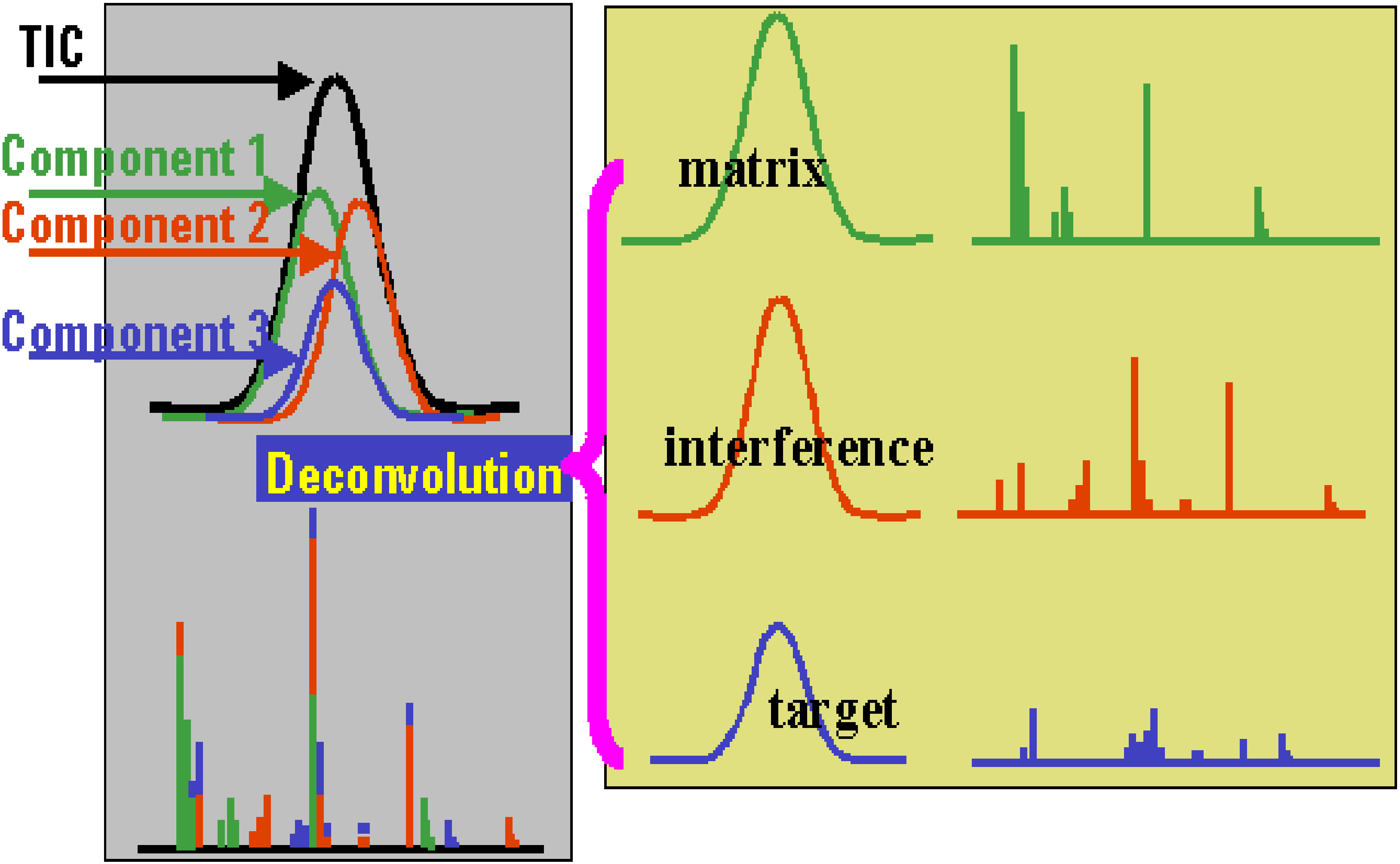
For the wells with nitrate level exceeding guidelines:

- **Caffeine**
- **Bacterial Source Tracking**
- **TIC/TOC and DIC/DOC**
- **GC/MS Identification (pesticides and others)**

- **GC/MS identification**
- **Spectra in SCAN mode**
- **Identification of peaks by library matching**
- **Pesticide identification:**
  Agilent deconvolution reporting software (for 540 pesticides)

TIC & Spectrum

Deconvoluted peaks and spectra



RESULTS

Caffeine:

- Analyzed at a two-month interval
- No caffeine was found
- MDL = 2 ng/L

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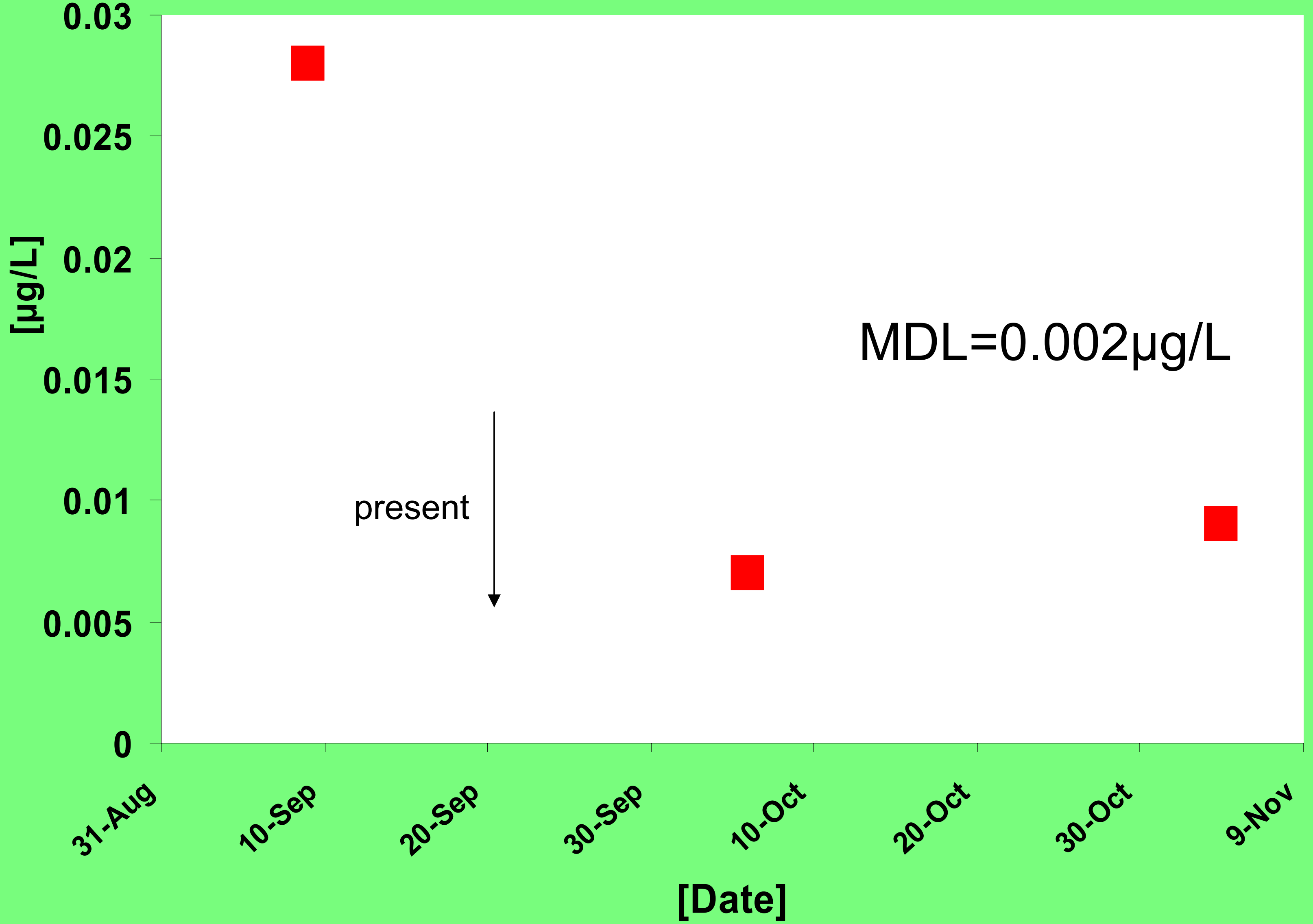
Metalaxyl in the well (2004)



