

Review of Kenai Peninsula Brown Bear Research

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Major research topics

Major research accomplished

Examples of brown bear management strategies across the spectrum of sustained yields, and implications for Kenai brown bear management

Kenai Peninsula brown bear research has been shaped by changing societal, political, and biological issues over the years.

Kenai Peninsula Brown bear research areas of study

Interagency Brown Bear Study Team
(IBBST) formed

Ground & Aerial surveys for presence of
brown bears

First population estimate
(150-250; habitat based)

First estimate of sustained yield
(7% of population; 12 animals)

Beginning work developing
handling/collaring methods

Telemetry studies (VHF & GPS) For habitat use

Cumulative effects data collection
initial demographics work

Population estimated at 277

Occasional high rate of human
caused mortality

Designated as Population
of Special Concern

Important diet items identified
spring moose, salmon

1980's

1990's

Areas of study, continued

Kenai Brown Bear Conservation strategy
&
Conservation assessment

Patterns of Landscape use by female
Kenai bears

Spatial Analysis of DLPs

Brown bear highway crossings and travel corridors

Genetic Health: structure,
haplotypic diversity, heterozygosity

DNA-MR protocols reviewed

IBBST dissolves

ADFG begins demographics research

Federal Agencies begin planning for DNA-MR

ADFG demographics study

Designation as population
of special concern removed

Federal Agencies conduct DNA-MR
on federal estate

ADFG/USGS Molecular Ecology laboratory:

Management considerations of
Kenai Brown bear genetic isolation

Management considerations of
low haplotypic diversity in
(founder effect?)
(Differential reproductive success?)

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35 publications in peer reviewed journals

- 1990's Canadian J. Zoology
J. Wildlife Management
Molecular Phylogenetics and Evolution
Oecologia
Ursus
- 2000's Canadian J. Zoology
Ecology
J. Wildlife Management
Landscape Ecology
Molecular Phylogenetics and Evolution
Oecologia
Wildlife Society Bulletin
Oikos
Ursus
- 2010+ J. Wildlife Diseases
J. Wildlife Management
Proceedings National Academy of Science
Wildlife Society Bulletin

