UNIVERSITY OF MINNESOTA

CIDRAP Center for Infectious Disease Research and Policy

Chronic Wasting Disease Resource Center

July 7, 2020 Webinar:

The Human Dimensions of CWD: Implications for Management and Surveillance

Presenter:
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cidrap.umn.edu/cwd

THE HUMAN DIMENSIONS OF CWD: IMPLICATIONS FOR MANAGEMENT AND SURVEILLANCE

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Thanks to colleagues and graduate students: Ellen Goddard, Marty Luckert, Brenda Parlee, Lusi Xie, John Pattison-Williams, Geoff Durocher, Merlin Uwalaka, Pat Lloyd-Smith, Margo Pybus and Anne Hubbs

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Department of Resource Economics and Environmental Sociology
Faculty of Agricultural, Life and Environmental Sciences

Alberta CWD Social / Economic Team

- **University of Alberta - Faculty**
  - Vic Adamowicz
  - Ellen Goddard
  - Marty Luckert
  - Brenda Parlee
- **University of Alberta – PostDocs and Graduate Students**
  - John Pattison-Williams
  - Geoff Durocher
  - Lusi Xie
  - Merlin Uwalaka
  - Pat Lloyd-Smith
- **Funding**
  - Alberta Prion Research Institute
  - The Canadian Agri-food Policy Institute
  - Genome Alberta
  - Genome Canada
- **Partnerships**
  - Alberta Environment and Parks (Margo Pybus, Anne Hubbs)
  - Science Team (Systems Biology and Molecular Ecology of Chronic Wasting Disease – McKenzie et al)

Overview

- **Human Dimensions**
- **CWD in Canada, focusing on Alberta and on CWD in wild cervids (Illustrative case study)**
- **Hunter perceptions, behaviour, economic valuation, and role in management (individual level data)**

- **Hunter demand for draw licenses over time (aggregate level data)**
- **Public perceptions of CWD and Preferences for Management Options (individual level data)**
  - Canadian and Alberta surveys

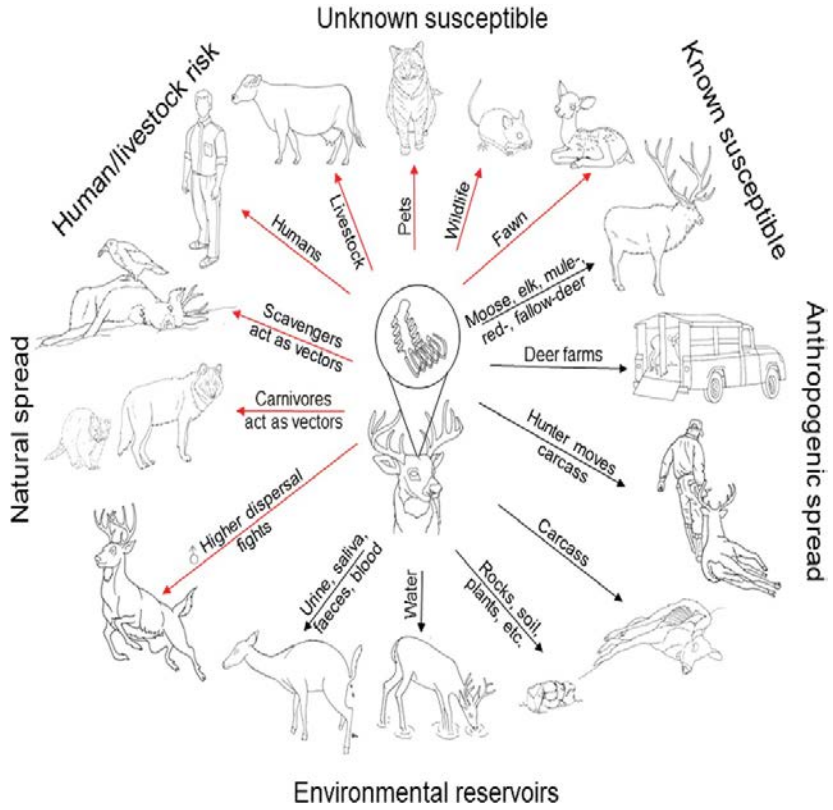
- **Generalizations?**
- **COVID-19, CWD and Hunting**
- **Discussion**

"Human Dimensions of CWD"

- **Chronic Wasting Disease (CWD):** *"Prions are misfolded infectious proteins responsible for a group of fatal neurodegenerative diseases termed transmissible spongiform encephalopathy or prion diseases. Chronic Wasting Disease (CWD) is the prion disease with the highest spillover potential, affecting at least seven Cervidae (deer) species.."* Escobar et al, 2020. pg. 393.
- **Social Science aspects of CWD - human behavior, risk perceptions, values, motivations, trust, policy acceptability, norms, etc.**
- **Vaske (2010): Lessons Learned from Human Dimensions of Chronic Wasting Disease Research**
  - CWD affects a wide range of stakeholders
  - There is heterogeneity in risk perceptions, behavioral responses, and preferences
  - Risk perceptions affect behavior
  - Risk perceptions and trust affect policy acceptability,
  - Knowledge varies across stakeholders
  - Acceptability and efficacy of management practices vary.
- **Some New lessons learned?**
  - *Risk perceptions may change with information, context, and over time*
  - *Risk is endogenous / people adapt*
  - *Selection of management options is challenging because of uncertainty, and the distribution of benefits and costs*
  - *…..*

“Human Dimensions”

- **CWD – wide range of potential impacts (Leiss et al, 2017; Osterholm et al 2019)**
  - Wild cervid populations
    - Indigenous People / Communities
    - Recreational Hunters
    - Outfitters
    - Wildlife viewing
    - General public / “passive use values”
  - Farmed cervid populations
    - Farming sector
    - Consumers
  - Concerns from other agricultural sectors (livestock, landowners)
  - Concerns about other wildlife species
  - Public health concerns
  - International trade implications



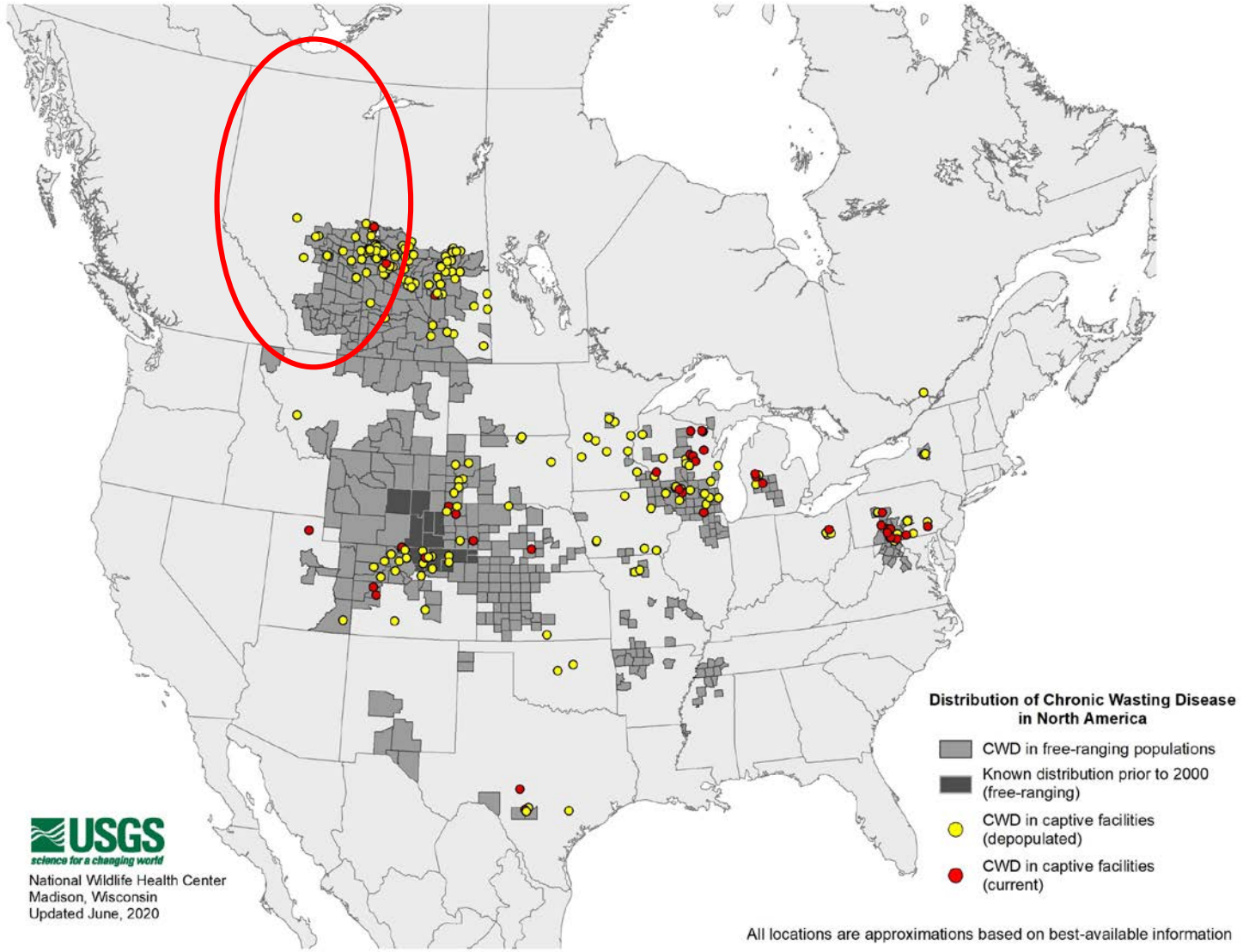
Escobar et al, 2020. The ecology of chronic wasting disease in wildlife. Biological Reviews
Biological Reviews, Volume: 95, Issue: 2, Pages: 393-408, First published: 21 November 2019, DOI: (10.1111/brv.12568)

"Human Dimensions - Economics"

- **Economic Analysis - Objectives**
  - Costs and benefits of management strategies (e.g. risk reduction strategies, surveillance)
  - Impacts of CWD on behavior and economic value
  - Economic (monetary) value measured by examining behavior (e.g. hunting): Use Values
  - Economic value measured through highly structured surveys: Passive Use Values