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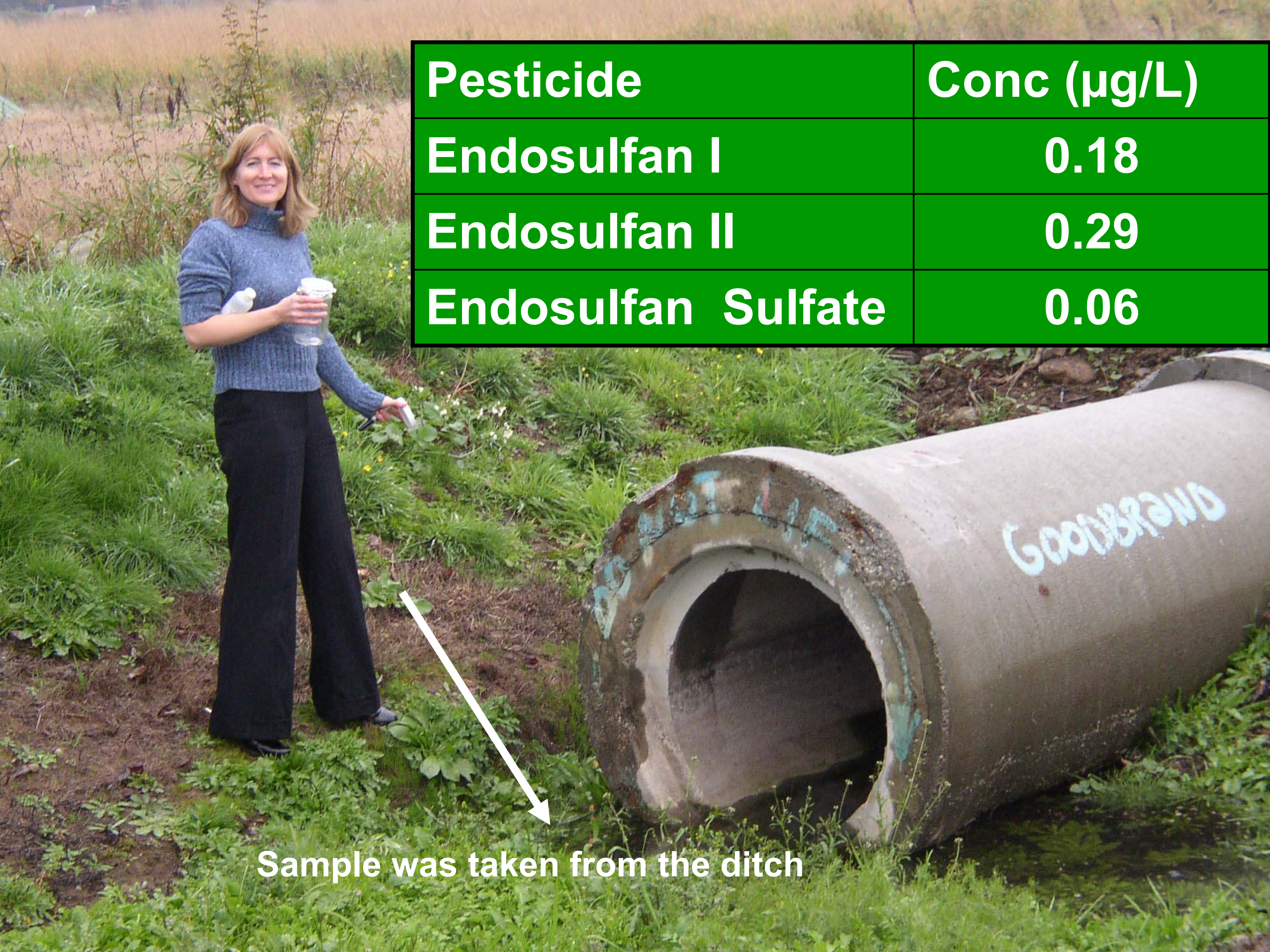
Pesticide	Conc (µg/L)
Endosulfan I	0.18
Endosulfan II	0.29
Endosulfan Sulfate	0.06



CONCLUSIONS

Agricultural influences detected in well water and surface water:

- **Metalaxyl was found in the well water**
  - **May be more than one source of Metalaxyl**

- **Endosulfan was found in the surface water**

Proposed methodology, GC/MS ID combined with deconvolution reporting software, is a very good technique for detecting molecular tracers/pesticides

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II. POSTER PRESENTATIONS

(in alphabetic order of first author's last name)

PESTICIDE EXPOSURE AND REPRODUCTIVE EFFECTS IN TWO SPECIES OF NATIVE AMPHIBIANS USING AGRICULTURAL HABITAT, SOUTH OKANAGAN, BRITISH COLUMBIA

Sara L. Ashpole, Christine A. Bishop, John Elliott, and Laurie Wilson
Canadian Wildlife Service. 5421 Robertson Rd., Delta, British Columbia, V4K 3N2, Canada.
(sashpole@uoguelph.ca; CAB.Bishop@ec.gc.ca; jelliott@ec.gc.ca; lwilson@ec.gc.ca)

ABSTRACT

The Okanagan valley in BC is an intensive agricultural area where 80% of the natural wetlands and riparian zones have been developed. Due to the presence of many rare species and the high potential for multiple exposure effects to pesticides and the lack of natural habitat, it is necessary to assess the risk of amphibian populations to the impact of pesticides. In 2003/2004 forty ponds, including 14 conventional and 9 organic agricultural ponds, were surveyed to determine breeding adult and larval productivity and relative population densities. Historic PCB and organochlorine contaminant levels were measured in sediment samples from eleven ponds. All samples had non-detectable PCB levels and with the exception of DDT and its metabolites, relatively low to non-detectable organochlorine pesticides. Sediment concentrations of DDT (0.24 - 47 ng/g d.w. (dry weight)), DDE (2.52 1938.9 ng/g d.w.), and DDD (5.26-1334.4 ng/g d.w.) had the highest levels detected. In 2004, early amphibian stages of development were investigated using two COSEWIC listed species; the Great Basin Spadefoot (Spea intermontana) and the Western Toad (Bufo boreas). Enclosures with eggs were placed in either conventional orchards (N=2) and exposed to realistic pesticide applications, or in organic orchards (N=3). Current use pesticides include azinphos-methyl, carbaryl, diazinon, endosulfan, and pirimicarb. Water samples for pesticides were conducted at standard times and after known spray events. Hatching success, tadpole survival to two days-post hatch, and developmental abnormalities were recorded. Substantial mortality was observed in both species at one of our conventional sites (92% and 100%) whereas, mortality was very low at one of our organic sites (3% and 4%). Mortality among our remaining sites ranged between 15% and 38%. A third year of inventories and reproductive studies examining amphibian development and a risk assessment of agricultural ponds will be conducted in 2005.

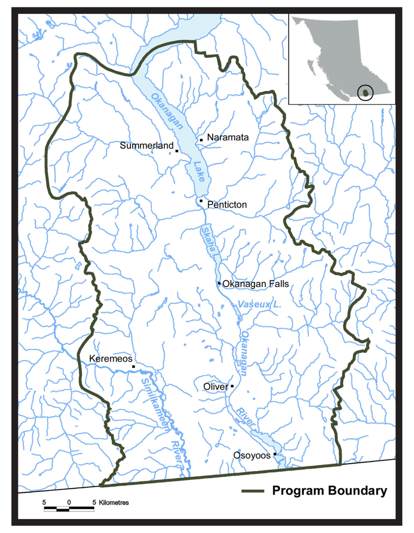
INTRODUCTION

THE OKANAGAN VALLEY

- rare and unique endangered ecosystem, with less than 20% of wetlands remaining
- little scientific data on known breeding ponds
- high current and historic use of contaminants
- very little known on the potential effects of these chemicals on amphibians

Spring blossom

Aerial photograph of Osoyoos



The South Okanagan

SPECIES AT RISK

Nationally Endangered
Tiger Salamander
Threatened
Great Basin Spadefoot Toad
Species of Special Concern
Western Toad
Not at Risk
Pacific Treefrog
Columbia Spotted Frog
Long-toed Salamander

Spadefoot Toad

Western Toad

Introduced
American Bullfrog
Extirpated
Northern Leopard Frog

PURPOSE

Due to the presence of many rare species and the high potential for exposure to pesticides and the lack of natural habitat, it is necessary to assess the risk of amphibian populations to the impact of pesticides.

The objectives of the study is to:

- inventory and determine the relative abundance and distribution of native amphibians
- assess exposure and effects of current in-use and historic pesticides on developing amphibians in agricultural habitats of the South Okanagan.

MATERIALS & METHODS

SPECIES INVENTORY

Study Sites

Every possible pond in the study area was surveyed (N=53) for adults and breeding productivity, to determine:

- species composition, and
- relative population densities

Ponds could be classified as:
conventional farm (n = 15)
organic farm(n = 8)
grazing (n = 5)
high elevation (n = 14)
miscellaneous (golf holes; residential)(n = 11)

Agricultural pond showing seasonal filling due to agricultural run-off.

Non-lethal Survey Techniques

- auditory call counts
- dip netting
- active systematic searching
- partially sub-mergent minnow traps
- incidental encounters
- road kill and tissues from mundane individuals were collected and archived

Site and Habitat Assessment

- habitat parameters, including: vegetation assessment, pond characteristics (perimeter, area, depth),local landscape features (distance to road, crops etc.) land use and modification, detection of fish
- standard water chemistry analysis
- analysis for organochlorines, PCBS, and trace metals in sediment (N=11)
  - samples had non-detectable PCB levels, and relatively low to non-detectable OC pesticides, with the exception of DDT and its metabolites, sediment concentrations (ng/g dry weight):DDT (0.24–47.0), DDE (2.5 – 1938.9), DDD (5.26-1334.4)

REPRODUCTIVE STUDY

Design

Eggs collected from reference sites were placed in nitex enclosures in either conventional (N = 2) or organic ponds (N = 3).

Pond located on a Test site (left) showing enclosure location, natural vegetation buffer, and proximity to crop. Pond located on an Organic site (right) with greater natural vegetation.