Research highlights

Diet

Current productivity

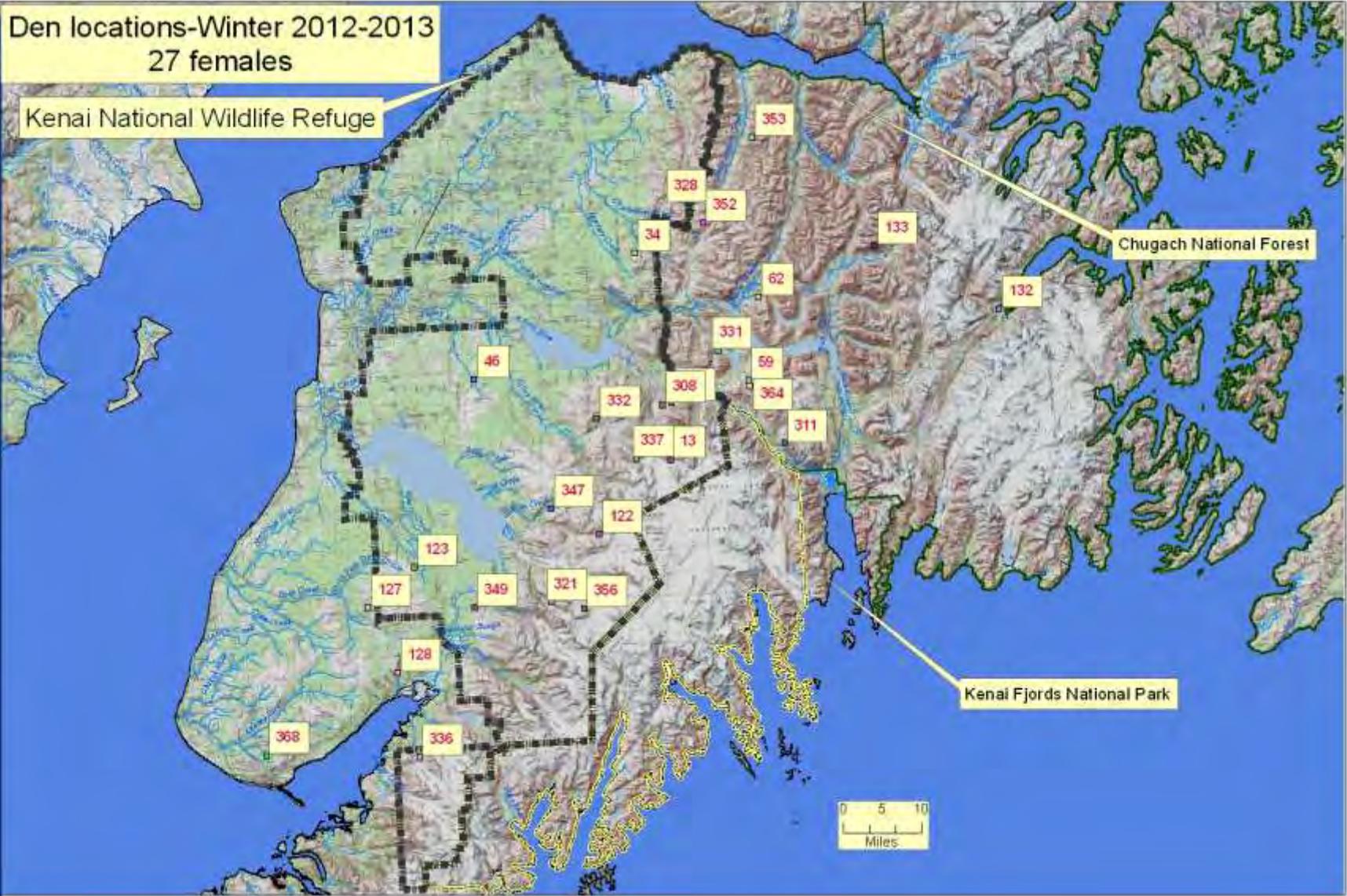