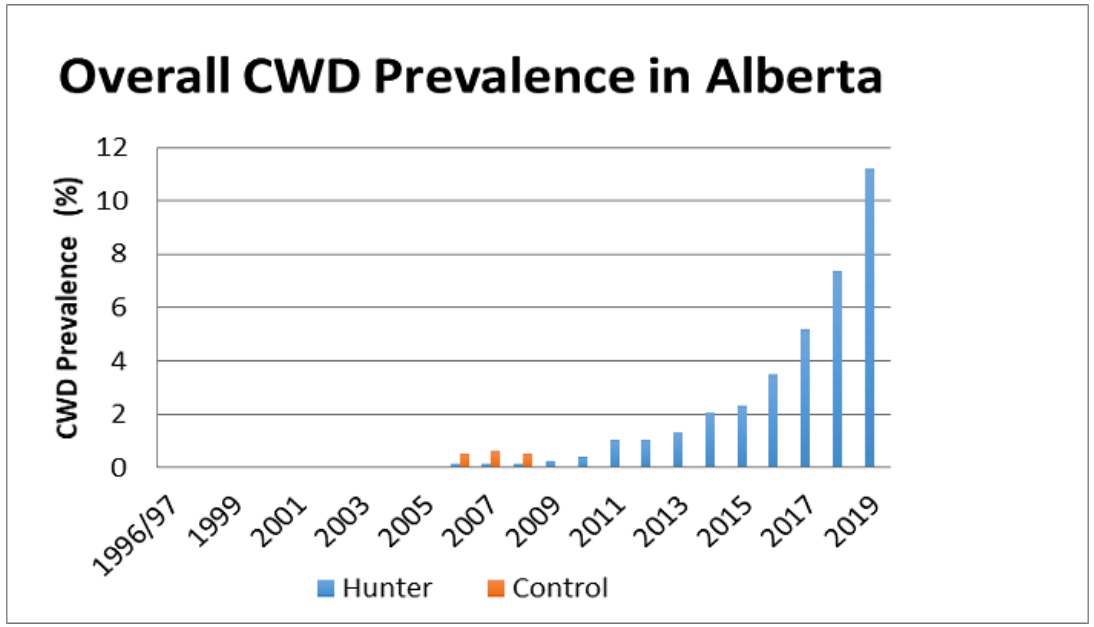
- **Understanding behavior / value involves understanding perceptions, knowledge, trust, norms, etc.**
- **Data sources:**
  - Individual level data: surveys, economic experiments, activity-based apps, etc.
    - Concerns: selection bias, strategic behavior, social desirability bias, measurement error, etc.
  - Aggregate level data: license sales, aggregate expenditures, etc.
- **Challenge: identification / causality (randomization, exogeneity)**

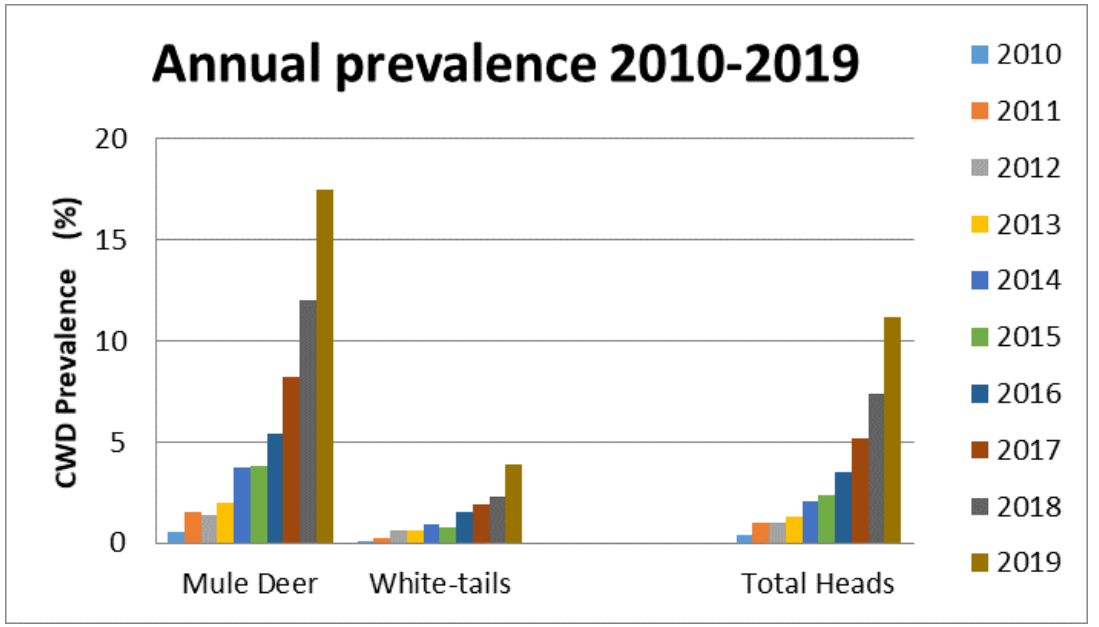
CWD in Alberta



https://www.usgs.gov/media/images/distribution-chronic-wasting-disease-north-america-0

