

Cougar Research & Management Update WDFW Commission Meeting March 18 2016

Presented By:
Rich Beausoleil
Bear & Cougar Specialist



PRESENTATION OVERVIEW



- > History of cougar management
- Research topics past 15 years
- **Research products**
- **▶** Management structure



- ► Inter-agency data comparison issues
- **Overview of the past 4 hunt seasons**



HISTORY OF COUGAR MGMT IN WA



- ► 1966 Classified as a protected game species
- > 1970 Mandatory reporting began
- > 1977 to 1986 ~ 70 day general hunting season
- > 1985 Tooth collection from mortalities began
- ► 1987 to 1995 ~ 60 day permit-only hunting season
- > 1996 I655 –voters banned hunting with hounds
- > 1997 to 2008 227 day general hunting season
- > 2000 to 2011 legislature approved hunting with hounds by permit only
- **2003 DNA collection from all mortalities began**
- > 2004 Cougar hotline & harvest guidelines implemented
- > 2009 to 2014 212 day general hunting season
- > 2015 242 day general hunting season



COUGAR: A CAT OF MANY NAMES





Sexual Dimorphism

Males: 120-190 pounds (adult avg = 140 lbs)

Females: 80-120 pounds (adult avg = 90 lbs)



COUGAR RESEARCH IS CHALLENGING













WA COUGAR RESEARCH TOPICS



- Social organization
- ► Abundance & density
- **Growth rate**
- New biopsy dart technique
- ► Habitat & space use
- > Source-sink management
- Using DNA to evaluate field ID of sex
- Older age structure and territoriality

- Genetic structure
- **▶** Harvest rate
- **Resource selection**
- Differential prey use
- **Effects of hunting**
- **Demographics**
- > Immigration & emigration
- Management throughout western North America
- > Staff response guidelines



PRODUCTS - SCIENTIFIC PUBLICATIONS



WikiNe Soviety Bulletin, 39(1)-203-209, 2015, DOI: 10.1002/vals-493

Tools and Technology

Using DNA to Evaluate Field Identification of Cougar Sex by Agency Staff and Hunters Using Trained Dogs

RICHARD A. BEAUSOLEIL, ¹ Washington Department of Fish and Wildijk, 3515 State Highway 92d, Wenatches, Wel 98101, USA KENNETH I. WARHEIT, Washington Department of Fish and Wildie, 600 Capital Was N. Olombia, WA 98501, USA ABSTRACT Cougar (Puma concolor) hunting has been classified typically as either selective-hunting with the

RH: Cougar Management Protocols • Beausoleil et al.

COLIGAR MANAGEMENT PROTOCOLS: A SURVEY OF WILDLIFE AGENCIES IN NORTH AMERICA

Richard A. Beausoleil, Washington Department of Fish and Wildlife, 3515 State Highway 97A, Wenatchee, WA 98801, USA, <u>beausrab@dfw.wa.sov</u> na Dawn. California Course Project. 8760 McCarty Ranch Dr. San Jose, CA USA 95135

Contents lists would be at SciVerse ScienceDirect Biological Conservation

Effects of male trophy hunting on female carnivore population growth

Robert B. Wielgus a.*, Dana Eleanor Morrison a, Hilary S. Cooley b, Ben Maletzke

journal homepage: www.elsevier.com/locate/biocon

Source populations in carnivore management: cougar demography and emigration in a lightly hunted population H. S. Cooley¹, R. B. Wielgus¹, G. Koehler² & B. Maletzke¹

Wildlife Society Bulletin; DOI: 10.1002/wsb.299

Research to Regulation: Cougar Social Behavior as a Guide for Management

RICHARD A. BEAUSOLEH!, "Indiagno Department of Fish and Widdle, 3555 Janu Highway 924, Wannine, THE 8850, USA GAND M. KORHILK, Weinington Department of Fish and Wildle, 2015 Deplace Stock, Househop, 180 8000, USA GAND M. KORHILK, Weinington Department of Fish and Wildle, Do. to 122, Juliusa, 180 9300, USA BERLINN N. KRETISKON, Weinington Department of Fish and Wildle, Do. to 122, Juliusa, 187 9300, USA BERLINN N. KRETISKON, Weinington Department of Fish and Wildle, 2015 Jan des NR, 2010 202, Department of Control of Contro

ABSTRACT Courar (Pursa conceler) populations are a challenge to estimate because of low densities and th ABSTRACT Corget (Penn control) population are a challeng to estimate because of the skendest madel disfinity sensing and controlling inferiousles, as must, their management in them based to an imported date. Current strategies with one associated concept, which tends to meal to a spatially charged surveil dates. The control of the con structure and social organization. We recommend a harvest strategy based on a population growth rate of 14% and a resident adult density of 1.7 coagan/100 km² that represent probable average values for western 14% and a realizate shift during of 1.7 congrant 100 has the represent position of congrant. Our proper different measures on opportunity to preserve behavioral and demographic attributes of congra populations, provide recordinal harvest, and accomplish a unitary of management objections. We believe this accordinal to congramant question in a congramant, tours from the congramant of the y added costs, satisfies agency and stakeholder interests, assures professional credibit roughout their range in western North America. © 2013 The Wildlife Society.

KEY WORDS congue, harvest management, harvest quota, intrinsic growth rate, management zone, Anna concider, regulation, social structure, source-sink, Washington.