Sites were visited every 48hrs, and developing embryos assessed for:

- egg mortality
- tadpole survival
- abnormalities
- at two days post-hatch the tadpoles were fixed in formalin

Study Species

Spadefoot Toad

- each egg mass was divided into five sub-samples and a portion of each mass placed in enclosures at each site
- small clutches of 5-80 eggs, hatching in 1- 2 days and transformation in 3-4 weeks

Western Toad

- a single mass was divided among cages
- 1000s eggs in a mass, hatching in 3 - 12 days, and transformation in 6 - 8 weeks

Sampling

Water Chemistry

- sampled at 2 days post egg entry

Contaminant sampling

- standard 24hrs post egg entry for carbamates and organophosphates
- as soon after known spray events including carbary, endosulfan, and pirimicarb

ACKNOWLEDGEMENTS

We would like to thank the private landowners, S.Black, O.Dyer, K.McNaughton, B.Purvis M.Sarell, W.Schebel and I.Smith for their assistance.

RESULTS

SPECIES INVENTORY

- Reproduction was observed at few sites
- Fish were detected in 18 of 47 natural ponds, 12 of these sites had no reproduction detected and rarely were auditory calls heard
- In both years the highest densities of tadpoles were observed at 3 conventional farms
- In 2003, a single pond with Tiger Salamanders experience high mortality, zero were observed at this site in 2004

Species	Number of Sites Observed			
	2003, N = 23 sites		2004, N = 53 sites	
	Any Stage	Reproductive	Any Stage	Reproductive
Treefrog	20	13	45	18
Spadefoot Toad	9	6	23	9
Western Toad	7	3	3	1
Columbia Spotted Frog	5	3	8	1
Tiger Salamander	4	3	3	1
Bullfrog	3	0	2	2
Long-toed Salamander	1	1	8	4

Figure 1. Number of study sites survayed in each year and the presence of amphibian species ay any stage and number of sites with reproductive success.

REPRODUCTIVE STUDY

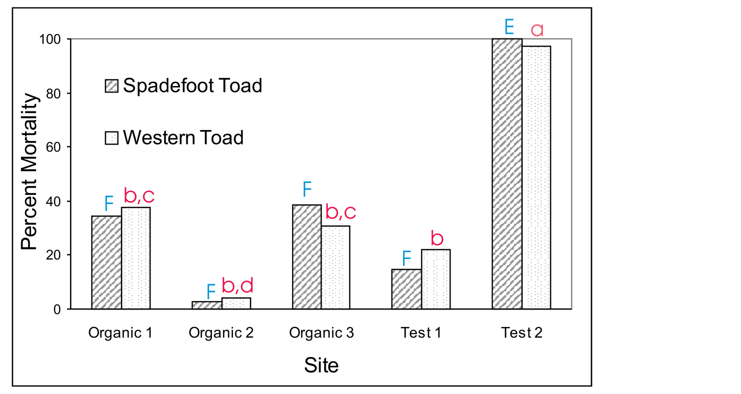


Figure 2. Species mortality at two days post hatch. Western Toad mortality was significantly greater at the Test 2 site (a) compared to all other sites (b) ($F(4,20) = 40.9$, $p < 0.005$) and mortality was greater at the Organic 1 and 3 site (c) compared to Organic 2 site (d). Spadefoot Toad mortality was significantly greater at the Test 2 (E) site compared to all other sites (F) ($F(4,20) = 19.4$, $p < 0.005$. In the spadefoot toad. subdivided egg masses did not significantly contribute to mortality($F(4,20) = 10.36$, $p = 0.83$).

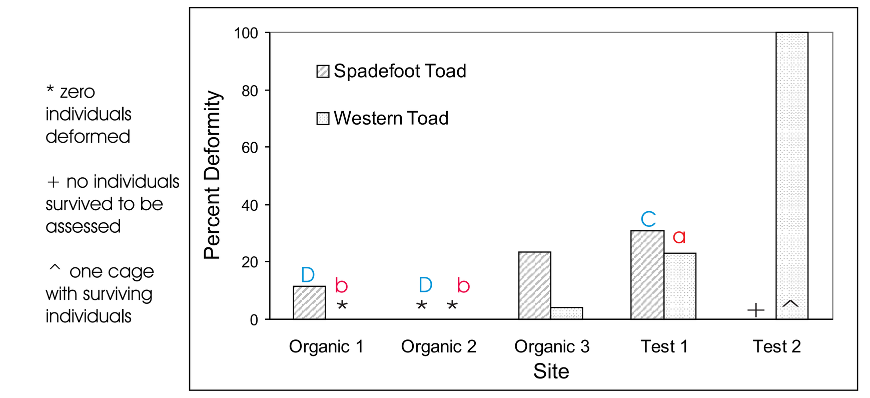


Figure 3. Species abnormalities at two days post hatch. Western Toad deformities were significantly greater at Test site 1(a) compared to Organic site 1 & 2 (b) ($F(3,16) = 4.7$, $p < 0.0\_15$) Spadefoot Toad deformities were significantly greater at Test site 1(C) compared to Organic site 1 and 2 (D)($F(4,15) = 0.64$, $p < 0.64$). Note: Spadefoot toads from Test site 2 preclude statistical analysis ($N = 1$).

DISCUSSION & CONCLUSION

Enormous effort was focussed on identifying amphibian breeding ponds. In the most Southern study region, all of the ponds can be classified as either agricultural or miscellaneous. With the exception of Native Lands to the east, almost no natural habitat exists. Identifying that amphibians in this region are under considerable environmental stress from habitat modification, including agricultural use.

Pesticide and irrigation management may impact amphibians breeding in these temporary ponds. These practices result in variable water availability and coincidentally affect the timing of local breeding, even between ponds within a close proximity to each other. Moreover, spray exposure between ponds can also be highly variable, making it challenging to assess risk.

Our study presents data that supports agricultural ponds as important breeding habitat for local amphibians and that realistic pesticide application during early stages of amphibian development may result in increased risk abnormalities.

In 2005, we plan to continue lowland amphibian inventories and site identification, expand our in situ cage studies to include additional amphibian species, and consider a microcosm study in agricultural test orchards.

ASSESSING CHLORINATED HYDROCARBONCONCENTRATIONS IN PREY AND PREDICTING ACCUMULATION IN EGGS OF PEREGRINE FALCONS (FALCO PEREGRINUS)

Environment Canada   Environnement Canada

J. E. Elliott[1], M. J. Miller[2], L. K. Wilson[1]

[1] Canadian Wildlife Service, Pacific Wildlife Research Centre, 5421 Robertson Rd., RR # 1, Delta, British Columbia, V4K 3N2, Canada

[2] Iolaire Ecological Consulting, 7899 Thrasher St., Mission, British Columbia, V2V 5H3, Canada

Abstract

Peregrine falcons now breed successfully in most areas of North America from which they were previously extirpated. The loss during the mid-part of the last century of many of the world's peregrine populations was largely a consequence of impaired reproduction caused by the effects of DDE on eggshell quality and embryo hatchability. Population recovery has been attributed to re-introduction efforts, coupled with regulatory restrictions on use of organochlorine pesticides. Peregrines have not returned to breed in some areas, such as the Okanagan Valley of British Columbia. That region has been extensively planted in fruit orchards which were treated annually with DDT during the early 1950s to the 1970s. Ongoing contamination of avian species, including potential peregrine prey, inhabiting orchards has been documented. In response to an initiative to release peregrines around the city of Kelowna in the Okanagan Valley, we collected potential peregrine prey species and analyzed whole bodies for chlorinated hydrocarbon residues. We used a simple bioaccumulation model to predict concentrations of DDE in peregrine eggs using concentrations in prey and estimates of dietary makeup as input. Peregrines would be expected to breed successfully only if they fed on a diet primarily of doves. Feeding on as little as 10% of other species such as starlings, robins, gulls and magpies would produce DDE concentrations in peregrine eggs greater than the threshold of 15 mg/kg. We also estimated the critical concentration of DDE in total prey to be about 0.5 mg/kg, one half of the previous most conservative criterion for peregrine prey. Critical concentrations of dieldrin and PCBs in peregrine prey are also suggested.

Introduction

- Many peregrine (*Falco peregrinus*) populations extirpated in last century by DDE effects on reproduction (Anderson & Hickey,1972)
- Most populations now recovered following DDE restrictions & intensive management (Cade et al 1988)
- Peregrines still do not breed in British Columbia interior (Rowell et al 2000)
- In Okanagan Valley (Fig. 1), peregrines once a common breeder
- DDT and metabolites (r-DDT) still high in Okanagan foodchains, particularly orchards (Elliott et al 1994, Harris et al. 2000)
- Privately funded program released juv. peregrines 1998-2001 at Kelowna
- No local breeding to date.

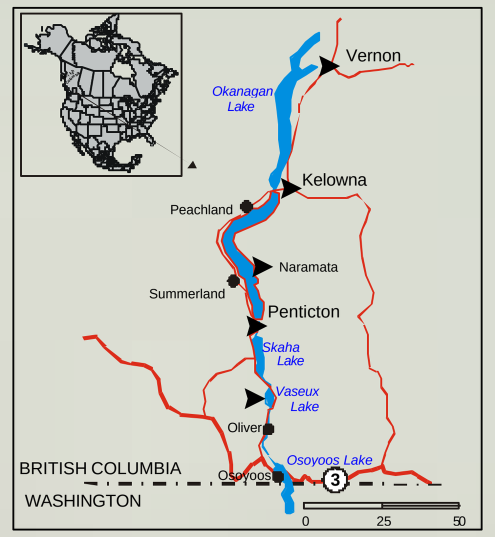


Fig. 1. South Okanagan Region of British Columbia, Canada. ➤ = Sample collection sites for peregrine prey assessment, 1998 – 2002

Objectives

- Assess contaminant burdens in prey from the Okanagan Valley & potential to cause adverse reproductive effects in Peregrines
- Evaluate use of biomagnification approach to determine critical concentrations of contaminants in prey

Materials and Methods

Study area

- Potential prey collected in the Okanagan Valley near Kelowna (Fig. 1)
- Mixed fruit orchards described previously (Elliott et al., 1994)
- Non-orchard habitats: sagebrush grassland, cattle pasture, cattail wetlands, and a landfill for urban refuse.