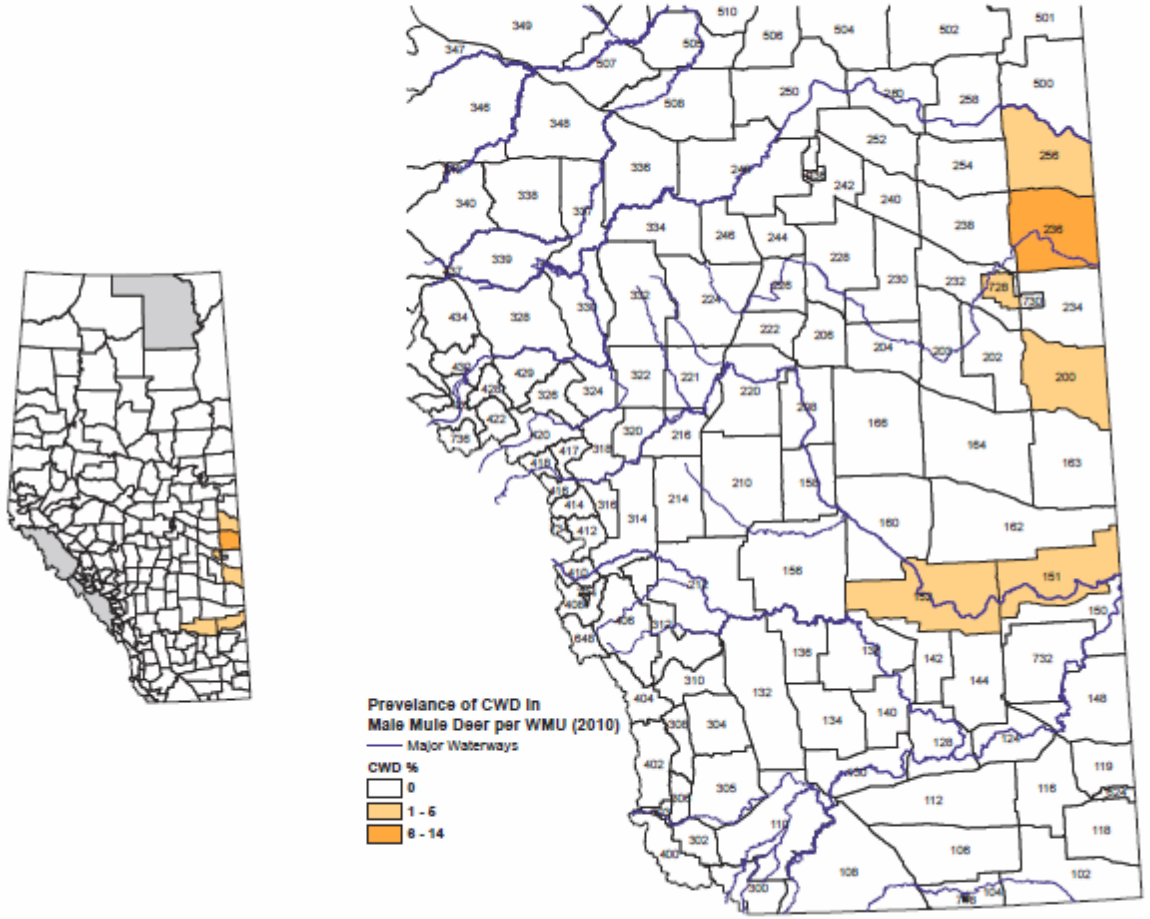
CWD in Alberta



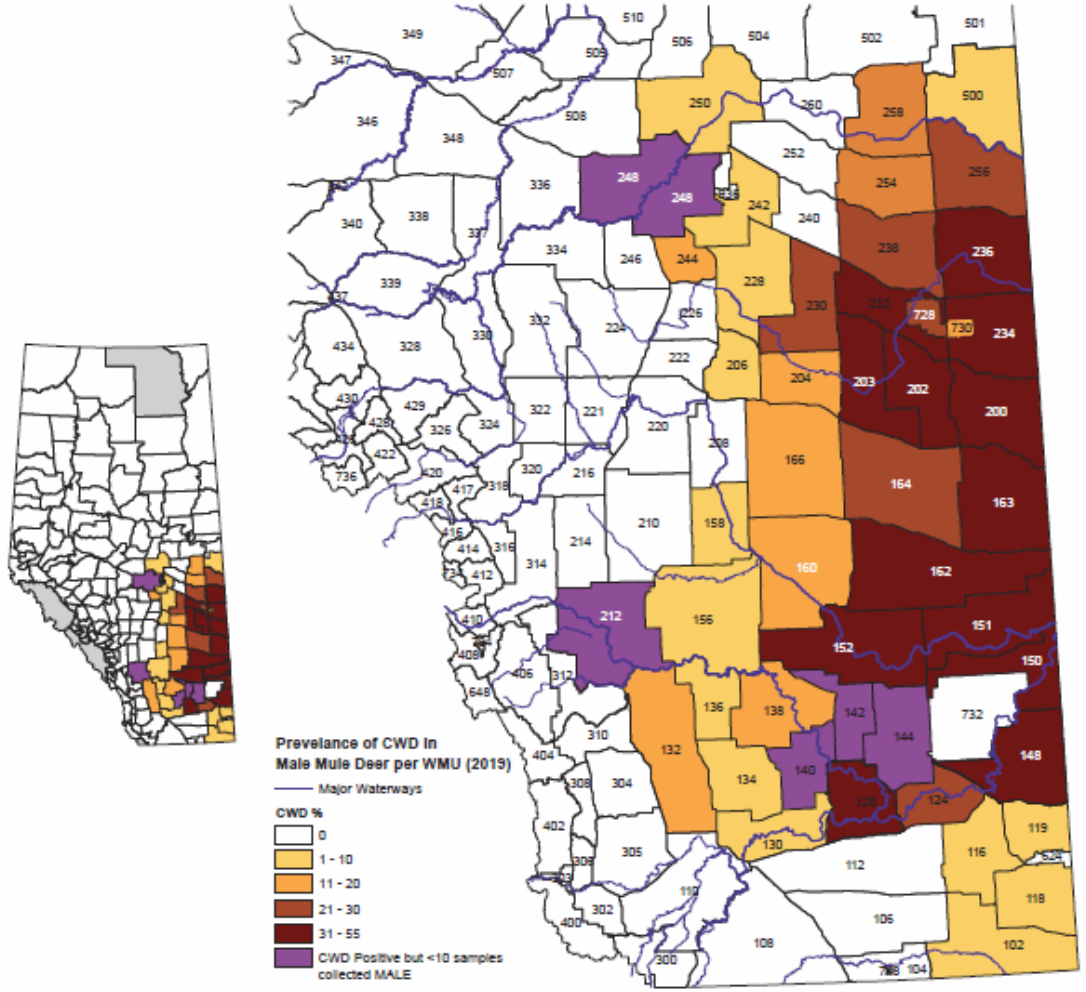


https://www.alberta.ca/chronic-wasting-disease-updates.aspx

2010



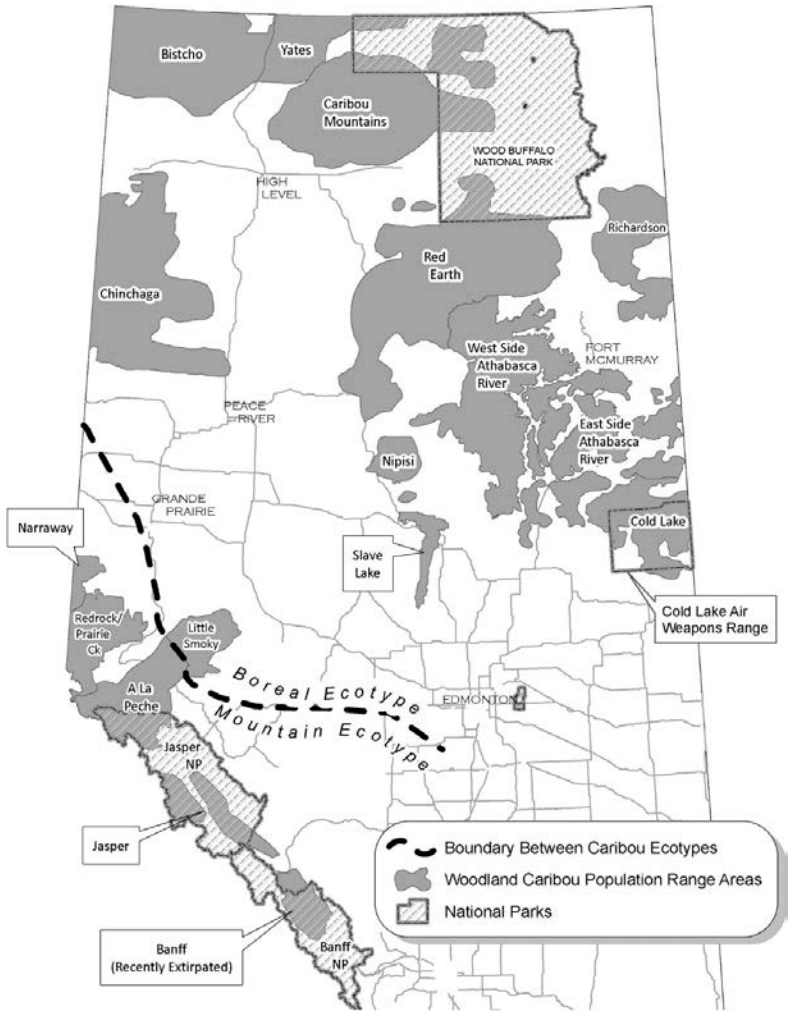
2019

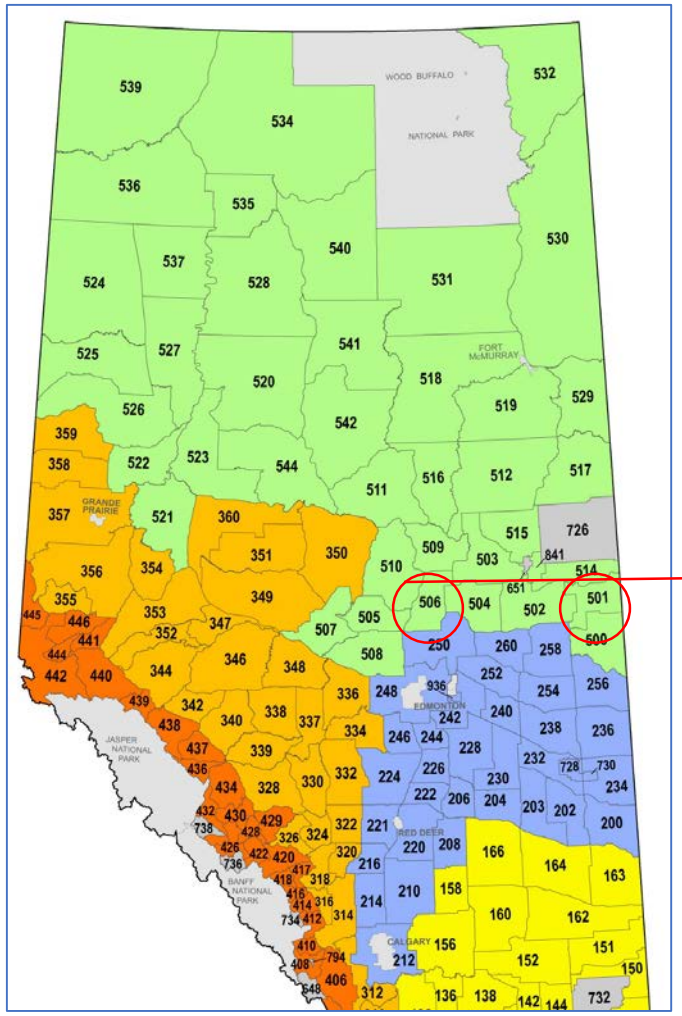


CWD in Male Mule Deer (% infected) 2010 and 2019.

https://open.alberta.ca/publications/chronic-wasting-disease-in-alberta-prevalence-percentage-infected-of-cwd-in-male-mule-deer

Woodland Caribou in Alberta





Hervieux et al, 2013. J. Wild. Mgmt. pg. 874

http://www.albertaregulations.ca/huntingregs/season-wmus.html

Indigenous Communities and CWD

- **Importance of traditional land use and foods**
  - Parlee et al (2014)
    - Important role of Traditional Knowledge in wildlife health monitoring
    - Care required in risk communication; Traditional Knowledge and trust in information
    - Communities are identifying CWD as a concern
  - Chiu et al (2016)
    - Examination of caribou consumption and substitution pattern with other foods (food diary)
    - Assesses the impacts of changes in caribou consumption / costs (econometric analysis)
    - Substitution relationship between caribou / country foods and store bought meats.
    - Recognize the high relative costs of store bought meats in northern communities
    - Caribou contributes to nutritional quality and diet diversity
  - Natcher (2019):
    - 49% of households harvested traditional foods, 20% of household diet (Alberta sample)
    - Significant cultural value including sharing networks
    - Concerns about cultural tipping points, arising from environmental conditions, costs, time constraints
- **High level of concern registered in communities**
  - Alberta Organization of Tribal Chiefs (AOTC) (Treaty 6, 7 and 8) resolution in June 2019, support collaborative research on CWD surveillance

Hunter perceptions, behavior, role in management and economic valuation (individual level data)

CWD and Recreational Hunting in Alberta

- **Surveys of resident hunters in 2007, 2017, 2018, and 2019**
  - Small sample in 2007 (90)
  - Larger samples 2017 (878), 2018 (399), and 2019 (1,089)
- **Hunting activity (trips, harvests), perceptions, preferences**
- **Questions about hunting intentions under different scenarios (contingent behavior).**
- **Economic valuation of alternative policy options**
- **2019 Economic valuation of enhanced surveillance and testing programs.**

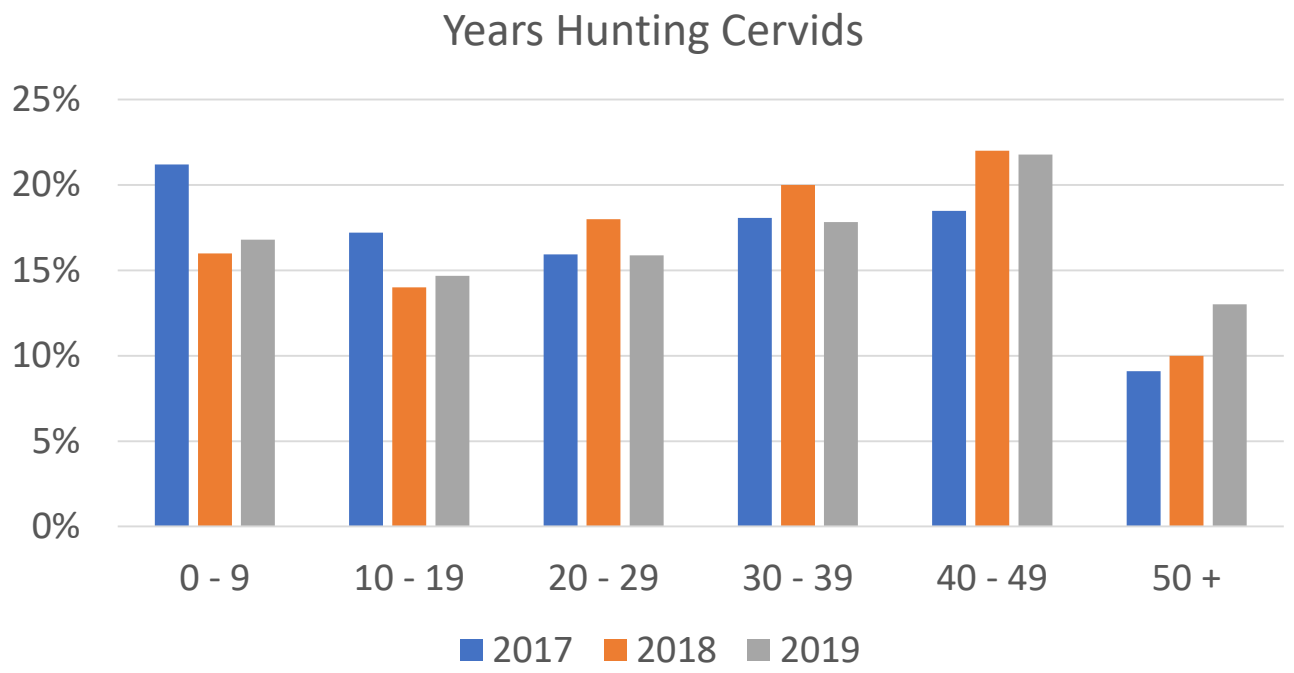
https://www.alberta.ca/chronic-wasting-disease-updates.aspx