The history of coagar (Pana concolor) management in

Washington and for the western United States as a whole has
2011) have elucidated coagar ecology, providing managers a He distily of torge (vent interest) interpretation of the control of the control

2006. Homodor and Negi 2000, Robinson and DeSimose 2011) have ducladated ourse orders, providing managen is 2011) have ducladated own orders, providing managen is Belaries and social explanation as important aspects of the properties of the properties of the properties of the con-cepting the ages of the tropic between Con-lored Test Constraints and Constraints of the Con-lored Test Constraints of the Constraints of the Con-lored Test Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints of the Constraints of the Con-traints of the Constraints of the Constraints

organisms..., older age structure to promote population and source sources of This model for cougar management addresses concerns of various constituencies to 1) provide a suttishable harvest, 2) provide quality recreational experience to the hunting public, 3) maintain viable cougar populations, and 4) more explicitly

Biological Conservation Effects of male targeted harvest regime on sexual segregation in mountain lion Ion R. Keehner * Robert B. Wielgus, Benjamin T. Maletzke, Mark F. Swanson ntal Conservation: page 1 of 10 © Foundation for Environmental Conservation 2010

Improving studies of resource selection by understanding resource use BRIAN N. KERTSON AND JOHN M. MARZLUFF*

School of Forest Researces, University of Washington, Seattle, WA 98195, USA Date submitted: 27 March 2009; Date accepted: 22 April 2010

Management and Conservation Article

Cougar Prey Selection in a White-Tailed Deer and Mule Deer Community

HILARY S. COOLEY, *Large Carnicon: Communication Laboratory, Department of Natural Resource Sciences, Washington State University, Pallman, WM 90144-5449, USA HUGH S. ROBINSON, Large Caralwee Conservation Laboratory, Department of Natural Resource Sciences, Washington State University, Pulman,

ROBERT E. WELDING, Logo Cardion Conversation Labratop, Department of Named Review Lineau, Weldington Best University, Palenau, 805 9936 4401, URL and Marcol Named Affairly Named Department Enlayer Coulom in its Malerians, Posit, Prince CVITHENNE S. LAMBERT, Logo Cardions Conversation Labratop, Department of Named Review Science, Weshington State University, Department of Named Review Science, Named Review Sc

Cougar Population Dynamics and Viability in the Pacific Northwest

CATHERINE M. S. LAMBERT, 12 Large Cambone Conservation Laboratory, Department of Natural Resource Sciences, Villatinosion State University Pulmar, Wh. concerns, use.

ROBERT B. WIELOUS, Large Carrivore Conservation Laboratory, Department of Natural Resource Sciences, Washington State University,
Alamso Will 20164-6410, USA

HUGH S. ROBINSON, Large Carnivore Conservation Laboratory, Department of Natural Resource Sciences, Washington State University;

Ecological Applications, 21(8), 2011, pp. 2866–2881 ID 2011 by the Ecological Society of America

Cougar space use and movements in the wildland-urban landscape of western Washington

BRIAN N. KERTSON, 1,5 ROCKY D. SPENCER, 2,6 JOHN M. MARZILIFF, 1 JEFF HEPINSTALL-CYMERMAN, 1 AND CHRISTIAN E. GRUE⁴

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U.S. Geological Survey, Washington Cooperative Floh and Wildley Research Usit School of Aquatic and Puberica Sciences,
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Back 35(00), University of Washington, Scattle, Washington 9192 USA

About. The williand-what instiface lies at the confunce of lumani-dominated and willise coolings, below, and evolution it is interface as independently by both material and human placements. But requires practic understanding of how driven bactors affect managing a feequent and often understanding of how driven bactors affect managing a feequent and often understanding of the will analysis have larger to managing a feequent and often understanding of the will analysis in the second of we experted and indistricted 27 coughts to model space use and understand the role of landscape fatures in twist term (spillings) consumes, and depositions) between congust-landscape fatures in twist-training consumes, and of productions between congus-lated and twee probably attentive to proxy influential to proxy valueshilly, and associated with limited or on machinal development. They accessioned force they confer force to the will be a supplementation of the contract of the with limited or no moleculal development. Early-accessional forest (+), confer forest (+), distance to not (-), residential density (-), and (-) explained residenty (-) and develone (-) was originated prostive and highly variable. Spece use and movement rates in wildland and readential areas were similar because congers used suddischafels from term schens, enercy, and controls in readential because congers used suddischafels from term schens, enercy, and controls in readential term schens and the schens of the sche landscape planning. Resource utilization functions provide a proactive tool to guide these activities for improved coexistence with wildlife using both wildland and residential portions of the landscape.

Key words: cougar; interaction; Pama concolor; resource utilitation functions (RUF); space use; Weshinston State USA: wild and-urb an interface.

Human beings dominate the world's diverse ecosy olutionary processes and direct utilization and mlocation of plants and animals requires ethinking the science of ecology (Alberti et al. 2003) and the conservation of biological diversity (Turner et al. 1991,

McKinney 2002, Jenkins 2003), Foremost in this reconsideration is an understanding of the variation in human action and its spatially explicit role as a driver of other species' ecology and natural history (Marzluff and Ewing 2001, Sanderson et al. 2002). In North America, residential development of natural

landscapes is substantial and influential (Brown et al. 2005, Theobald 2005, Wade and Theobald 2010 Memoripi racinel 26 May 2011; accepted 1 Janu 2011.