Current genetics

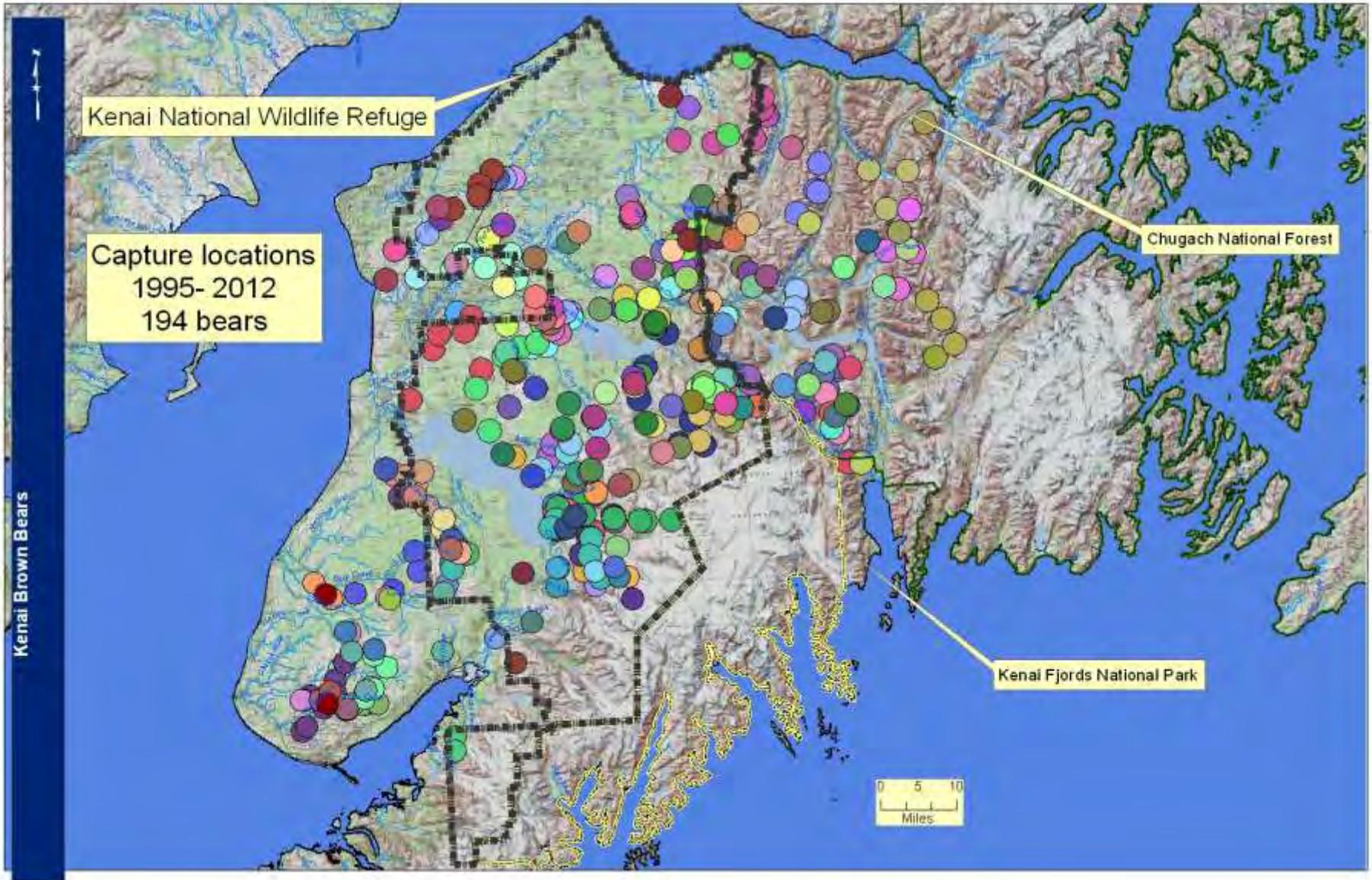
Den locations-Winter 2012-2013
27 females