1. Hunter Background Information

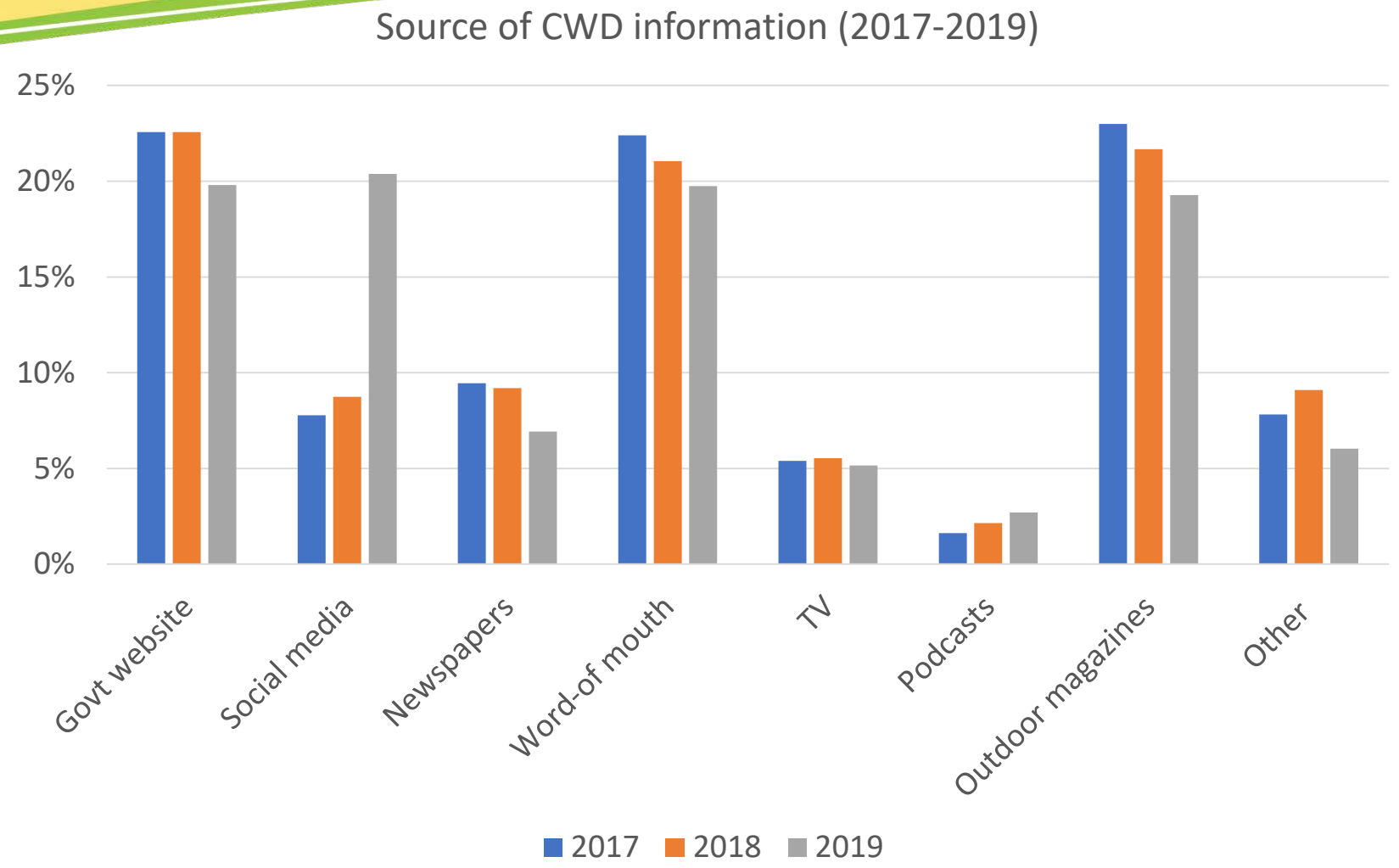
Alberta Population: 4.4 Million

Licensed Hunters: 120,000
(peaked in 2015, little decline)

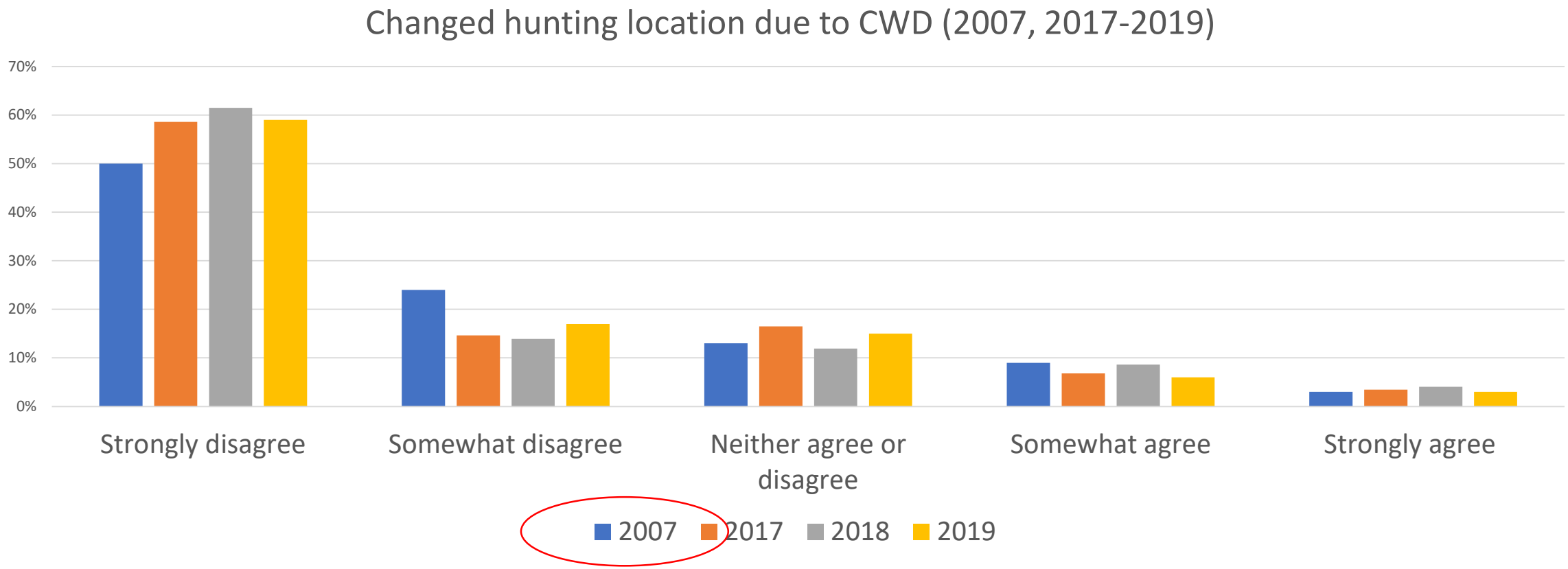
Over 400,000 draws submitted



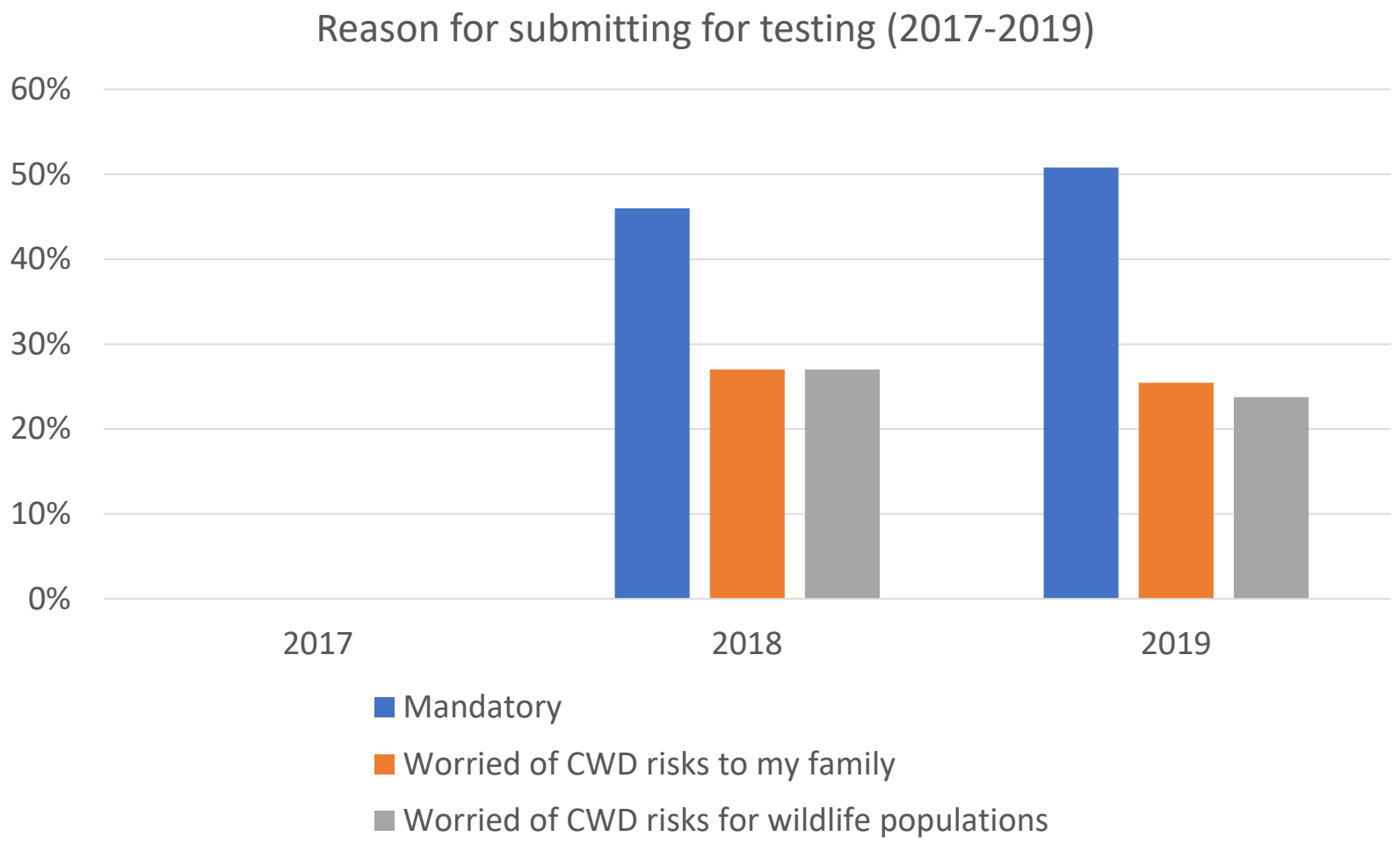
2. Hunters and CWD



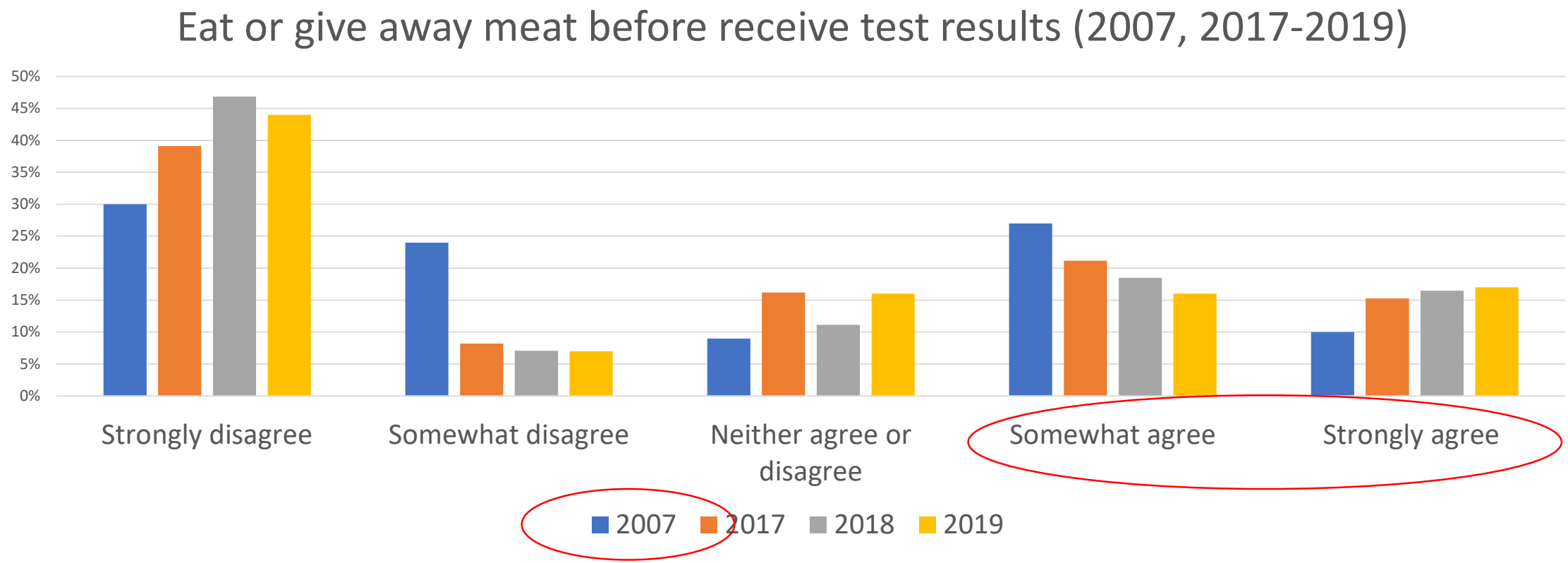
3. Hunters, Behavior and CWD Risk Perceptions