Germay-radie gales Residential development threatens the long-term viability introduction and expansion of invasive species (Hansenet al. 2005, McDonald et al. 2009), and increased risk of

Effects of Remedial Sport Hunting on Cougar Complaints and Livestock Depredations

Kaylie A. Peebles 14, Robert B. Wielgus 1, Benjamin T. Maletzke2, Mark E. Swanson

Ecology, 90(10), 2009, pp. 2913-2921

Does hunting regulate cougar populations? A test of the compensatory mortality hypothesis

He and S. Congres J. Brancow B. Witt com J. Carry M. Kongress J. House S. Brancow, M. and Brancow T. Marcowse. ³Large Carnivere Conservation Laboratory, Department of Natural Resource Sciences, Washington State University Pullman, Mushington 99164-64B USA ²Washington Department of Fish and WHIBQ. Olympia, Washington 98501 USA

Ecological Applications, 18(4), 2008, pp. 1028-1037 © 2008 by the Ecological Society of America

SINK POPULATIONS IN CARNIVORE MANAGEMENT: COUGAR DEMOGRAPHY AND IMMIGRATION IN A HUNTED POPULATION

HUGH S. ROBDSON, 1,3 ROBERT B. WIELGUS, 1 HILARY S. COOLEY, 1 AND SKYE W. COOLEY Large Carnivore Conservation Laboratory, Department of Natural Resource Sciences, Washington State University, Pullman, Washington 99164-6440 USA

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where they conflict with human interests. It is widely believed that sport hunting is effective in

The Journal of Willife Management 75/0-1115-1120 2015 DOI:10.1002/james144

Differential Prey Use by Male and Female Cougars in Washington

WA WISE-BELL, USE
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BENJAMIN T. MALETZKE, Large Carnicon Conservation Laboratory, Department of Natural 8
Philines, WA 97164-6401, USA

Ecology and Evolution

Effects of hunting on cougar spatial organization

Benjamin T. Maletzke¹, Robert Wielgus¹, Gary M. Koehler², Mark Swanson¹, Hilary Cooley¹ & J. Richard²

Department of Fish and Wildlife, PO Box 238, South Cle Elum, WA 98943.

The effects of increased mortality on the spatial dynamics of solitary camivores are not well understood. We examined the spatial ecology of two outgrapequations that differed in hurting intensity to test whether increased mortality affected home range size and overlap. The stability bypothesis predicts that home range is and overlap will be similar for both sears among the two arrans. The instability hypothesis predicts that home range size and overlap will be greater in the heavily hunted population, although may differ for males versus females due to behavior strategies. We marked 22 adult resident cougan in the lightly hunted population and 20 in the heavily hunted population with GPS collars from 2002 to 2008. Cougar denoities and prediction rates were similar collar from 2001 to 2000. Coage densities and prediction rates were entitive morage arrass, agginging to difference in pre-quite resources. We compared home range state, these dismensional home range overlap, and three dimensional base transparence and three dimensional base rates and training dendershive energia feet. To the reason of the contraction of the contraction of the reason of the contraction of the contraction of the reason of the contraction of the cont

hypothesis. Increased hunting and ensuing increased male home range size and overlap may result in negative demographic effects for congars and potential unintended consequences for managers.

For the last 50 years, management of cougars in western North America has focused on setting harvest for recrea-tional value and to protect livestock, human safety, sensitive species, or bolster ungulate populations (Logan and Swannor 2010; Jenks 2011) because it is generally believed that increased harvest will reduce the density of cougan. Management strategies that incorporate metapopulation (source-sink) dynamics can be used to accomplish harvest objectives while ensuring overall population viability (La-undré and Clark 2003). Source areas are generally located 2000; Robinson et al. 2008; Cooley et al. 2009a,b; Ruth

areas, national parls, monuments, and sinks in areas where access is high cougar predation is a concern, or cougar-human conflicts occur (Laundré and Clark 2003). However, source-sink management may not account for monthly effect on descriptions. mortality effects on demography and spatial dynamics or the unintended consequences on management objectives when harvest is spatially dumped (Beausoleil et al. 2013). Long-term research has provided insights into the negative effects of high (>20% per year) mortality on demo

1E-mail: richard begandei Mdf v. voz. m.v. Researched or al. • RH Behavior-Band Course Managemen



PRODUCT - USING BEHAVIOR FOR MGMT



Not a new idea – albeit a different application

- Cargill raising cattle since 1865
- 126 years later, in 1991, Dr. Temple Grandin approached them with an idea



• Using cattle's behavior for mgmt "she revolutionized the industry". Thinking outside the box

- ► WDFW– managing cougars since 1966
 - 47 years later, WDFW using behavior to improve management & preserve social stability
 - Like Cargill, WDFW is leading rather than following



WA COUGAR RESEARCH PROJECTS

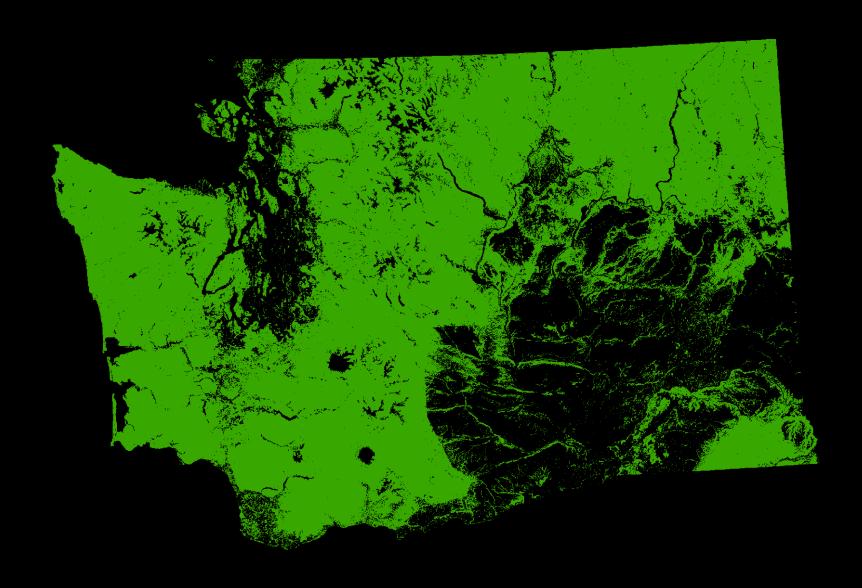


Study Area	# Years	# Cougars*	Study Area (km2)	
Makah	4	17	1,061	
Westside	10	64 3,500		
Cle Elum	8	46	1,652	
Okanogan	10	77	1,797	
Biopsy	10	133	2,878	
Wedge	6	57	735	
Selkirk	5	52	5,600	
Blue Mtns	5	33	384	
total	58	479	17,607	
* Does not include n	nultiple captures of	same individual		