Sample collection

- Samples stored on ice then frozen (-20 °C), shipped to National Wildlife Research Centre (NWRC, Ottawa, ON).

Chemical analyses

- Carcasses pooled as groups of conspecifics or closely related taxa & analyzed for organochlorine (OC) pesticides and polychlorinated biphenyls (PCBs) at NWRC, by GC/MSD

Data analysis

- Bioaccumulation equation:
  - Y_{PEFA} = BMF [F1(X1) + F2(X2)…+ Fn(Xn)]
    - Y_{PEFA} = Contaminant concentration in peregrine falcon egg
    - BMF = Biomagnification factor for a given contaminant
    - F1 = Fraction of item one in diet
    - X1 = Contaminant concentration in item one
    - Fn = Fraction of the nth item in diet
    - Xn = Contaminant concentration in the nth item in diet
- BMFs from herring gull (*Larus argentatus*; Braune and Norstrom, 1989) and osprey (*Pandion halieetus*; Henny et al, 2003)
- Used published accounts of peregrine diets (e.g. Baril et al., 1990; Court et al., 1996, Corser et al., 1999), to simulate a continuum of exposure from a low DDE diet of 100 % doves to a high DDE diet of 50% gull species
- Compared calculated egg concentrations to critical values derived by Newton et al (1989) and Peakall et al (1990).

Results

OCs in Prey homogenates

- DDE low in rock doves; much higher in other prey species (Fig 2)
- Gulls from landfill higher concentrations of other OCs & PCBs (Table 1)
- Other OCs < D.L. (<0.0009 mg/kg wet wt) in most samples, e.g.: tetrachlorobenzene, pentachlorobenzene, hexachlorocyclohexane, photomirex, mirex, oxychlorostyrene, tris(4-chlorophenyl)methanol.

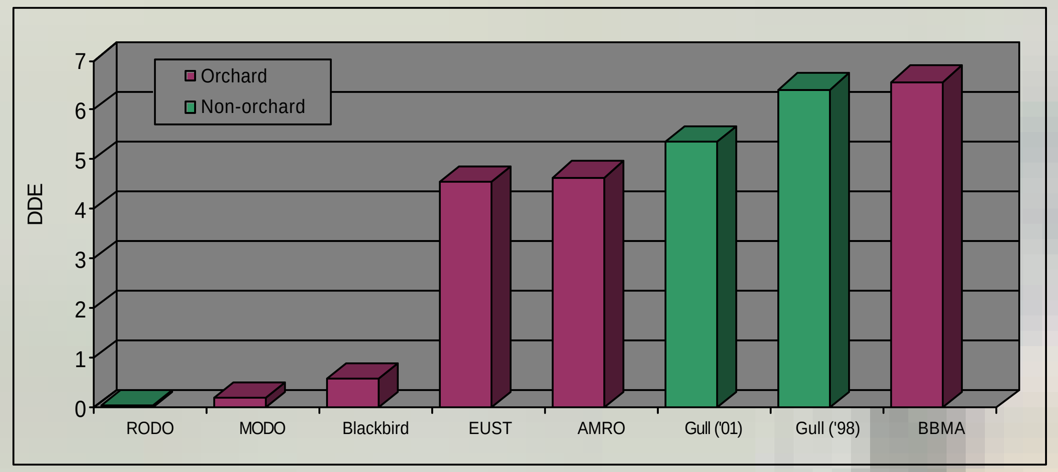


Fig. 2. DDE concentrations in carcass homogenates of potential Peregrine Falcon Prey from the Kelowna region of British Columbia, 1998, 2001

TABLE 1. Mean organochlorine concentrations (mg/kg wet wt) in potential prey of Peregrine Falcons collected in three habitat types summers 1998 and 2001, Kelowna, BC. Residue levels reported were not corrected for laboratory internal standard recoveries

Species [a]	N	% H20	% Lipid	DDT	DDE	DDD	DDE: DDT	Σ chlordane	Dieldrin	Hept. Epox.	HCB	Σ PCBs
Non-orchard [b]												
Gull	10	65.6	12.1	0.004	6.39	TR	1600	0.065	0.05	0.017	0.005	0.321
Gull	10	62.2	7.8	0.024	5.33[f]	TR	222	0.067	0.121	0.02	0.007	0.369
Non-orchard												
RODO	8	65.1	8.8	TR	0.016	TR	--	ND	ND	ND	TR	0.001
Orchard												
MODO	5	67.6	7.0	0.018	0.151	0.005	8.4	ND	ND	ND	TR	TR
Blackbird [c]	4	68.1	5.2	TR	0.567	TR	--	0.008	0.003	0.001	TR	0.007
EUST	6	71.6	4.5	0.002	4.52	TR	2260	0.014	0.045	0.003	TR	0.006
AMRO	8	72.6	5.24	0.068	4.64	0.022	68.2	0.009	ND	0.001	TR	0.01
BBMA	2	69.4	3.3	0.031	6.55	0.015	211	0.021	0.015	0.002	TR	0.012

[a] - AMRO - American Robin (*Turdus migratorius*), MODO - Mourning Dove (*Zenaida macroura*), EUST - European Starling (*Sternus vulgaris*), RODO - Rock Dove *Columba livia*), BBMA - Black-billed Magpie (*Pica pica*).
[b] Kelowna urban landfill site
[c] Blackbird: Red-winged Blackbird (*Agelaius phoencieus*), N = 2; Brewer's Blackbird (*Euphagus cyanocephalus*), N = 2

Prediction of OCs in peregrine eggs

- DDE ranged from 0.544 mg/kg with diet of 100% rock dove to 283 mg/kg with diet of 50% gull (Table 2)
- Mean concentration of starling, robin, magpie and gull in the diet was ~ 5 mg/kg
- With BMF of 34, the presence of any single item or amalgam of those taxa constituting 10% of the diet would produce eggs > critical concentration of 15 mg/kg DDE (Fig 3).

Table 2. Calculation of DDE concentrations in eggs of peregrine falcon from concentrations in potential prey items collected in 2001 from the Okanagan Valley of British Columbia, Canada. See text for details.

Species[a]	RODO	MODO	BB spp	EUST	AMRO	BBMA	Gull spp	Calculated Mean DDE in prey	Calculated DDE in PEFA eggs BMF = 34	Calculated DDE in PEFA eggs BMF = 87
DDE measured in prey (mg/kg ww)	0.016	0.15	0.6	4.5	4.6	6.6	6	3.2	111	278
Fraction of diet (%)	100	0	0	0	0	0	0	0.016	0.544	1.39
"	75	25	0	0	0	0	0	0.05	1.7	4.35
"	75	10	10	2.5	2.5	0	0	0.315	10.7	27.4
"	85	5	5	5	0	0	0	0.28	9.52	24
"	90	5	0	0	0	0	5	0.32	10.9	28
"	90	0	0	5	6	0	0	0.469	16	40.8
"	90	0	0	10	0	0	0	0.4644	15.8	40.4
"	50	10	10	15	15	0	0	1.45	49.3	126
"	40	2.5	2.5	2.5	2.5	0	50	3.27	111	284

[a] AMRO - American Robin (*Turdus migratorius*); BB spp. – blackbird species: red-winged blackbird (*Agelaius phoencieus*), brewer's blackbird (*Euphagus cyanocephalus*); BBMA - black-billed magpie (*Pica pica*), EUST - European Starling (*Sternus vulgaris*), MODO - mourning dove (*Zenaida macroura*), PEFA – peregrine falcon (*Falco* peregrinus), RODO - rock dove (*Columba livia*), gull spp., california gull (*Larus californicus*), ring-billed gull (*L. delawarensis*)

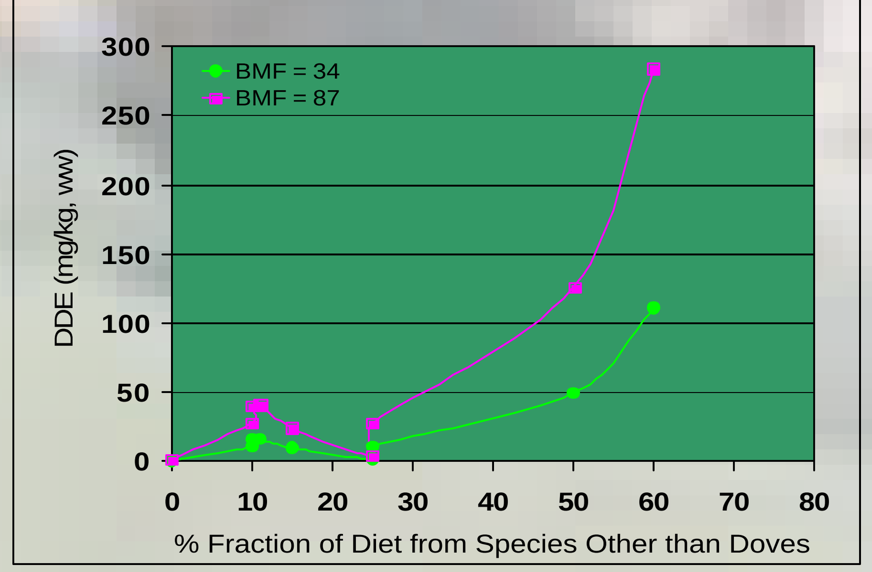


Fig. 3. Calculation of DDE in PEFA eggs based on diet estimates in Table 2

Discussion

Hazard to peregrines from OC concentrations in prey

- Critical DDE level in prey = ~ **0.5 mg/kg** (back-calculation from critical egg level of 15 mg/kg using BMF equation)
- Critical prey concentration for dieldrin, 0.57 mg/kg & PCBs, 0.78 mg/kg - not exceeded here
- Peregrines would accumulate >15mg/kg in eggs if diet contained >10% of any prey other than doves (and possibly some blackbird spp.).