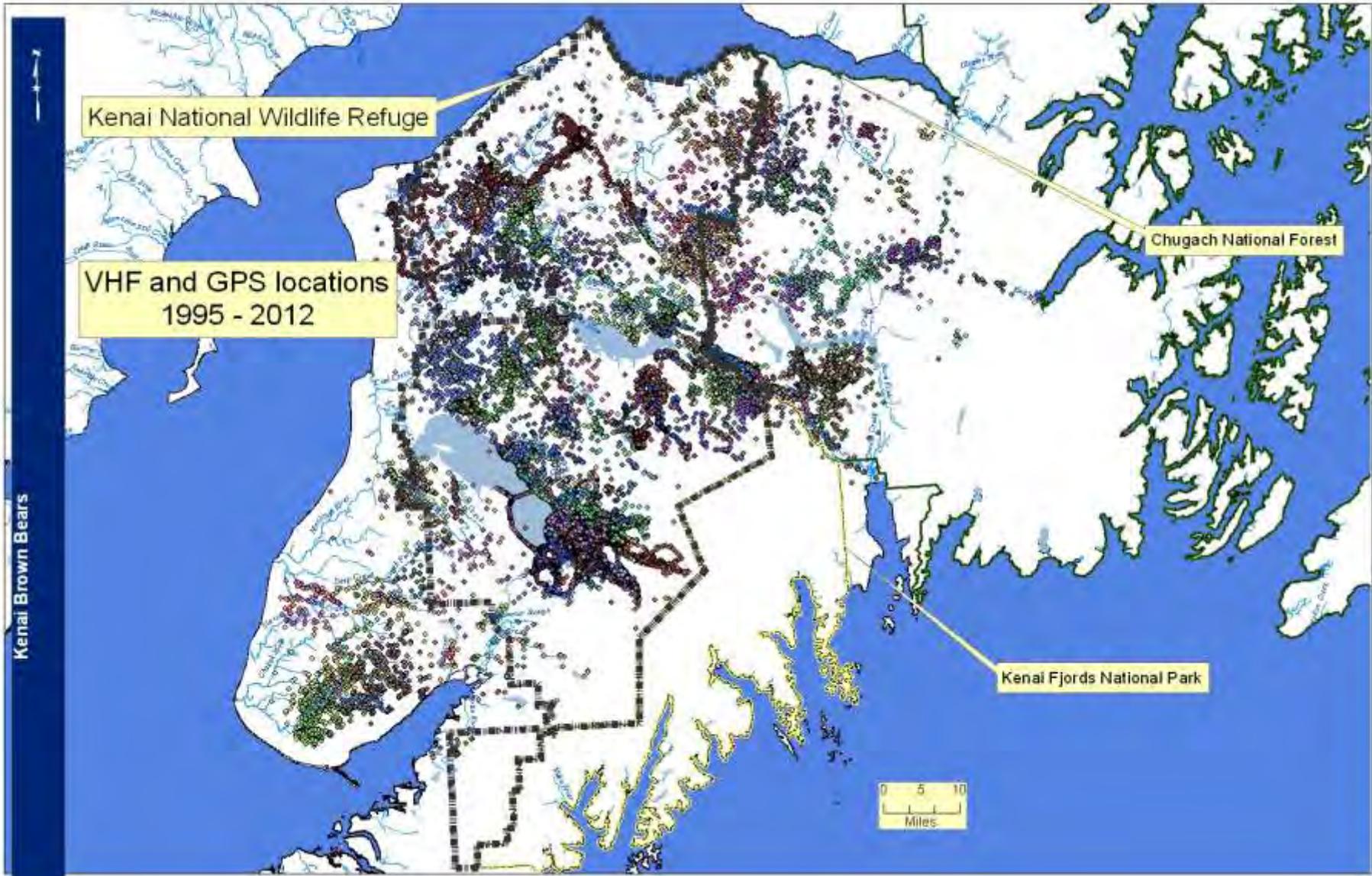
Kenai National Wildlife Refuge

Chugach National Forest

Kenai Fjords National Park







DIET

Kenai brown bears require significant seasonal increases in body mass and composition to meet the metabolic demands of hibernation and reproduction.

Kenai brown bears will double their percent body fat from spring to fall, largely from ingesting salmon.

The springtime intake of terrestrial meat by Kenai brown bears primarily replaces body reserves used over hibernation and is a significant proportion of spring diet. Mass and body composition changes from mid-summer to fall are largely supplied by marine derived nutrients.

DEMOGRAPHICS

Cub production on the Kenai Peninsula (through 2012)

Cub age

	COY	Yrling	2YR	3YR
Mean litter size	2.18	2.04	2.01	2.0

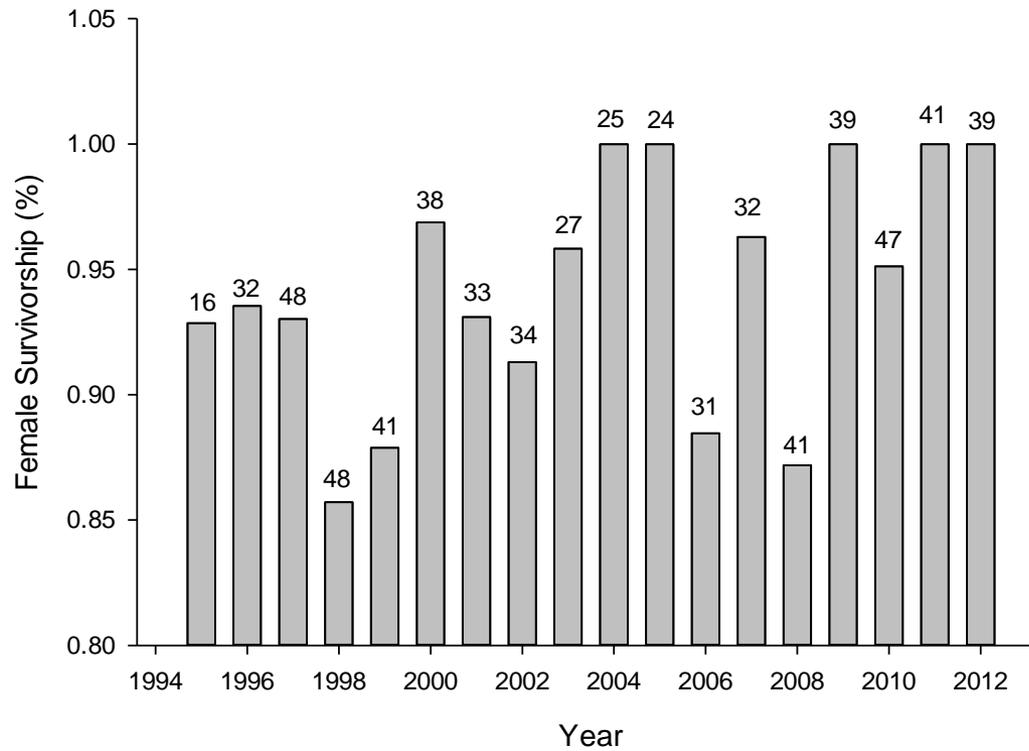
DEMOGRAPHICS

Overall cub survival on the Kenai Peninsula-2012 inclusive

	COY	Yrling	2YR	3YR	Total
Alive	211	145	132	16	504
“Lost”	151	92	15	0	258
Total	362	237	147	0	762
Survival	0.59-0.67	0.61-0.67	0.92-0.96	1.0	

Kenai Brown bear

(Total number of bears collared at beginning of each year is indicated.
This total can fluctuate annually if bears previously censused because
of lost collars are re-identified through recapture or DNA analyses of samples.)