PRODUCTS - NEW STATEWIDE HABITAT ASSESSMENT

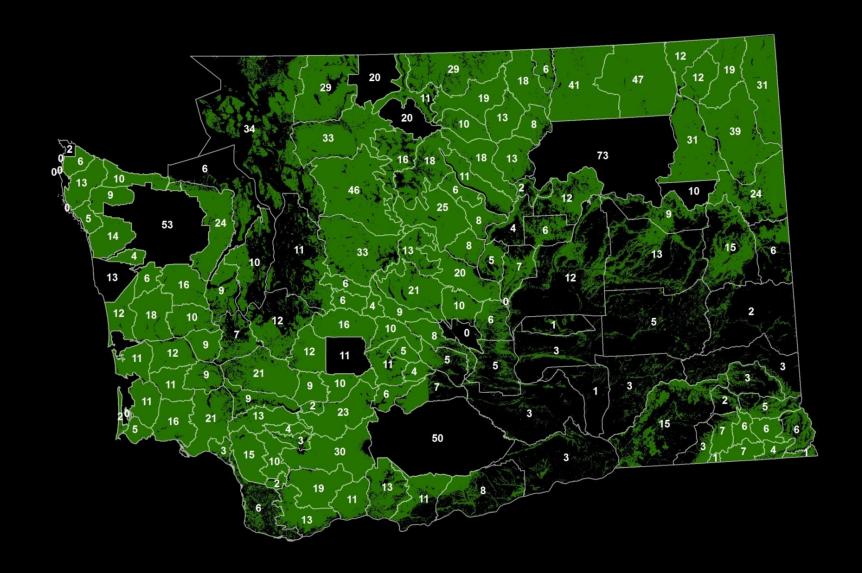






PRODUCTS - NEW STATEWIDE POPULATION ASSESSMENT

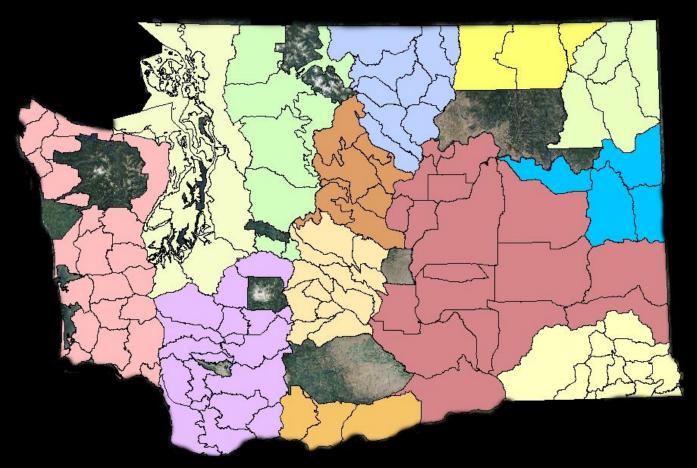






ZONE MANAGEMENT 2004-2012





- > 13 zones large-scale geographic areas
- Comprised multiple game management units (3-22 GMU's)
- Basic geographic boundaries



PMU MANAGEMENT 2012-CURRENT



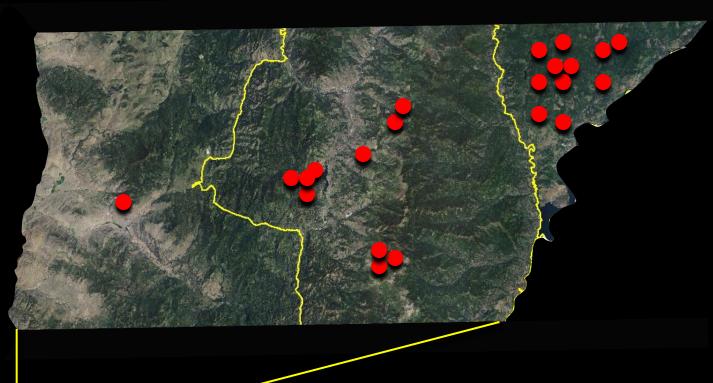
- ➤ Since 2012, 50 PMU's were created (1-4 GMU's)
 - Habitat, density, harvest history, access, & people were all considered when creating the boundaries
 - Reg. staff fine tuned boundaries based on local knowledge