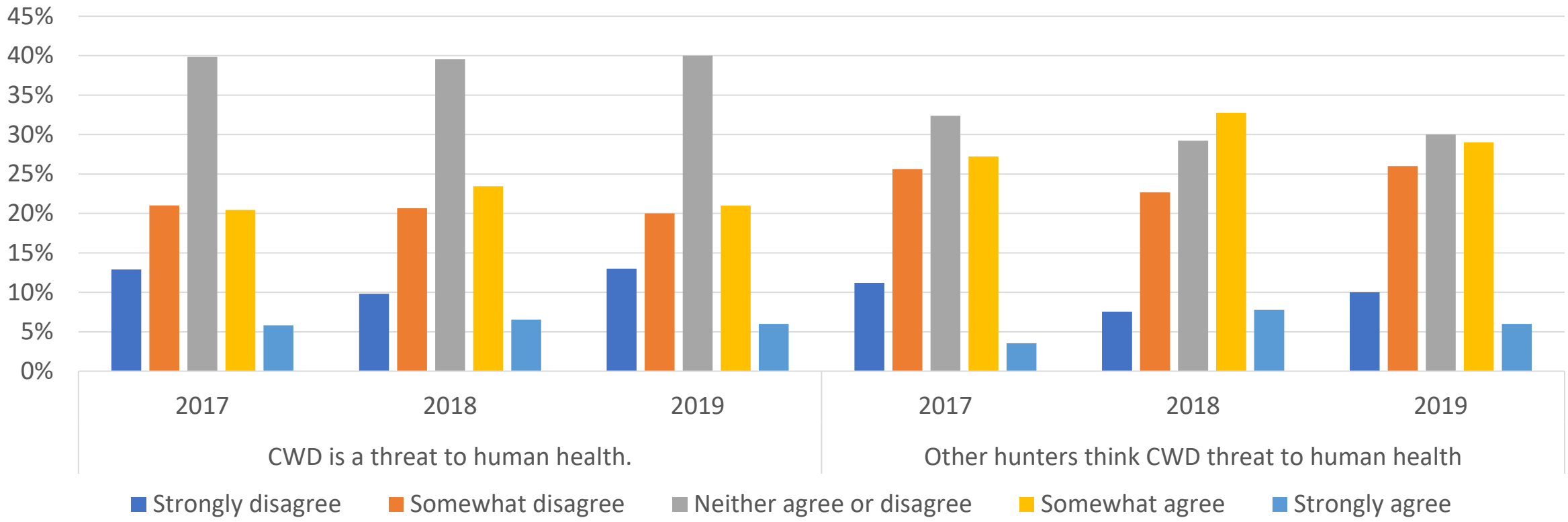
3. Hunters, Behavior and CWD Risk Perceptions



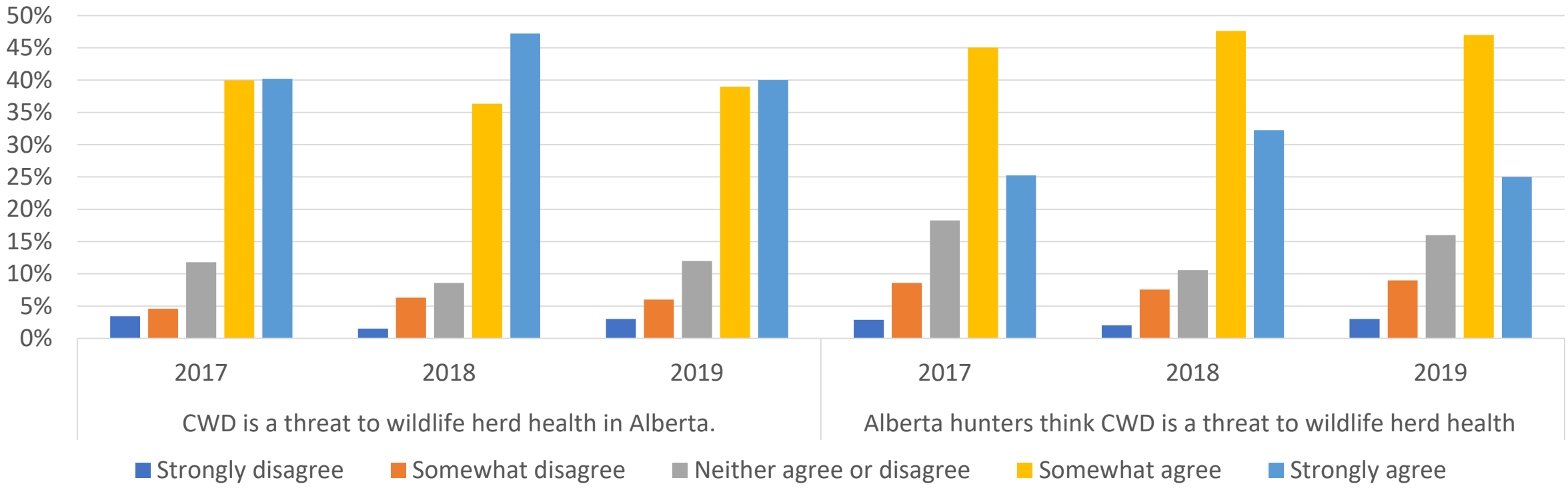
4. Meat consumption / risk perception



Threat to Human Health



Threat to Wildlife Health



Deer hunters' disease risk sensitivity over time

Jerry J. Vaske & Craig A. Miller

To cite this article: Jerry J. Vaske & Craig A. Miller (2019) Deer hunters' disease risk sensitivity over time, Human Dimensions of Wildlife, 24:3, 217-230, DOI: 10.1080/10871209.2019.

Table 2. Comparison of means for perceived risks of T diseases among Illinois deer hunters by year.[a]

Dependent: Perceived risk from…	2004 *M*	2012 *M*	*t*
CWD	2.12	1.64	
Mad cow	1.93	1.50	
Salmonella	2.10	2.21	
E. coli	2.13	2.20	
West Nile virus	2.45	2.22	
Lyme disease	2.43	2.27	

[a] Items coded on a 4-point scale: (1) no risk, (2) slight risk, (3) moc (4) high risk

Table 5. Comparison of means for perceived risks of TSE, food-borne, and vector-borne diseases among Illinois deer hunters by level of risk (no, slight, moderate) and year (2004, 2012).[a]

Dependent: Perceived risk from…	2004 *M*	2012 *M*	*t*-value	*p*-value	η
CWD					
No risk	1.52	1.24	8.21	< .001	.229
Slight risk	2.05	1.51	22.65	< .001	.336
Moderate risk	2.96	2.15	14.53	< .001	.310
Mad cow					
No risk	1.21	1.06	6.35	< .001	.219
Slight risk	1.85	1.41	18.17	< .001	.316
Moderate risk	2.94	1.99	15.89	< .001	.368
Salmonella					
No risk	1.19	1.10	3.83	< .001	.115
Slight risk	2.09	2.12	1.47	.143	.026
Moderate risk	3.27	3.24	0.84	.400	.023
E. coli					
No risk	1.23	1.10	5.27	< .001	.162
Slight risk	2.13	2.10	1.61	.107	.029
Moderate risk	3.26	3.21	1.25	.213	.034
West Nile virus					
No risk	1.83	1.50	8.51	< .001	.227
Slight risk	2.43	2.13	12.49	< .001	.216
Moderate risk	3.21	2.95	5.42	< .001	.129
Lyme disease					
No risk	1.92	1.64	7.26	< .001	.185
Slight risk	2.45	2.23	9.36	< .001	.151
Moderate risk	2.99	2.82	3.60	< .001	.085

[a] Items coded on a 4-point scale: (1) no risk, (2) slight risk, (3) moderate risk and (4) high risk.

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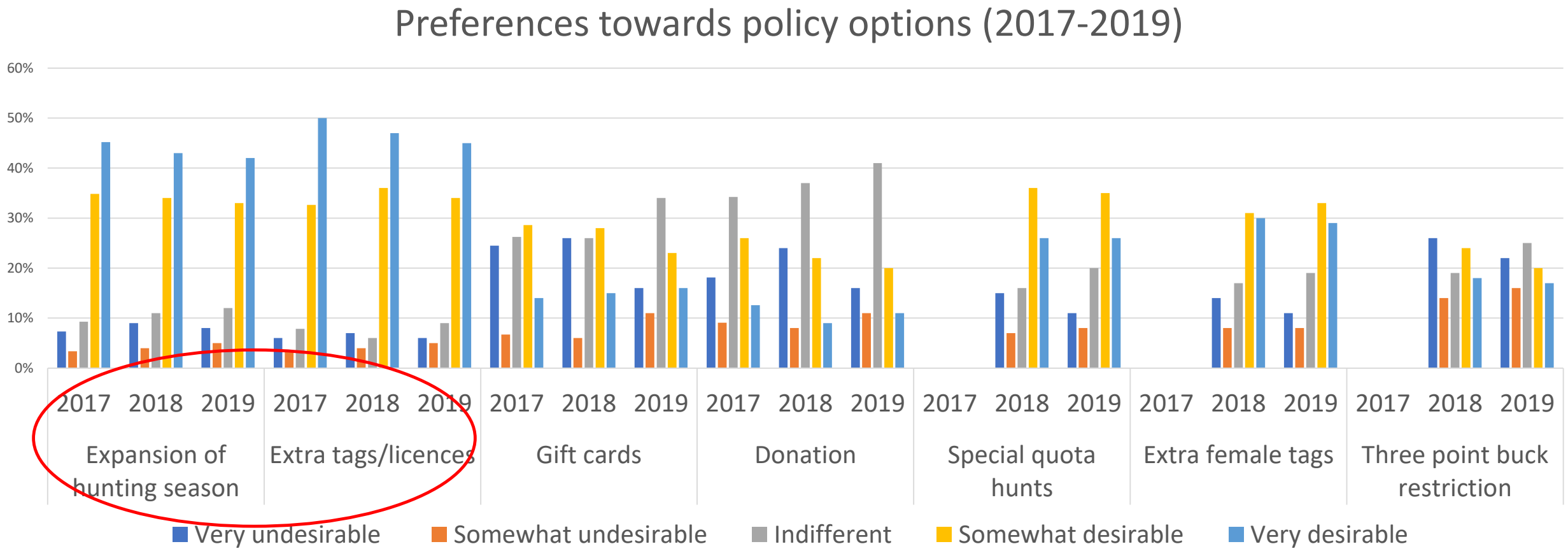
5. Preferences over Policy Options