Sources of DDE and other chlorinated hydrocarbons

- Consistent with previous results – Okanagan food chains contaminated with r-DDT (Elliott et al., 1994; Harris et al., 2001)
- Lower DDE:DDT ratio in orchard samples consistent with hypothesis of historical DDT persistence from slow degradation rates in orchard soils (Harris et al., 2000)
- DDT persistence may be affected by heavy metal (Cu, As) inhibition of microbial activity (Gaw et al., 2003; Van Zwieten et al., 2003)
- Cu, As, Pb containing agrochemicals applied regularly in past to Okanagan orchards (Sinclair & Elliott, 1993, Parker and Lamerson, 1943)
- Gulls likely acquired PCBs and dieldrin from aquatic food chains and/or the landfill.

Conclusions

- Successful reproduction of Peregrines unlikely
- DDE probably remain elevated for some time
- Future peregrine releases should be on natural cliffs elsewhere
- Test prey prior to choosing release site.

Acknowledgements

S. Lee assisted with field work & graphics. C. Copeland and G. Grigg assisted in collection of prey samples. A. Preston collected the eggs. Samples were prepared and analyzed by K. Timm and H. Won under the supervision of B. Wakeford and R. McNeil C. Morrissey and C. Henny provided useful comments.

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Out With the Old
In With the New

Recent Changes in Analytical Procedures And Packages

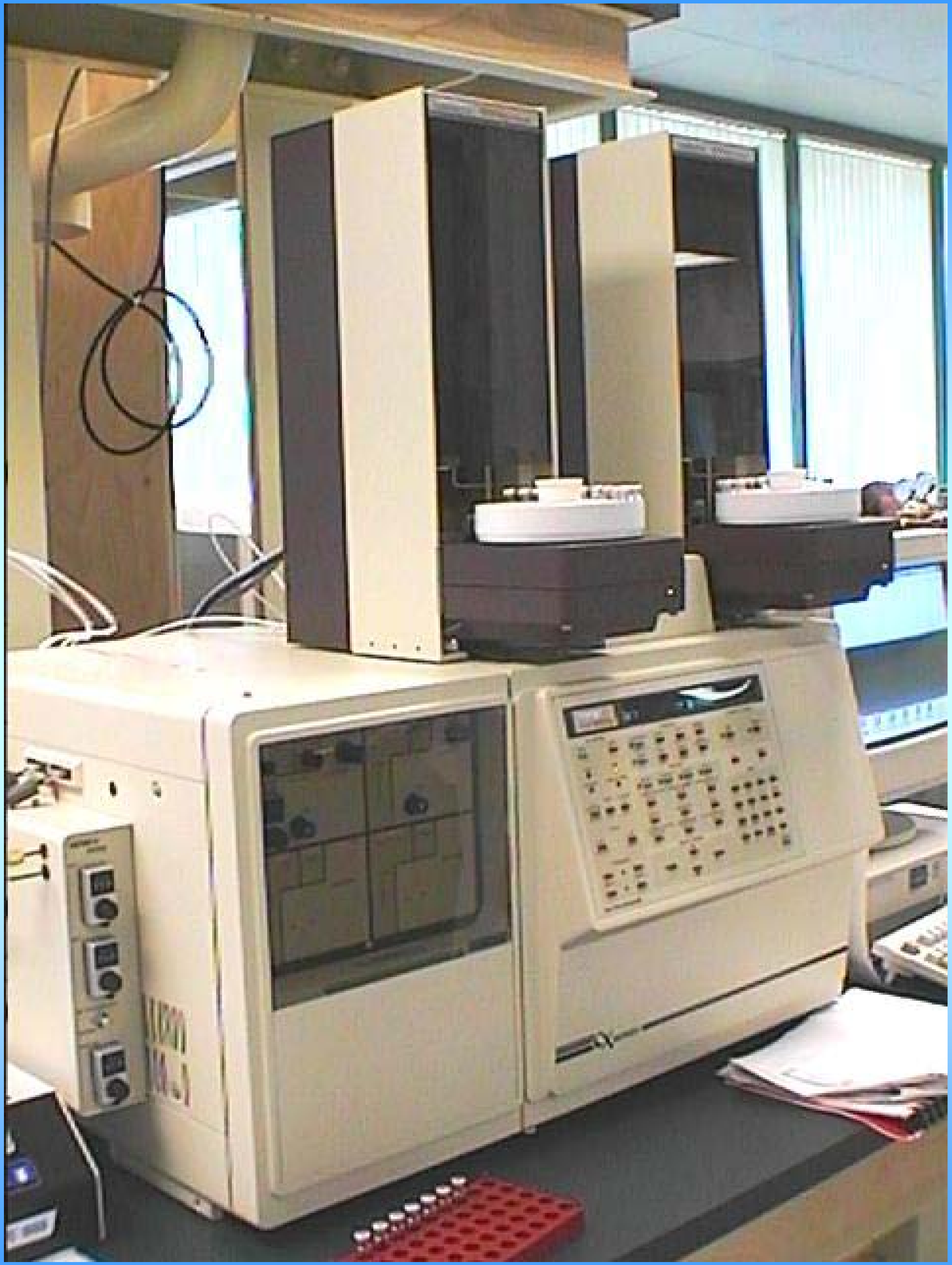
Brad McPherson
Pacific Environmental Science Centre

Pesticide Workshop 2004

Instrumentation - Current and Historical

- HP 5890 Gas Chromatograph with Dual Columns and ECD Detectors

- Typically used for Halogenated compounds such as OC Pesticides and Acid Extractable Herbicides



- Varian 3600 Gas Chromatograph with Dual Columns and PFPD and TSD Detectors
- Typically used for Nitrogen and Phosphorous Containing Pesticides

Agilent 6890 Gas Chromatograph with 5973 Mass Selective Detector

- Universal Detector that can be used for almost any Herbicide or Pesticide
- Provides compound identification and confirmation without using dual columns and detectors

Organochlorine Pesticides

Past and Present– HP5890GC/ECD

Compound	MDL*
Alpha-BHC	0.01
Beta-BHC	0.01
Gamma-BHC	0.01
Delta-BHC	0.01
Heptachlor	0.01
Aldrin	0.01
HeptachlorEpoxide	0.01
Endosulfan 1	0.01
Dieldrin	0.01
P,P'-DDE	0.01
Endrin	0.01
Endosulfan 2	0.01
P,P'-DDD	0.01
Endrin Aldehyde	0.01
EndosulfanSulfate	0.01
P,P'-DDT	0.01
Methoxychlor	0.01

*ug/L
Note that Mass Spectometry is not necessarily
More sensitive than a dedicated detector such as the
ECD used for this analysis

Present – HP6890/5973MSD

Compound	MDL*
Alpha-BHC	0.01
Beta-BHC	0.01
Gamma-BHC	0.01
Delta-BHC	0.01
Heptachlor	0.01
Aldrin	0.01
HeptachlorEpoxide	0.01
Endosulfan 1	0.01
Dieldrin	0.01
P,P'-DDE	0.01
Endrin	0.01
Endosulfan 2	0.01
P,P'-DDD	0.01
Endrin Aldehyde	0.01
EndosulfanSulfate	0.01
P,P'-DDT	0.01
Methoxychlor	0.01
α-Chlordane	0.05
γ-Chlordane	0.06
Quintozene	0.05
Chlorothalonil	0.03

Acid Extractable Herbicides

Past – HP5890

Compound	MDL*
Dicamba	0.1
Dichlorprop	0.1
2,4-D	0.1
Triclopyr	0.1
2,4,5-TP	0.1
2,4,5-T	0.1
Dinoseb	0.1
Picloram	0.1

Present – HP6890

Compound	MDL*
Dicamba	0.01
Dichlorprop	0.01
2,4-D	0.01
Triclopyr	0.01
2,4,5-TP	0.01
2,4,5-T	0.2
Dinoseb	0.2
Picloram	0.01
MCPA	0.01
Mecoprop	0.01

*ug/L

Nitrogen Pesticides

Past – Varian 3600/TSD

Compound	MDL*
Simazine	1
Atrazine	1
Propazine	1
Carbaryl	1
Metalaxyl	1
Anilazine	1
Hexazinone	5

Present – HP6890/MSD

Compound	MDL*
Simazine	0.1
Atrazine	0.1
Propazine	0.1
Carbaryl	0.5
Metalaxyl	0.25
Anilazine	1
Hexazinone	0.3
Desethylatrazine	0.1

*ug/L

Organophosphorous Pesticides

Past – Varian 3600/PFPD

Compound	MDL*
Mevinphos	0.05
Demeton-O	0.1
Naled	0.1
Demeton-S	0.1
Dimethoate	0.05
Diazinon	0.05
Malathion	0.05
Chlorpyrifos	0.05
Parathion	0.05
Methidathion	0.05
Ethion	0.05
Azinphos-methyl	0.1