PREVIOUS ZONES = HARVEST CLUMPING



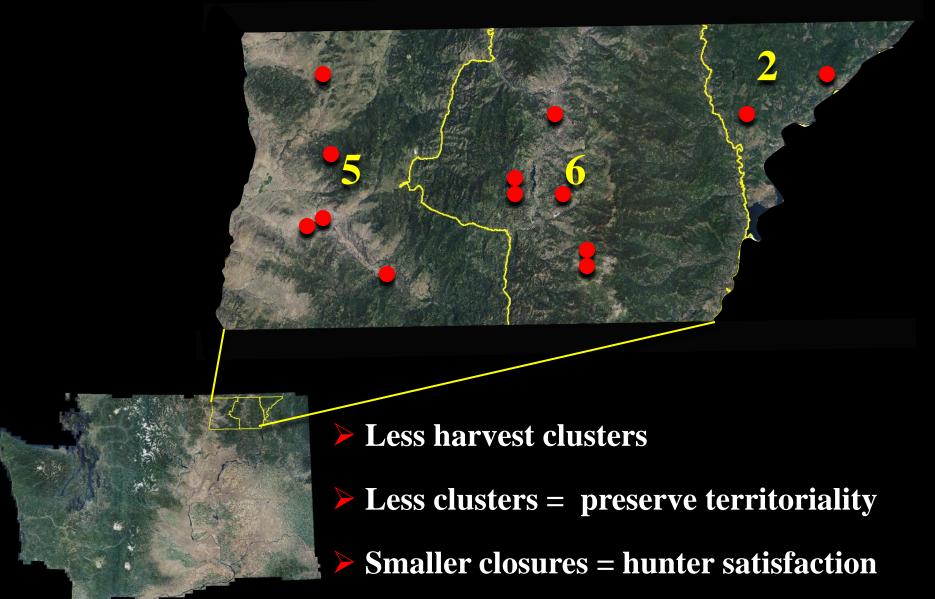


- **▶** High access = inequitable harvest
- ► Harvest clusters ≠ social stability
- Widespread closures = hunter frustration



NEW PMU'S = STABILITY & EQUITY







BENEFITS OF PMU's FOR PEOPLE



- **For hunters:**
 - Older aged animals on the landscape a better quality hunt
 - Harvest is fair & equitable across the landscape
 - Not negatively affected by large closures, hunt next door
- **▶** For non-consumptive user groups:
 - Recognizes their values by maintaining the integrity of social structure & ecosystem
- For managers:
 - Simple for user groups to understand
 - Inexpensive to implement
 - Scientific and defensible
 - Satisfies agency and multi-stakeholder interests





THE PMU CLOSURE PROCESS



- There is no closure regardless of harvest prior to Jan 01
- ► Harvest is tallied once per week and 2-3 days notice is given
- > Telephone hotline & website provide hunters with information
- > Only hunter kills apply towards the guideline

Cougar Hunting Area Openings and Closures

Harvest guideline system

In hunt areas with a harvest guideline, the Director may close the cougar late hunting season after January 1 in one or more GMUs if cougar harvest meets or exceeds the guideline.

Starting January 1, cougar hunters may hunt cougar from January 1 until the hunt area harvest guideline has been reached and the GMU(s) is closed by the Director or April 30, whichever occurs first.

All cougars killed by licensed hunters during the early and late hunting seasons, and seasons authorized under WAC 232-12-243 shall be counted toward the harvest guideline.

It is each cougar hunter's responsibility to verify if the cougar late hunting season is open or closed in hunt areas with a harvest guideline. Cougar hunters can verify if the season is open or closed by calling the toll free cougar hunting hotline (1-866-364-4868) or visiting this website.

The hotline and website will be updated weekly beginning January 1, 2016.

Information last updated: November 4, 2015

Three things to know

- Anticipated closures are not official until considered and approved by the director of WDFW.
- Hunters can also verify closures by calling the toll-free cougar hotline (1-866-364-4868, press 2 after the recording).
- After January 1, 2016, all hunters must report their kills via the cougar hotline within 24 hours (press 3 after the recording), and kills must sealed by WDFW staff within 5 days (unfrozen)



AGENCY USE OF HARVEST GUIDELINES



- ➤ WDFW uses the term harvest "guidelines" rather than "quotas" or "limits" because
 - a quota connotes a target rather than a threshold
 - a limit connotes a maximum rather than a guideline

- ► Of 13 western states that manage cougars
 - 12 (92%) use harvest guidelines
 - All (100%) have mandatory inspection / sealing protocols
 - 11 (85%) use a telephone reporting / info hotline
 - All but WA have a 24-hour closure notice



THE 12-16% HARVEST GUIDELINE



- **Some confusion with the concept including:**
 - "high" vs "low" harvest areas
 - male vs female harvest %
 - adult vs subadult harvest %
- High vs low harvest in manuscripts discussed the 2 ends of the spectrum, we needed to find the "sweet spot"
 - When hunting & territorial effects were removed, the intrinsic growth rate was 14% (± 2) in both populations
- ► Rate of growth = the rate at which a population would increase with no hunting and no territoriality effects
 - Mortality > growth rate = population decline ("high" vs "low")



THE 12-16% HARVEST GUIDELINE



- ➤ All sex and age classes are treated the same with the intent of preserving social structure & replacement (kittens not included)
- **Each** sex & age class contributes to population structure
 - For ach cohort (1yr, 2yr, 3yr...) higher removals of 1 age class is carried into subsequent age classes for years

- > PMU's have resulted in well mixed sex & age classes in harvest
- ➤ This strategy is based on equilibrium, harvesting at or below the rate of growth is the goal
 - below ≠ population increase due to territoriality effects