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DEPARTMENT OF RESOURCE ECONOMICS AND ENVIRONMENTAL SOCIOLOGY

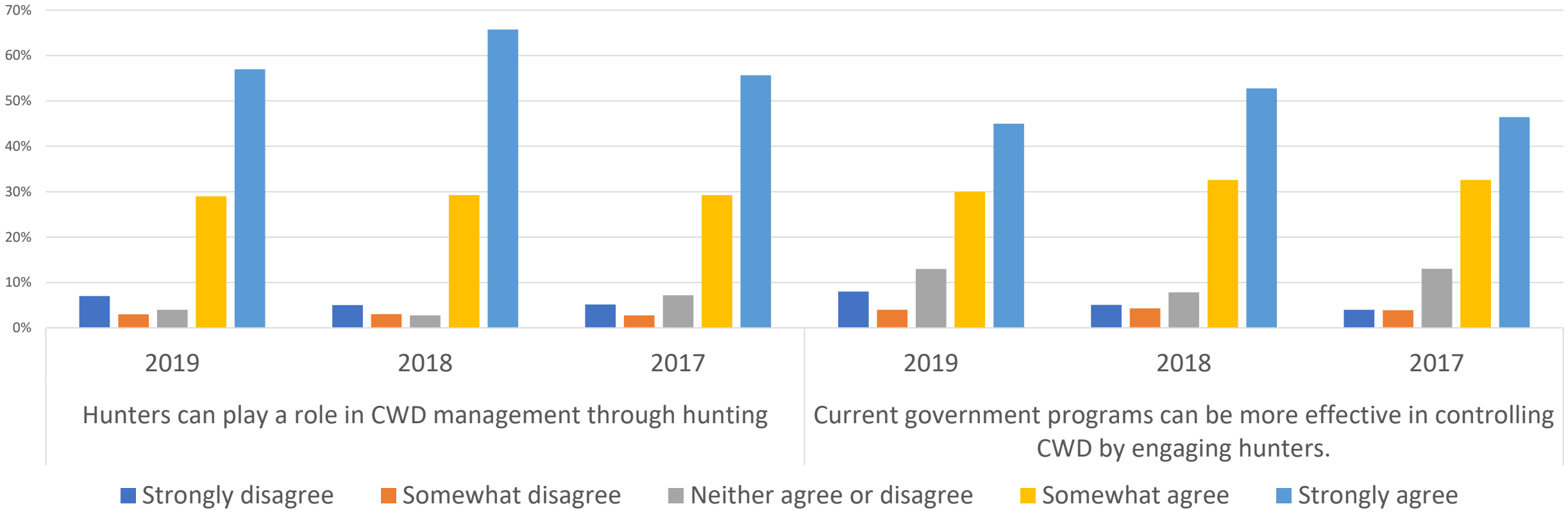
Expected Spatial and Temporal Response of Hunters to Potential CWD Management Programs

Lusi Xie[1], Vic Adamowicz[1], Patrick Lloyd-Smith[2]

[1]Department of Resource Economics and Environmental Sociology, University of Alberta

[2]Department of Agricultural and Resource Economics, University of Saskatchewan

Hunters' role in CWD management (2017-2019)



Quantitative Economic Analysis

- **Recreation demand model:**
  - Analysis of hunter choice behavior (actual and contingent behavior - randomized)
  - Examining impacts of site (i.e. CWD) and individual characteristics on hunting trip decisions
  - Measure monetary value of alternative CWD management strategies
    - Extended seasons
- **Dependent variables:**
  - Spatial and temporal choices (e.g. where and when to hunt, # of trips)
  - "Multiple discrete / continuous model, or Kuhn-Tucker demand model"
- **Independent variables:**
  - Travel costs to each hunting site
  - CWD prevalence levels
  - Indicator variables for each proposed policy scenario
  - Socio-demographic information (e.g. urban/rural)
  - Site specific fixed effects

Results: Estimates

	Estimate	z-stat
Baseline marginal utility (when no trips are taken)		
CWD	-0.427	-1.290
Extended season	-0.495***	-13.708
October	0.063	0.654
December	0.233***	2.252
Urban	0.013	0.266
Children	-0.159***	-2.343
Landowner	-0.178***	-2.813
Contingent behavior	0.063	0.493

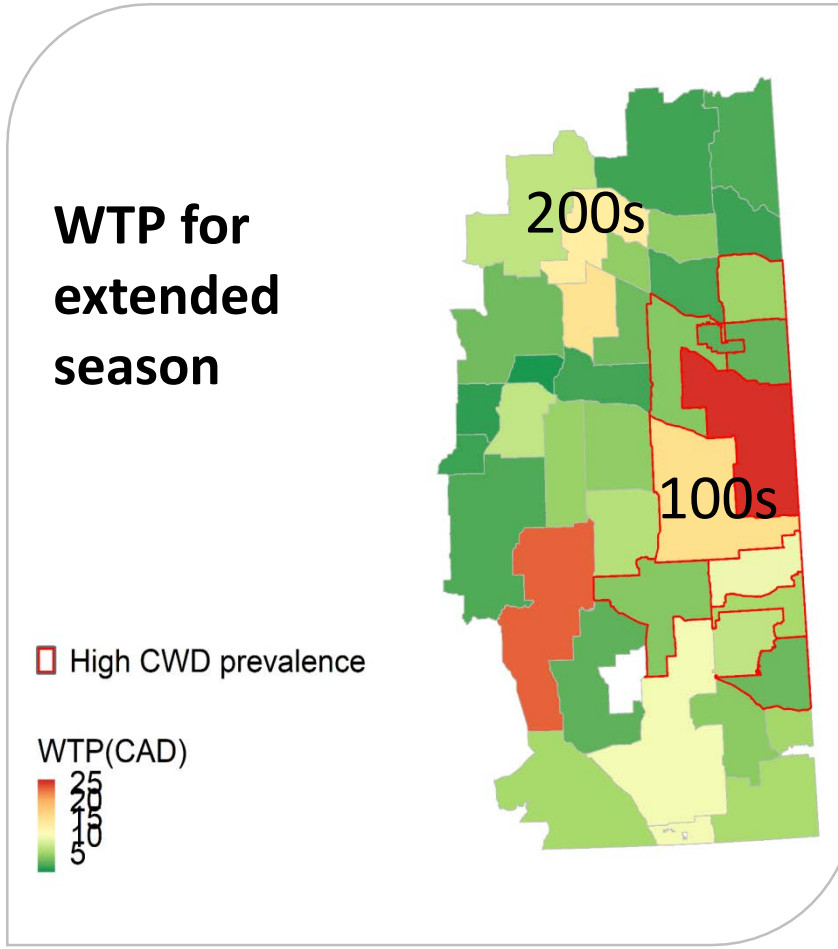
Note: The model includes one ASC for each site.
ASCs and other utility parameters are not presented.

Xie, et al, 2020

Results: Economic Values

Monetary value per person for the extended season

Series	Mean (CAD/person)	Standard Error
All hunting sites	229.62	13.23
WMU 100 Series (18 sites)	151.78	10.67
WMU 200 Series (19 sites)	76.28	4.83
WMU 500 Series (1 site)	1.56	0.26



Xie, et al, 2020

Conclusion: Economic Valuation

Individuals' *behavioral responses* to the wildlife disease and the extended season

- Recreational hunters do not appear to avoid hunting in disease infected areas.
- Spatial and temporal substitution behavior

The impacts of the *non-monetary* *incentive with time flexibility*

- generates additional hunting trips (intensity)
- increases hunting satisfaction, especially in CWD-infected areas
- generates welfare gain, heterogeneous across sites

Using the extended season as an incentive for wildlife disease management

Monetary incentives undesirable

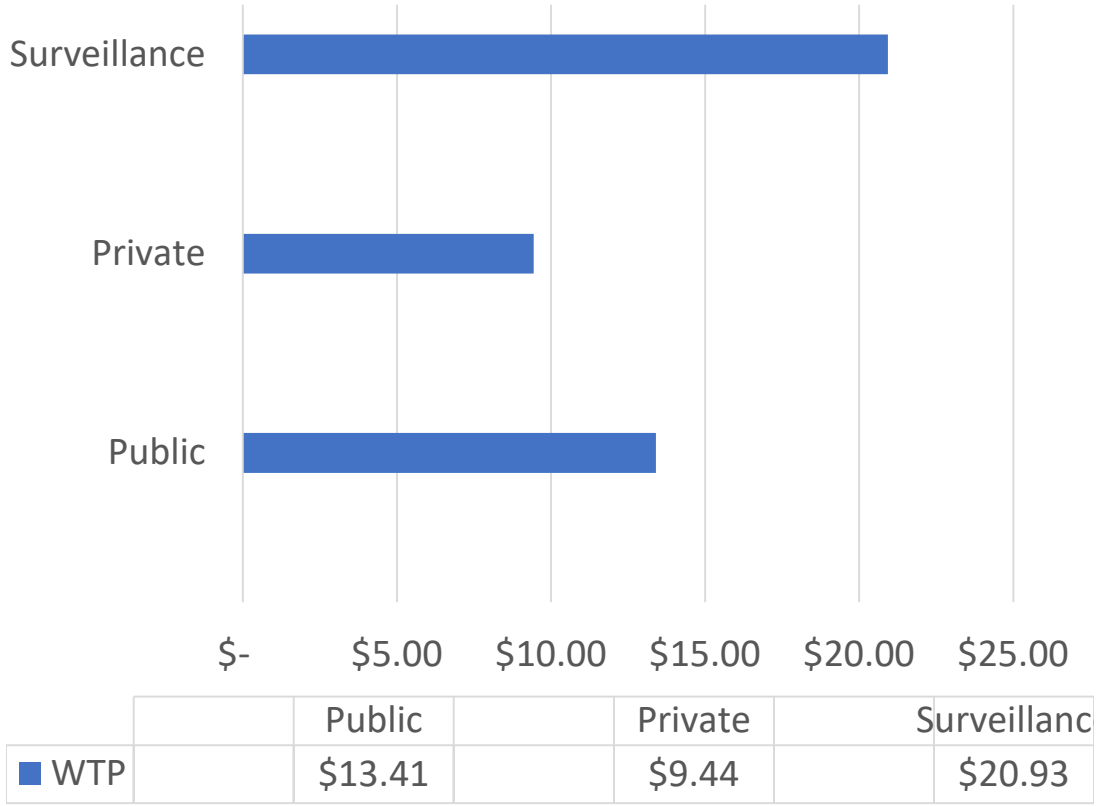
Xie, et al, 2020

Hunter Support for Additional Testing / Surveillance

- Stated Preference Valuation Questions (randomized) for:

1. Increased surveillance of CWD
2. More rapid testing by private agency
3. More rapid testing by public agency

Willingness to pay increases in fees.