Present – HP6890

Compound	MDL*
Mevinphos	0.2
Demeton-O	0.4
Naled/Dichlorvos	1.0
Demeton-S	0.5
Dimethoate	0.2
Diazinon	0.1
Malathion	0.2
Chlorpyrifos	0.1
Parathion	0.2
Methidathion	0.2
Ethion	0.2
Azinphos-methyl	2
Metolachlor	0.1
Captan	0.5
Terbufos	0.1

*ug/L

Note that Mass Spectometry is not necessarily more sensitive than a dedicated detector such as the PFPD used for this analysis

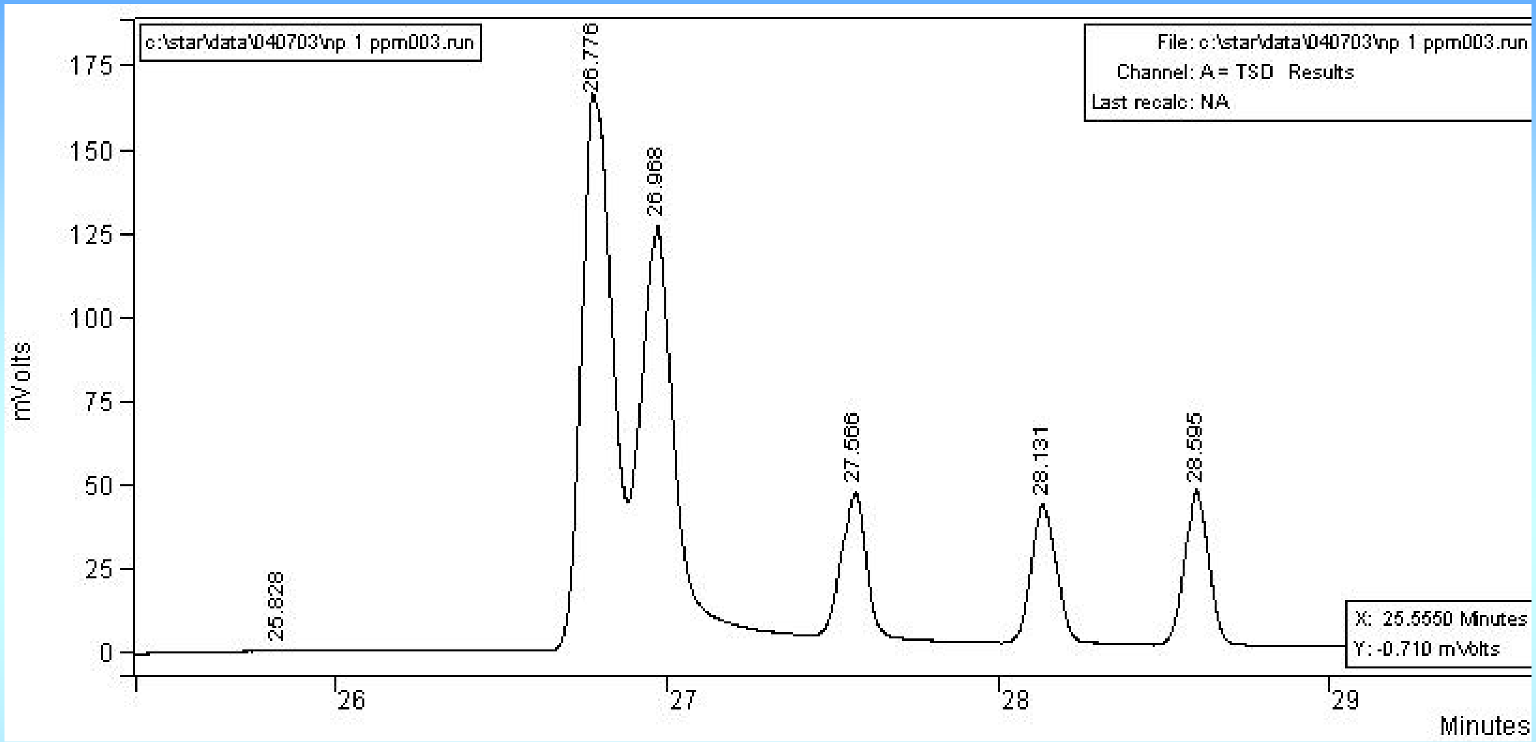
Under Development*

Future– HP6890GC/MSD

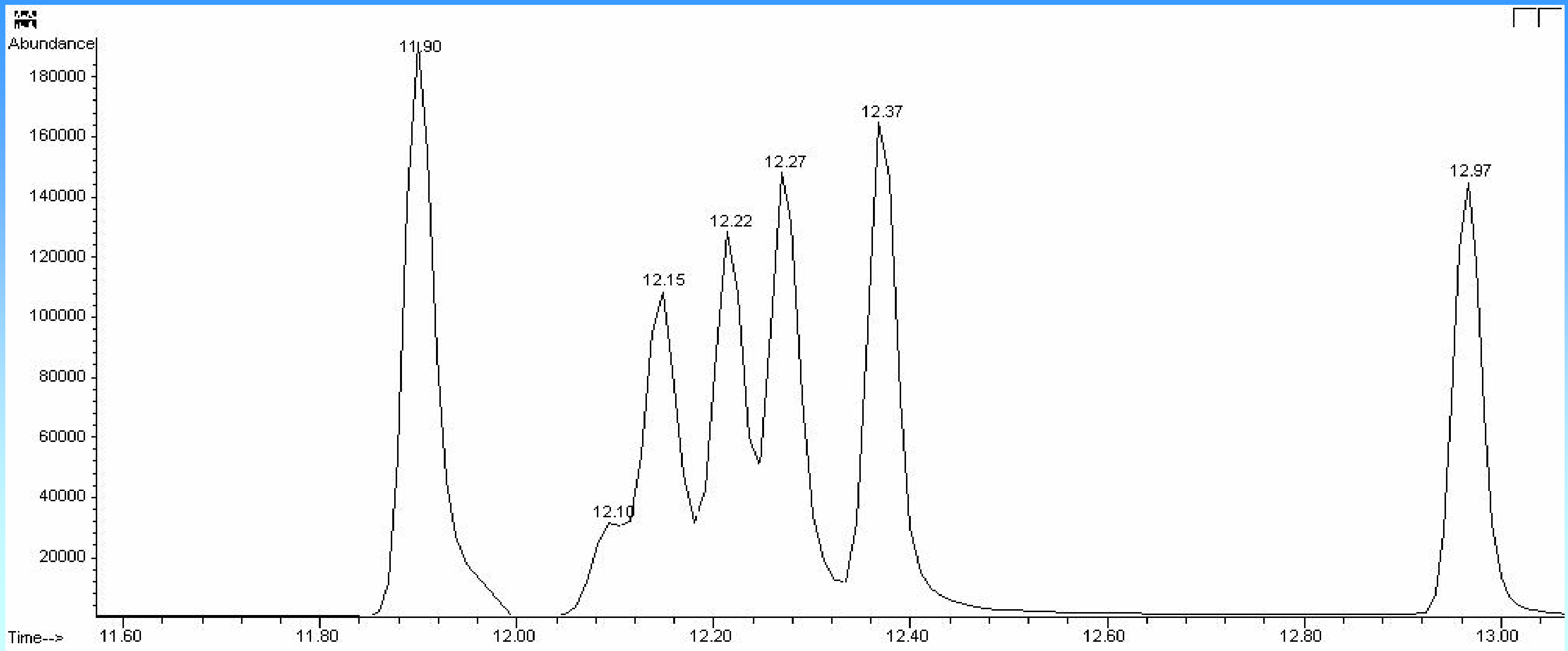
Compound	Class
Cis-Nonachlor	OC
Trans-Nonachlor	OC
Mirex	OC
Oxychlordane	OC
2,4-DB	AEH
Bromoxynil	AEH
Methyl Parathion	OP
Phorate	OP
Phosalone	OP
Phosmet	OP
Fenthion	OP
Fensulfothion	OP
Carbofenotion	OP
Coumaphos	OP
Fonophos	OP
Disulfoton	OP

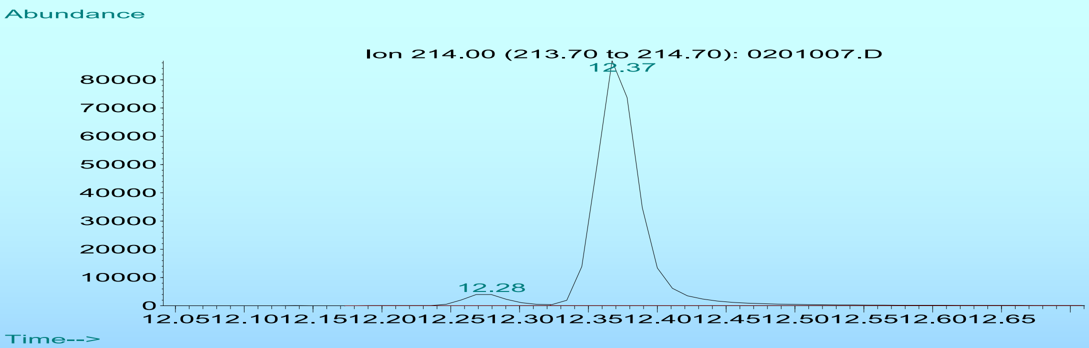
*In all cases only determination of MDLs remains to be done before introduction into written SOP

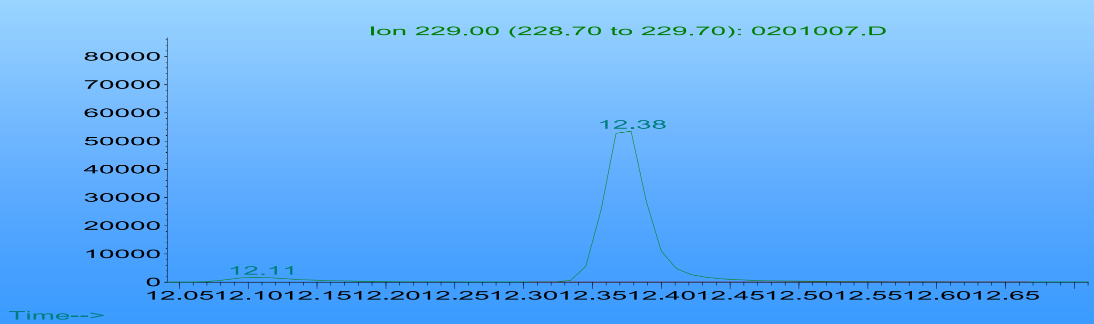
Why MSD?