THE 12-16% HARVEST RATE

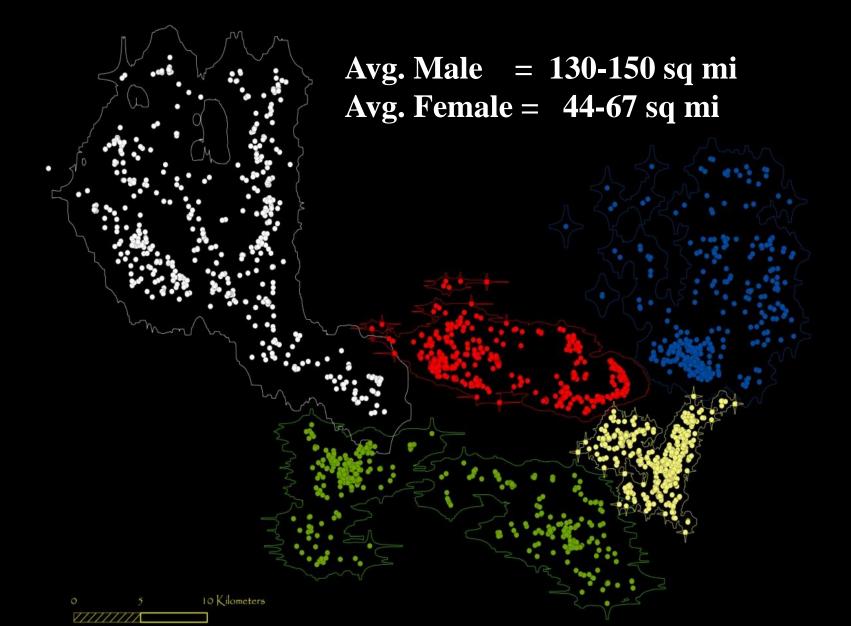


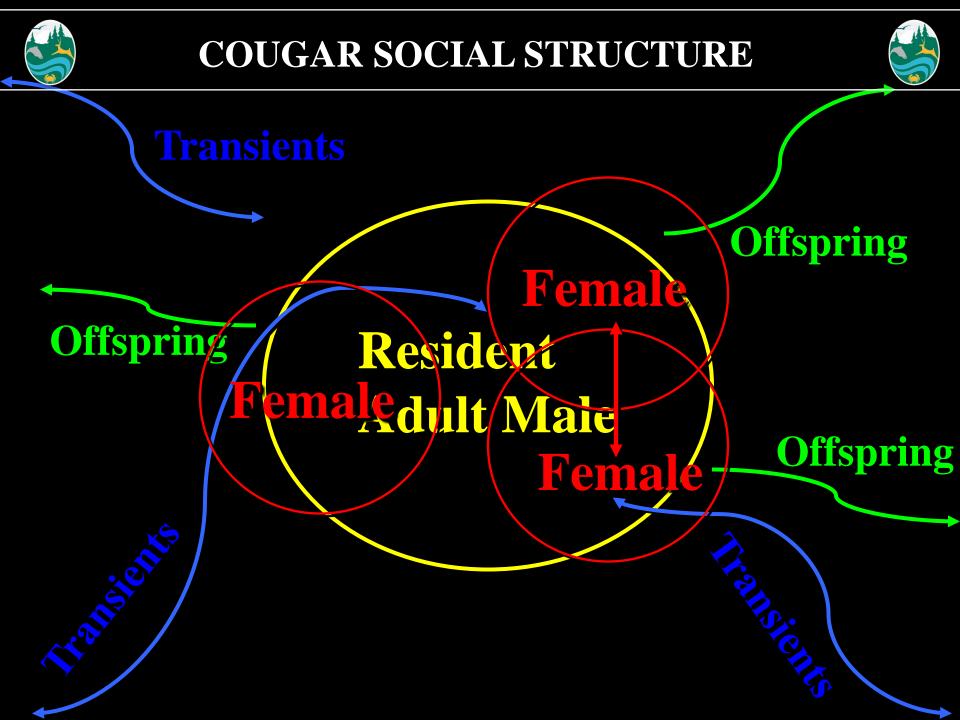
- > 3 additional studies have since validated the 12-16% results
 - Robinson et al. 2014 (MT, 12% growth rate)
 - Logan et al. 2015 (CO, → population @ 15.5% harvest)
 - Beausoleil et al. 2016 (WA, → population @ 14% harvest, 7-21%)
- ► Important to note that only hunting mortality applies towards the harvest guideline in WA
 - All other mortality is recorded but does not apply
- ➤ WDFW's structure allows district staff the flexibility of using 12, 14, or 16% hunter harvest based on total mortality & age class of kills