Hunter demand for draw licenses over time (aggregate level data)

Analysis of Draw License Demand

An empirical analysis of hunter response to chronic wasting disease in Alberta

John Pattison-Williams, Lusi Xie, Vic Adamowicz, Margo Pybus, Anne Hubbs

Analysis of Draw License Demand

- Sample: draw data from 2005-2016 in mandatory CWD submission WMUs
- Draw information:
  - Total applications and success rate for mule deer (antlered and antlerless)
- CWD-related information
  - Number of heads submitted for CWD testing
  - Number of positive cases and prevalence rate
- Quantitative results
  - Hunters are not being negatively influenced by presence of CWD
  - Draw applications are increasing even in areas where more CWD positive cases are appearing.
  - Not influenced by changing quotas

Analysis of Draw License Demand - Summary

- Quantitative results
  - Hunters are not being negatively influenced by presence of CWD in the demand for draw applications
  - Draw applications are increasing even in areas where more CWD positive cases are appearing.
- Implications for Management
  - Potential for increased quota and harvests as a management option.
- Similar to Holland et al, 2020. Haus et al, 2017 findings regarding harvests and hunting demand.

Table 2. Ordinary least squares (OLS) and fixed effect (FE) regressions modeling the influence of covariates on the aggregate hunting draw applications for mule deer hunters in eastern and central Alberta from 2005 to 2018 (N = 518; groups = 37)[a e].

Variable[b]	Model 1 OLS CWD Info (*N* = 518)	Model 2 FE (WMU) CWD Info (*N* = 518)	Model 3 FE (WMU) CWD Info + Mule Draw Info (*N* = 516)	Model 4 FE (WMU) CWD Info + Mule Draw Info + All Cervid Draw Info (*N* = 516)	Model 5 FE (WMU) CWD Info + Mule Draw Info + All Cervid Draw Info + Indirect Factors (*N* = 486)[d]
CONSTANT[c]	746.99***	750.02***	877.97***	206.85***	229.82**
	(20.74)	(10.16)	(43.18)	(53.64)	(56.96)
CWD PREVALENCE	21.96***	20.69***	14.02**	2.44	2.38
	(5.81)	(4.27)	(3.80)	(2.14)	(2.08)
QUOTA			75.76***	16.90	19.00
			(12.38)	(11.65)	(12.02)
SUCCESS RATE			−8.95***	−1.21	−166.22
			(1.15)	(1.12)	(114.31)
ALL DRAWS				2.10***	1.99***
				(.17)	(.15)
TEMPERATURE					3.69*
					(1.39)
PRECIPITATION					.09
					(.47)
UNEMPLOYMENT RATE					3.09
					(4.06)
Adj. R^2 (within)	.09	.23	.41	.69	.69

Generalizations?
Hunters, CWD and CWD Management

- Economic impact of CWD on hunting
  - Early literature suggested negative impacts of CWD on activities and economic values
    - Bishop, 2004; Lazo et al, 2004; Zimmer et al, 2011; Zimmer et al, 2012; Seidl and Koontz, 2004.
    - Employed a mixture of models, assumptions, stated preference responses in measurement
  - Our recent models show no adverse impact of CWD on activity (currently)
- Efficacy of engaging hunters in management
  - Evidence from the literature is “mixed” (Uehlinger et al, 2016)
  - Efficacy depends on trust in agency, agreement with objectives, risk perceptions, agreement that objectives are achievable, etc.
    - Cooney et al, 2010; Holsman et al, 2010

Generalizations?

- **Our results are not dissimilar to those in the U.S. regarding behavioral response to CWD.**
  - Considerable concern associated with initial outbreaks, but over longer time period limited reduction in harvest, demand, etc. Holland et al, 2020. Haus et al, 2017.
  - Risk perceptions are a function of location, trust in the management agency; Risk perceptions may decline with familiarity over time. Vaske et al, 2018a, b. Vaske and Miller, 2019.
  - At some point, CWD prevalence may lead to a decline in hunting (Risk preferences? Population impacts? Delays in testing? Availability of substitutes?)

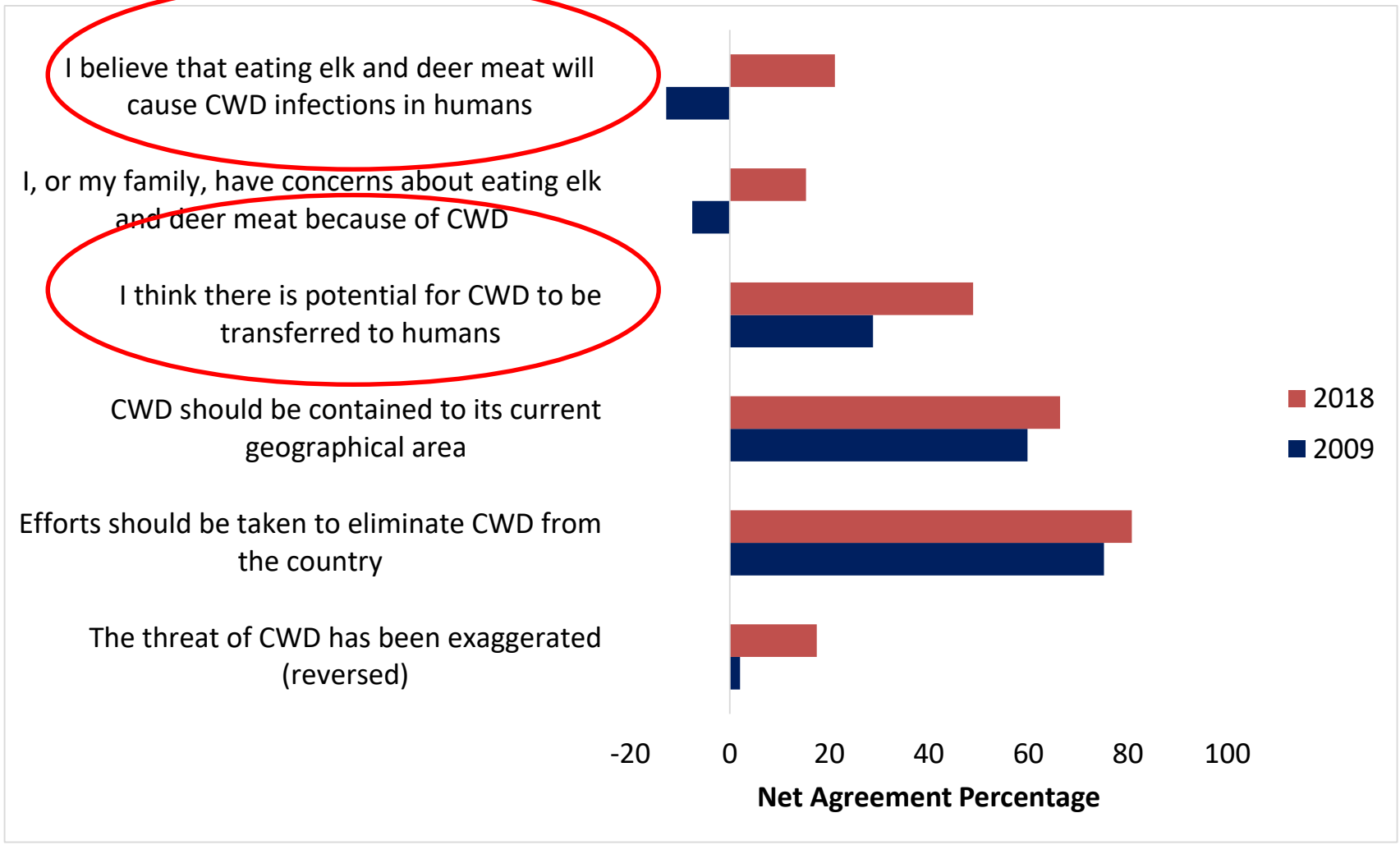
Public perceptions of CWD and Preferences for Management Options (individual level data)

Surveys of the General Public and Stakeholder Groups

- Ellen Goddard and co-authors, and Marty Luckert and co-authors, have been surveying the general public and investigating perceptions of CWD and preferences for policies.
- Examples of Stakeholder Groups:
  - Hunters, Landowners, Rural Residents, General Public
- Goddard et al's public surveys have spanned several years
- Myae and Goddard, 2020; Muringai and Goddard, 2017.