With a TSD detector, co-eluting or non-separable peaks leave room for error in calculations due to unreliable peak area. The problem is exacerbated in difficult matrices where the peaks may be masked by interference from the sample.







With MSD, the peak at RT 12.37 (or any other) can be isolated, an accurate area measured, and positively identified by mass criteria.

In the future …

- Add new compounds as required
- Move all OC pesticides to MSD
- Add new Transformation Products
- Achieve lower method detection limits

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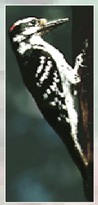


Assessing avian exposure to monosodium methanearsonate (MSMA) as used for bark beetle control in British Columbia forests

Christy Morrissey[1], Patti Dods[1], Courtney Albert[2], Laurie Wilson[1], William Cullen[3], Tony Williams[1] and John Elliott[1]

[1]Canadian Wildlife Service, Environment Canada, Delta, B.C. [2]Simon Fraser University, Burnaby, B.C., [3]University of British Columbia, Vancouver, B.C.

ABSTRACT

Recent and historical outbreaks of the mountain pine beetle (*Dendroctonus ponderosae* Hopkins) have caused significant damage to forests in British Columbia through destruction of thousands of hectares of large diameter, mature lodgepole pine, ponderosa pine and white pine. Management strategies employ a variety of techniques to reduce timber losses from beetle outbreaks including the use an arsenic based insecticide monosodium methanearsonate (MSMA). Given that insectivorous birds, particularly woodpeckers, are attracted to beetle outbreak areas in forests due to increased food availability, they may be subsequently exposed to elevated concentrations of organic arsenicals through ingestion of wood boring insects from MSMA treated trees. We assessed the risk to avian predators through analysis of bark beetles from different life stages and in trees with MSMA treatment (4 weeks and 1 year after treatment) to determine levels of total arsenic and organic/inorganic arsenic speciation. MSMA metabolites were highest in adult mountain pine beetles relative to larval and pupal stages and other insects collected from trees at both 4 weeks and 1 year post treatment. Concentrations of total arsenic in mountain pine beetles from treated trees ranged from 0.22- 354.1 µg/g dw with the organic metabolite monomethyl arsine (MMAA) contributing over 90% to the total arsenic extracted. Mountain pine beetles from reference trees had low concentrations that averaged 0.11 µg/g dw total arsenic. Debarking indices and radio telemetry methods were used to identify woodpecker foraging on beetle infested trees with and without MSMA treatment. Debarking indices indicated woodpecker foraging of MSMA treated trees was significantly lower than non treated trees. However, approximately 30% of MSMA trees had some evidence of woodpecker foraging (5%-100% debarked), while focal observations and surveys confirmed woodpeckers use MSMA stands. Given the extent of mountain pine beetle infestation and the increasing use of MSMA in British Columbia forests, this study addresses important knowledge gaps on woodpecker exposure to MSMA.

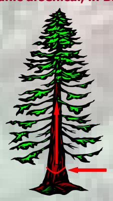
Mountain Pine Beetle (MPB) Outbreak in British Columbia, Canada

•MPB attacks and kills large mature lodgepole pine, ponderosa pine and white pine.

•B.C.'s MPB infestations have increased exponentially in past 5 years.

•MPB red attack doubled in 2003 over 2002 (approx. 4.2 million ha attacked in 2002) and still increasing exponentially despite forest management efforts.

Treatment of MSMA *(monosodium methanearsonate)*, an organic arsenical, in B.C. Forests



Study Objectives / Methods

•To assess As levels and As speciation (organic and inorganic) in mountain pine beetles and other wood boring insects of different life stages in trees with known MSMA treatment (4 wks and 1 yr post treatment) from study areas near Merritt, British Columbia, Canada;

•To determine woodpecker use of MSMA treated and non-treated trees using debarking indices, blood sampling and radio-telemetry methods.

•To determine the degree of MSMA uptake, elimination and target tissues in model songbirds (lab dosing study).

Results: As in Bark Beetles

• Total arsenic (As) concentrations significantly higher in bark beetles from treated MSMA trees (geo mean = 91.7 µg/g, range 0.22- 354.1 µg/g) vs. nearby reference trees (geo mean = 0.11 µg/g, range 0 - 1.96 µg/g) for both green attack (4 wks) and red attack trees (1 yr after infestation) (Figure 1).

• Arsenic found in wood boring beetles from treated trees is primarily in the organic form of monomethyl arsine (MMAA), which is the deionized form of MSMA, regardless of insect life stage or species (Figure 2).

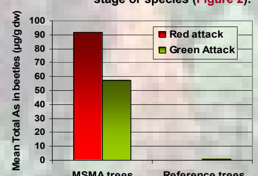


Figure 1: Geometric mean total As (µg/g dw) in bark beetles collected from MSMA and reference trees 4 weeks (green attack) and 1 year (red attack) after infestation and treatment.

Note: MPB larvae can survive concentrations over 100 µg/g dw. Some dead adult beetle samples contained up to 354 µg/g dw.

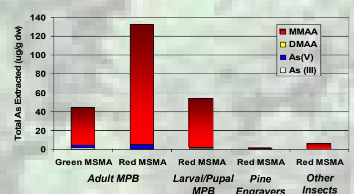


Figure 2: Arsenic speciation (organic and inorganic forms) in bark beetles (mountain pine beetle, pine engravers and other insects) collected from MSMA treated trees.

Results: Evidence of Woodpecker Exposure from Foraging

• 402 beetle infested trees (reference) and 449 treated (MSMA) trees were scored for amount of debarking by woodpeckers (0 - 100% = index 0 - 7) immediately after treatment and 1 year after attack.

• Majority of MSMA treated trees (70%) were not debarked (index = 0, no foraging) compared to 13% of reference trees after 1 year. However 30% of treated trees had some foraging (5-100% debarked, index 1-7) (Figure 3).

• Mean total arsenic concentrations in bark beetles were negatively correlated with the amount of debarking on MSMA trees indicating woodpeckers were feeding more from trees with lower arsenic levels and possibly targeting larger live beetle broods (Figure 4).

Woodpecker Foraging

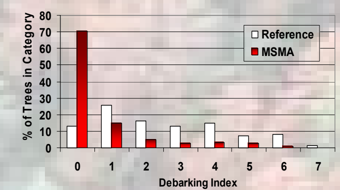


Figure 3: Index of woodpecker foraging: % of sampled trees (reference and MSMA) that are debarked (foraged on) one year after infestation (0 = no debarking, 1 = <5%, 2 = 5-10%, 3 = 10-20%, 4 = 20-40%, 5 = 40-60%, 6 = 60-80%, 7 = 80-100%).

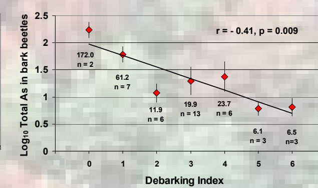


Figure 4: Mean concentrations of total As (µg/g dw) in bark beetles from treated trees with different levels of debarking (foraging). Values shown below points are geometric means and sample sizes.

Woodpecker Exposure

• Woodpeckers that specialize in feeding on bark beetles (Hairy and Three-toed woodpeckers) had higher concentrations of As in blood than other species (Red-naped sapsuckers) occupying treatment areas (Figure 5).

• Focal observations of radio-tagged adult woodpeckers further confirmed birds were feeding on bark beetles from treated stands.

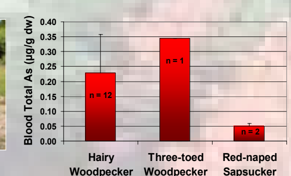


Figure 5: Mean (±SD) total As concentrations (µg/g dw) in blood of 3 species of woodpeckers from MSMA treated areas of Merritt, B.C.

Summary

• Bark beetles from MSMA treated trees contained variable amounts of arsenic (geo mean = 23.1 µg/g dw, range 0.22 - 354.1µg/g)- adult mountain pine beetles had highest concentrations, primarily in organic form MMAA.

• Woodpeckers are foraging on treated trees but not selectively- likely because MSMA causes mortality of beetles and woodpeckers are foraging on larger live broods from non-treated trees.