COUGAR HOME RANGE SIZE



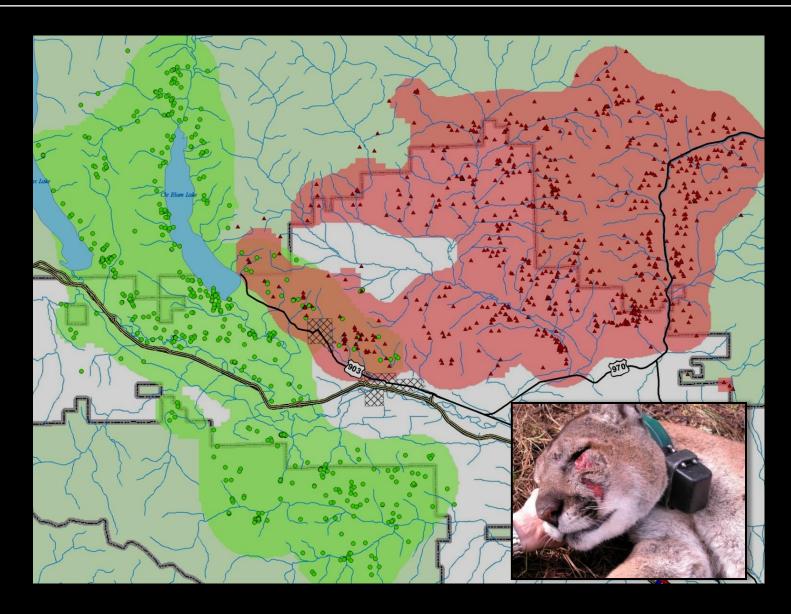






COUGAR TERRITORIALITY



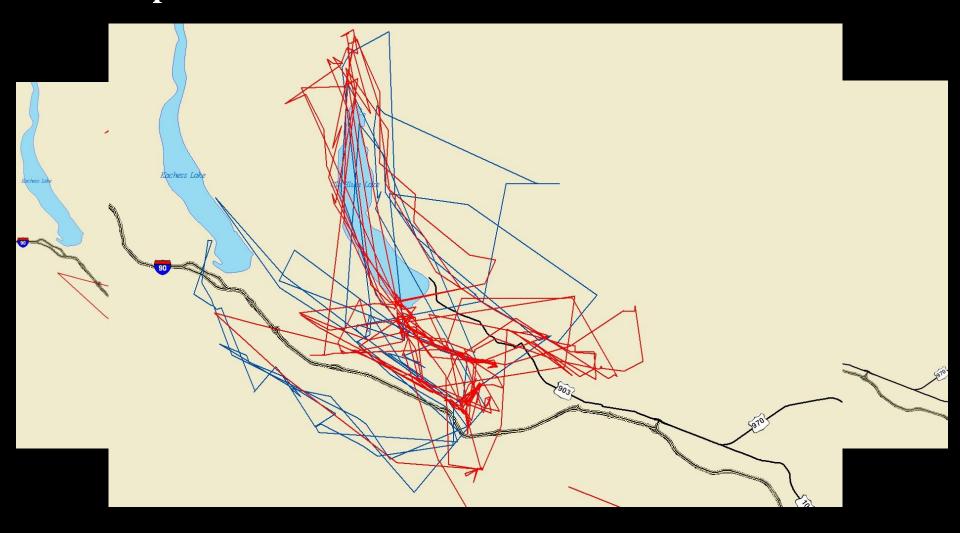




COUGAR TERRITORIES



► Males are border patrol agents....and HR boundaries are used by their replacements





COUGAR TERRITORIAL MARKERS

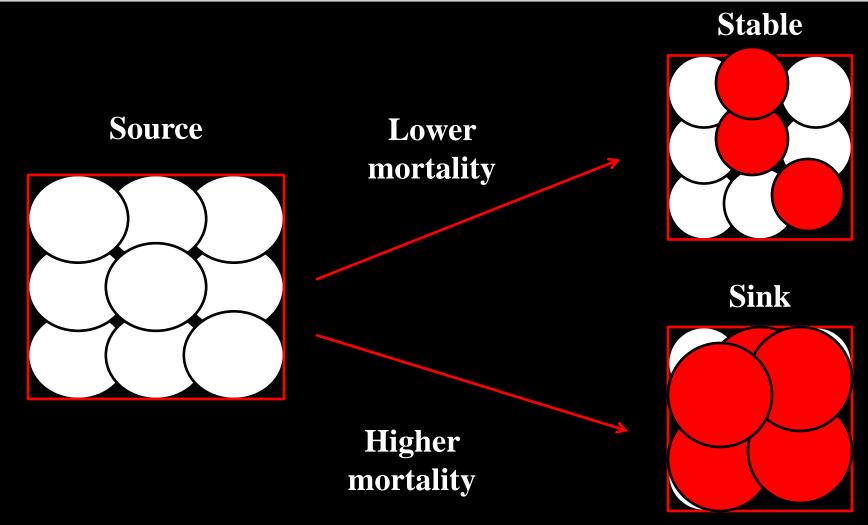






MALE SOCIAL BEHAVIOR





➤ Density can be the same in these scenarios. Not just hunter kills....all mortalities affect this structure



EFFECTS OF HIGH HARVEST



- ➤ Although local population sinks may be re-populated by immigration of subadults, high harvest can lead to:
 - **✓** breakdown of territoriality
 - ✓ increased HR size & overlap

perception of population increase

- Demographic changes:
 - **✓** younger age structure
 - **✓** reduced adult females
 - **✓** increased kitten mortality



May create unanticipated consequences, including an increase cougar-human interactions



DENSITY DEPENDENCE



➤ Because of territoriality, cougar populations are not analogous to muskrat populations, there is a ceiling to growth potential

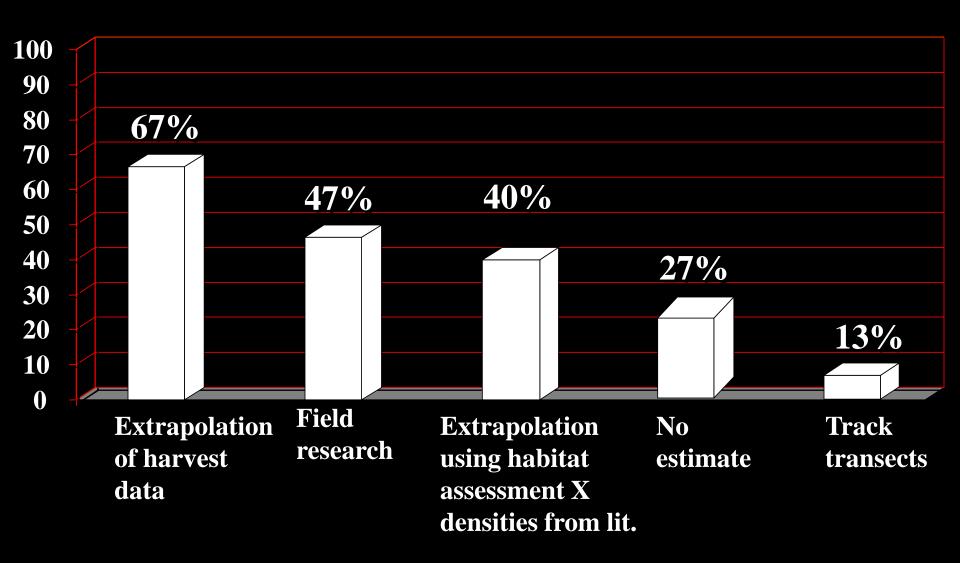


1 natural cause of death to cougars are other cougars- density dependent



WHY AGENCY DENSITIES DIFFER







STANDARDIZED DENSITY ESTIMATION



➤ Using GPS data locations, create a 95% female composite for female density calculation (annual HR)