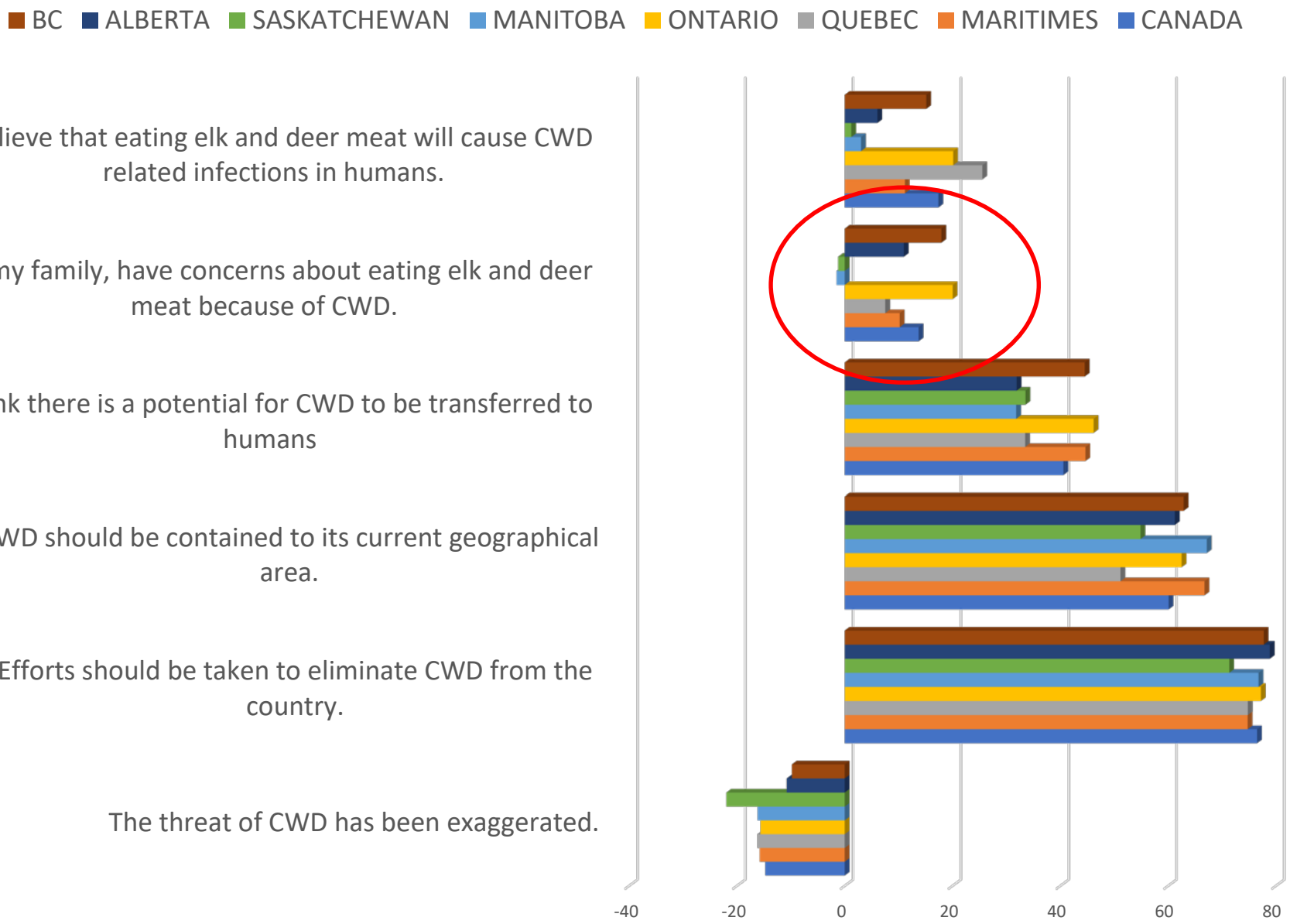
Muringai and Goddard

Risk perceptions about CWD: Canada



Thanks to Ellen Goddard for this slide

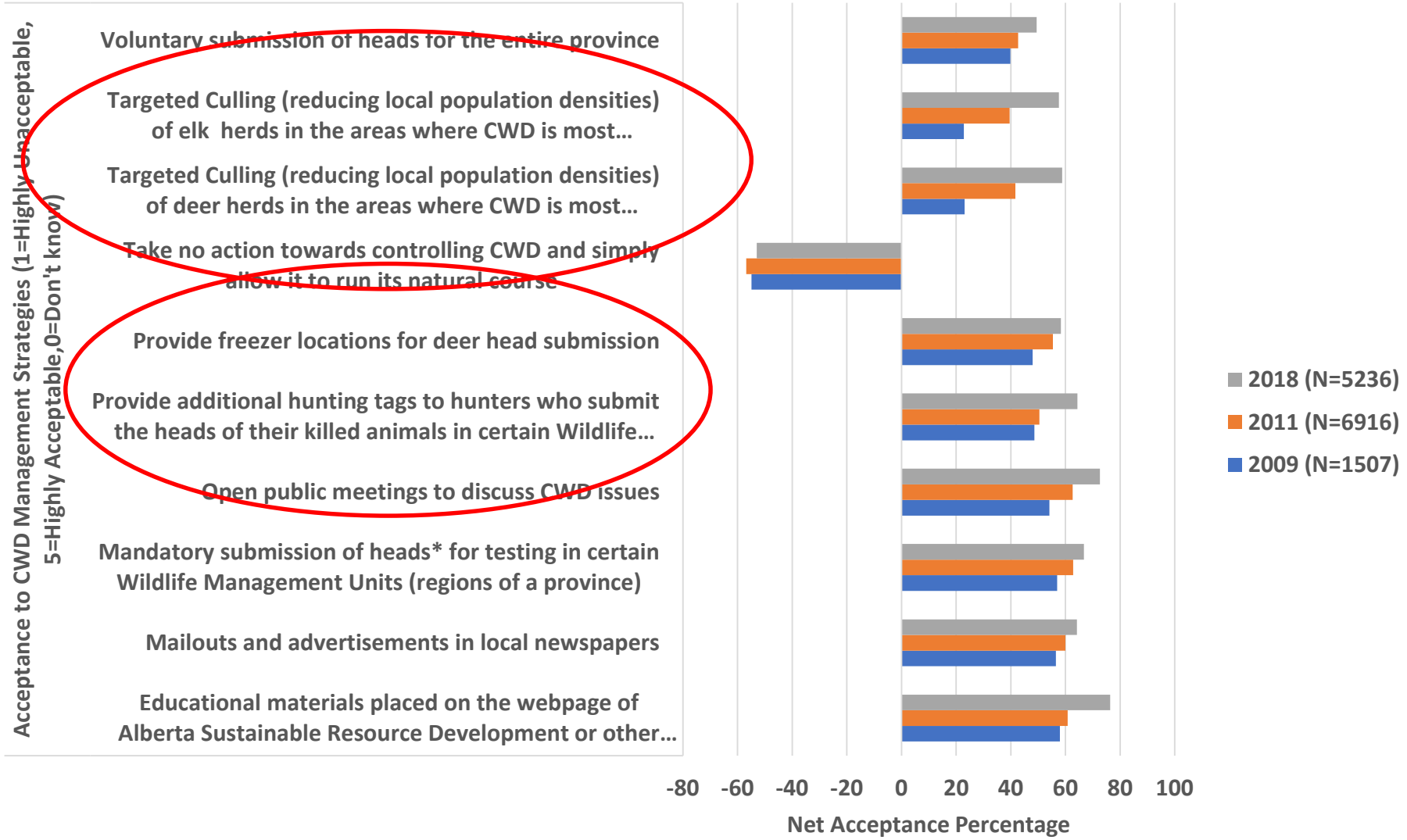
CWD ATTITUDES *June 2018* Net Agreement %



Thanks to Ellen Goddard for this slide

Myae and Goddard

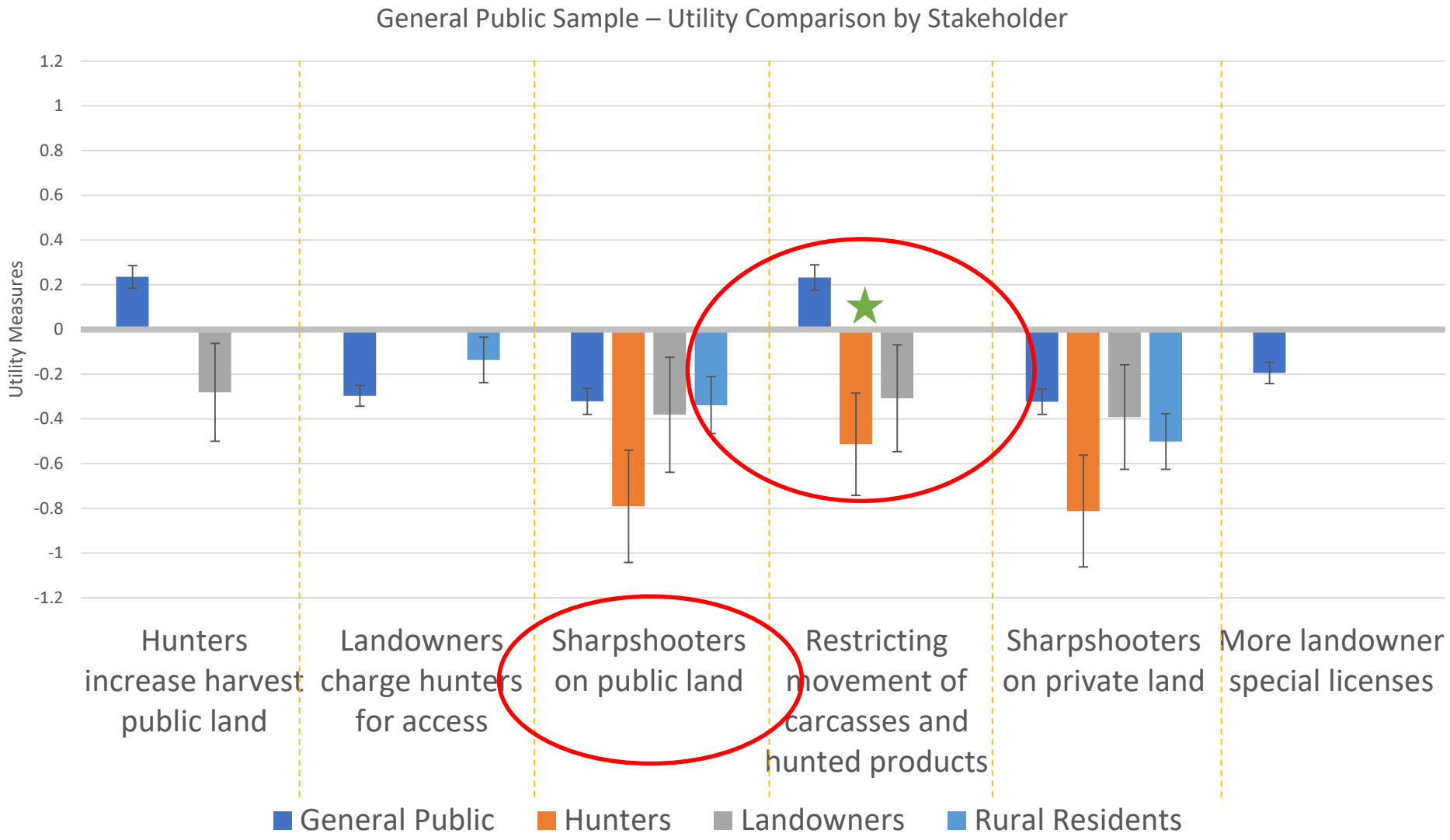
Acceptance of CWD Management Strategies Across Time



Thanks to Ellen Goddard for this slide

Results – Management Options by Stakeholder Groups

Durocher and Luckert 2019



Generalizations?

- **Public risk perceptions**
  - Less awareness in U.S. general public relative to Canada (Muringai and Goddard, 2017)
  - Relationship between trust (general, institutional) and risk perceptions (Muringai and Goddard, 2017)
  - Risk perceptions may be increasing over time (Canadian data)
  - Vaske and Miller (2018): Overall risk perceptions declining; Hunters perceive higher risk than the public
  - Stafford et al (2007): Non-hunter landowners not as concerned as hunters regarding CWD.

Covid-19, CWD and Hunting

- **COVID-19 is affecting the economy, health / risk perceptions, social interactions, etc.**
  - Increases in unemployment, declines in income?
- **There is some evidence in the literature that increases in unemployment, and declines in income, lead to additional hunting demand (Boman et al, 2013)**
  - Evidence among recreational hunters as well as Indigenous harvesters.
- **But heightened concerns about risks and zoonotic diseases may also arise.**
- **COVID-19 is also affecting provincial / state / federal budgets**
  - Impact on surveillance programs
  - Influence on research
- **Lessons Learned from COVID-19? (role of science, communication; adaptation, cooperation)**

Conclusions – From our Research

- **The majority of Alberta hunters are not changing their hunting behavior in response to CWD**
  - Hunters who were very concerned may have stopped hunting or starting hunting for other species or in other locations.
- **Alberta Hunters are concerned about CWD impacts on wildlife populations and some are concerned about human health impacts**
  - Risk perceptions are stable or declining, But perhaps CWD prevalence is not high enough to change behavior. Changes in wildlife populations, or other factors may results in reduced activity and economic value
- **Alberta Hunters are interested in participating in programs that get them involved in CWD management**
  - Season length extensions, extra tags – can generate increases in economic value.
- **The general public has positive preferences for monitoring, management by hunters**
- **There is support and a willingness to fund increased surveillance (hunters, general public)**

Conclusions - Human Dimensions of CWD

- **CWD management is a challenge because of the variety of stakeholders, the heterogeneity of preferences /perceptions, uncertainty and identification challenges.**
- **Assessing the benefits, costs, acceptability, and distribution of impacts is challenging**
- **Two examples:**
  - Engaging hunters in management (public support, hunter support, but not accepted by all groups)
  - Enhanced surveillance (hunter and public support, but costs, implementation issues)
- **Other policy / management options?**
  - Testing requirements (farmed, wild); Investment in technology (mitigation, remediation)
  - Coordination of policies (provinces / states); Various other options (Gillen et al, 2018)
- **Future Research**
  - Indigenous People and Communities – Traditional Knowledge, Community Based Monitoring
  - Risk perception, responses to information / communication, trust, and behavior
  - Improved data collection – behavior, valuation, perception, knowledge

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QUESTIONS / COMMENTS?

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