• Woodpecker species that are known to forage on bark beetles were regularly observed feeding in treated stands and had elevated levels of arsenic in blood indicating exposure.

• Current research is focusing on dosing a model songbird (Zebra finches) in lab to determine the degree of uptake and elimination of MSMA and potential toxicity.

III. HANDOUTS

Surveillance of Pesticide Residues in Agricultural Runoff from the Lower Fraser Valley of British Columbia: A Pesticide Science Fund Study Update as of November 2004

Principal investigator: Michael T. Wan
Collaborators: Jen-ni Kuo, John Pasternak (Commercial Chemicals Division, Environmental Protection Branch, Environment Canada)

In 2003 and 2004, residues from a variety of in-use agricultural pesticides in the Lower Fraser Valley (LFV), British Columbia (BC) were determined in farm runoff leading to ditches contiguous to salmon streams. The following pesticides were selected for analysis, including some of their transformation products (in *italics*):

- acid extractable herbicides (AEH): 2,4-D, dicamba, MCPA, mecoprop, triclopyr;
- organochlorine (OC) pesticides: aldrin (*dieldrin*), BHC, endosulfan (*endosulfan sulfate*), chlordane, heptachlor (*heptachlor epoxide*), methoxychlor, and DDT (*DDD*, *DDE*);
- organo-phosphorus (OP) pesticides: azinphos-methyl, chlorpyrifos, dimethoate, diazinon, methamidophos, naled, parathion; and
- miscellaneous (MISC) pesticides: atrazine (*desethylatrazine*), captan, chlorothalonil, copper ions, glyphosate [*aminomethylphosphonic acid (ampa)*], metalaxyl, metolachlor, methoprene, quintozine, simazine, trifluralin.

In October and November 2003, water samples from 24 locations (including 3 controls) in the LFV were collected and sent to the Pacific Environmental Science Center (PESC) Laboratory, North Vancouver, BC for pesticide residue analyses. Samples were collected in 4.5 L amber glass bottles, stored at 4^{o}C, and submitted to the laboratory the same day. One litre filtered and unfiltered water samples were extracted and analyzed for pesticide residues per site. In April and May 2004, a further 6 unfiltered water samples were collected from 6 selected locations close to where the 2003 sampling was conducted. These sampling points were located in ditches contiguous to fish-bearing streams about 0.10 km downstream of the 2003 runoff sampling points.

While no residues of AEH were measured above the detection limit of 0.10 µg/L in the filtered October-November 2003 water samples, 4 AEHs (2,4-D, dicamba, MCPA and mecoprop) were found in the unfiltered water samples. During that sampling period, 6 OC pesticides (a-chlordane, ?-chlordane, *dieldrin*, ß-endosulfan, *endosulfan sulfate* and *p,p*-DDT) were also detected (detection limit of 0.02 µg/L) in the filtered water samples. On the whole, measurable levels of 28 pesticides were positively identified in the unfiltered water when compared to only 19 pesticides in the filtered water. However, the total amount of pesticides found in filtered farm runoff (7.33 µg/L; average frequency (f)/number of samples (n) = 6.2/27) was about 67% more than that of unfiltered farm runoff (4.39 µg/L; av.f/n = 4.9/27). It is likely that the more water soluble pesticides, such as the glyphosate/ampa herbicides and OP compounds, contributed to the higher levels of total pesticide residues in the filtered water samples.

Pesticide residues were also measured in the unfiltered water samples collected during April and May 2004 about 0.1 km downstream of selected sampling sites where runoff samples were previously taken in October-November 2003. Two AEHs (MCPA, mecoprop) 7 OCs (a-chlordane, ?-chlordane, *dieldrin*, a-endosulfan, *endosulfan sulfate, heptachlor epoxide*, and *p,p*-DDT), 2 OP compounds (chlorpyrifos, diazinon) and 9 MISC compounds (atrazine, *desethylatrazine*, glyphosate, *ampa*, metalaxyl, metolachlor, quintozine, simazine and trifluralin) were found above their respective limits of detection. The total amount of pesticides measured in ditch water contiguous to fish streams was 5.97 µg/L (av.f/n = 2/6).

It should be noted that some water samples taken during the October and November 2003 sampling event were collected shortly after an unseasonable deluge of an estimated total precipitation of about 450 mm within a period of two weeks. This phenomenon would have greatly diluted pesticide concentrations found in runoff when compared with a year having seasonal precipitation. Pesticide concentrations found in water samples collected about 0.1 km downstream in April-May 2004 (about a month post-treatment) represented that of a normal year of precipitation frequency and quantity.

The manuscript of the final results of this study will be submitted for publication consideration to the *Journal of Environmental Quality* after March 31, 2005.

The Sustainability of an Agricultural Pest Control Option That Includes the Use of Triazine Herbicides in the Management of Agricultural Crops in the Lower Fraser Valley of BC: A Georgia Basin Action Plan Project Update as of November 2004

Principal investigator: Michael T. Wan
Collaborators: Jen-ni Kuo, John Pasternak (Commercial Chemicals Division, Environmental Protection Branch, Environment Canada); Graham Van Aggelen (Pacific Environmental Science Centre, Environmental Conservation Branch, Environment Canada); C. Helbing (University of Victoria).

The objectives of this project are to verify concentrations of triazine herbicides in fields and adjacent waterways in the Lower Fraser Valley (LFV) of BC and study how they affect non-target sensitive aquatic organisms and amphibians. Based on the results, alternative agricultural pest management options will be recommended.

In 2003/2004, a preliminary literature search was undertaken to review published work on the acute and subtle effects of triazine herbicides, notably atrazine and simazine and their transformation products, on selected non-target aquatic indicator organisms. These organisms included salmonid fish (coho, chinook and rainbow trout), crustaceans (*Daphnia magna and Hyalella azteca*), and tadpoles (*Rana spp.*). The available information on the environmental levels of triazine herbicides in the Lower Fraser Valley (LFV) and elsewhere in continental North America were also searched and reviewed.

Triazine herbicide analytical standards (technical and formulated products) were purchased for the project.

Range finding toxicity tests were conducted at the Pacific Environmental Science Center (PESC) Aquatic Toxicity Laboratory to estimate the lethality ranges for the herbicide compounds and indicator organisms identified in Table 1. A field survey was also conducted in October and November 2003 in the LFV to determine the control and field sampling sites. Selected crop soils, sediments and water from ditches contiguous to salmon streams from the LFV were sampled. These samples were spiked with triazines and then analyzed by PESC in an effort to verify the analytical techniques and to determine the rates of chemical recovery from these media.

In 2004/2005, residues of triazine herbicides in the LFV, were determined in farm soils, sediments and ditch water contiguous to salmon streams. Residues of the following triazine compounds and transformation products (in *italics*) were determined: atrazine, d*esethylatrazine*, simazine and *simazinehydroxy*. Analysis was also conducted for metolachlor since it is formulated in a commonly used triazine product.

Table 1. Toxicity range finding tests conducted for triazine herbicides

Atrazine (technical formulation)	**Simazine (technical formulation)**	**Atrazine/ Metalachlor (technical formulation)**
Coho	Coho	Coho
Chinook	Chinook	Chinook
Rainbow trout	Rainbow trout	Rainbow trout
Daphnia magna	*Daphnia magna*	*Daphnia magna*
Hyalella azteca	*Hyalella azteca*	*Hyalella azteca*
Frog tadpole	Frog tadpole	Frog tadpole

During the September-October 2004 period, crop soil samples, runoff ditch sediments and water were collected from 13 corn growing areas (excluding the control site) in the LFV. They were submitted to the Pacific Environmental Science Center (PESC) Laboratory, North Vancouver, B.C., for triazine analyses. Water samples, consisting of a composite of 10 x 0.100 L per site, were collected in 1 L amber glass bottles. Likewise and using a steel trowel, a composite of 10 x 0.030 kg soil/sediment samples were collected in 0.30 kg amber glass containers. They were stored at 4^{o}C and submitted to the laboratory the same day. The analytical results of these surveys are currently being processed.

The acute toxicity tests conducted (or to be conducted) for this study are summarized in Table 2. The results of these studies will be summarized in an upcoming publication. Of the tests conducted to date, Atrazine 500 and Atrazine MET are toxic to certain tested aquatic indicator organisms (see Table 2). Further acute toxicity testing is being conducted to complete the table noted below. As well, sub-acute toxicity testing based on levels found in the ambient environment are scheduled for completion in 2005/2006.

Table 2. Acute toxicity of triazine herbicides to aquatic indicator organisms

Atrazine tech	**Atrazine 500**	**Atrazine MET**	**Simazine 90**	**MET**
? Coho	Coho ***toxic***	? Coho	Coho ***slightly toxic***	? Coho
Chinook ***toxic***	Chinook ***toxic***	? Chinook	Chinook ***slightly toxic***	? Chinook
? Rainbow trout	Rainbow trout ***toxic***	Rainbow trout ***toxic***	Rainbow trout ***slightly toxic***	? Rainbow trout

? Daphnia	Daphnia ***slightly toxic***	Daphnia ***toxic***	Daphnia ***slightly toxic***	? Daphnia
? Hyalella	Hyalella ***toxic***	? Hyalella	Hyalella ***slightly toxic***	? Hyalella
Frog tadpole ***toxic***	Frog tadpole ***toxic***	? Frog tadpole	? Frog tadpole	? Frog tadpole

Notes:

? – tests to be conducted; toxic = 10 – 100 mg/L; slightly toxic = 100 mg/L.