➤ Calculate female density within the composite (e.g. 1.3/100km²)

➤ Overlay male GPS locations & calculate male density using only that portion within female composite (e.g. 0.7 & 0.6/100km²)

> Plot harvest by sex & apply avg. density of collared animals by sex



LONG TERM DENSITY = CONSISTENCY



Modified from Quigley and Hornocker 2010						
Location	Reference	2 yr. + Density per 100km²				
NM	Logan & Sweanor	1.5				
AB	Ross & Jalkotzy	1.9				
BC	Spreadbury	1.0				
Vancouver	Wilson	1.7				
ID	Seidensticker	1.4				
MT	Robinson & DeSimone	1.8				
Yellowstone	Murphy & Ruth	0.9				
Jackson	Quigley & Craighead	1.3				
UT	Lindzey, Stoner & Choate	1.5				
WY	Logan	(1.5)				
WA	WDFW-WSU-UW	2.0 (18+ months)				
CA	Hopkins	(1.8)				



DENSITY & HARVEST RATE - T.H.P.'s



- ➤ Any discussion of harvest rate must first state the foundation of the population estimate used to calculate the harvest rate
 - How was density obtained?
 - Is estimate local, statewide, or extrapolated from elsewhere?

The density needs to explicitly state whether it is based on total population, > 1 year old, > 18+ months



When harvest rates are applied, it needs to be explicitly stated whether the rate is based on total population, > 1 year olds, > 18+ months



HUNT STRUCTURE UPDATE



Closures:

- 2012-13 35 of 49 PMUs remained open (71%)
- 2013-14 36 of 49 PMUs remained open (73%)
- 2014-15 41 of 49 PMUs remained open (84%)
- 2015-16 34 of 50 PMU's remained open (68%)
- Distributing harvest across the landscape is working
 - Areas with typically low harvest are increasing
 - Region 4 had an average of 2-4 harvests /year for a decade
 - In 2015-16 there were 19

Opportunity

- Current harvest guideline is 241 (205-277)
- A harvest of 241+ occurred 4 times since 1980



% HARVEST RATES IN CLOSURE AREAS



Region	Hunt Area	2012-13	2013-14	2014-15	2015-16	
1	101			18		
1	105	16	16	32		
1	108, 111	16	16	19	21	
1	113			16		
1	117	18	24	24	20	
1	121	19		20		
1	124, 127, 130	14				
1	145, 166, 175, 178	28	24	28	28	
1	149, 154, 162, 163	27	27		19	
1	169, 172, 181, 186	16	16		16	
2	204				14	
2	209, 215	14			14	
2	233, 239				16	
2	249, 251	16				
3	328, 329, 335	20	19		18	
3	336, 340, 342, 346	18	16		18	
3	352, 356, 360, 364, 368		16		16	
3	382, 388	16	40		16	
4	466, 485a, 490		14			
5	516		14			
5	564, 568				16	
5	572				14	
5	574, 578		16		16	
6	642, 648, 651	20	14			
6	667			28	14	

Northeast

Blue Mountains

Kittitas / Yakima

Olympia Peninsula



UNCERTAINTY IN WDFW MGMT



- ➤ Tribal harvest (in GMUs) & unreported kills are not included in harvest guidelines
 - Undocumented harvest is higher in R1, R3, R4, R6
- **Early hunt season has no guideline**
 - Guidelines can be met/exceeded



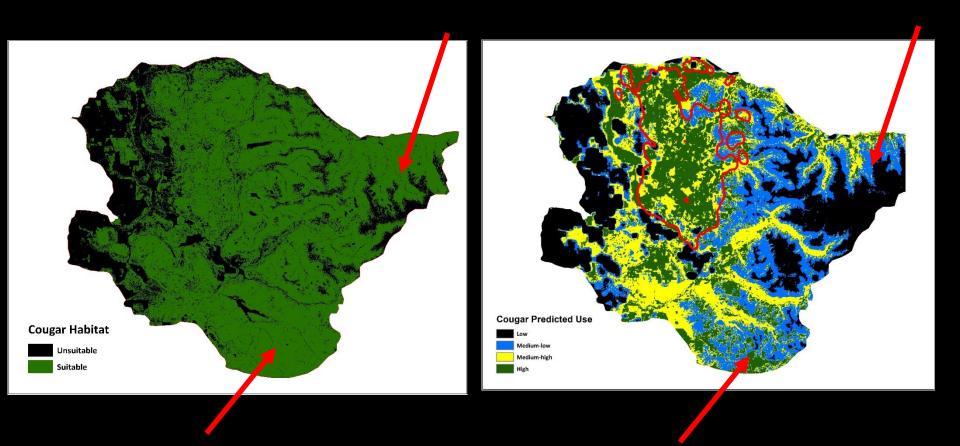
- We used binary code (0 or 1)
- Not all habitat quality is equal
- Density found in research study areas may not be representative
 - work conducted in highest quality habitats





COUGAR HABITAT EXAMPLE





• Potential to over-estimate cougar population size and allowable harvest within the PMU



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COUGAR – WORLD CLASS SPECIES