Population Estimates over time

Year	Area for calculations (km ²)	# Bears (various confidence intervals)	Density (#/1,000 km ²)
1989	8,800	150-250 Adults	17-29
1993	13,848	277 Adults	20
2013	11,500 ¹	428 ²	37
2013	13,848	624 ^{3,4} total	45

¹Study area for DNA-MR

²Estimated from hair of 166 bears on DNA-MR grid; 8 bears on rub trees; 29 ADFG radio-collared bears

³Calculated from 9,500 km² of DNA-MR study area

⁴KNWR estimates 200 adult males, 200 adult females, 224 cubs

DEMOGRAPHICS

Finite rate of increase (λ)
for Kenai brown bear population

1995 -1999 $\lambda = 1.0128$ (95% CI= 0.9634 -1.0588)

1995 -2012 $\lambda = 1.0451$ (95% CI= 0.9639 -1.1216)

Brown bears of the Kenai Peninsula are genetically isolated from mainland south central and southwestern Alaskan populations

We examined sequence data from nuclear microsatellite fragments and the control region of mitochondrial DNA. Our work uses 14 to 21 markers, which provides for very good mathematical certainty. The FBI uses up to 13 markers in crime scene investigations.

We compared levels of genetic diversity and population structuring of the Kenai brown bear population to other Alaskan brown bear populations and found the following:

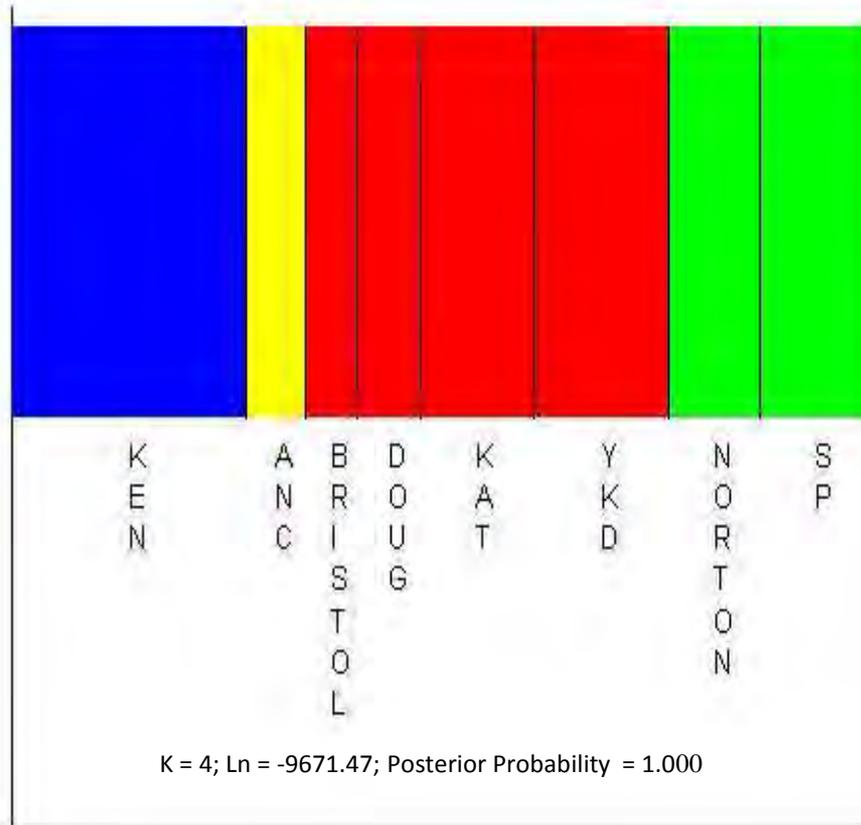
Kenai Peninsula brown bear genetic characteristics

1. The brown bear population on the Kenai Peninsula has genetic (nuclear and mitochondria) diversity lower than mainland bears, but in the range found for a peninsular population.
2. While nuclear diversity is representative of a peninsula bear population, haplotypic diversity is much lower than most insular and peninsular populations.
3. The brown bear population on the Kenai Peninsula is NOT structured across the Peninsula.

Kenai Peninsula brown bear genetic characteristics

3. Statistically significant differences exist between the brown bear population on the Kenai Peninsula and others, including Anchorage.
4. Brown bears (96%+) on the Kenai Peninsula possess a Western Beringia haplotype that is also found (at much lower frequency) in brown bear populations on Lake Clark, Yukon Kuskokwim Delta, and Katmai.

Future research should focus on augmenting datasets from Placer, Twenty Mile rivers, upper Eagle River, Girdwood, and western Prince William Sound



B. With Prior Population Assignment

Genetic structure among south central and southwestern Alaskan brown bear populations, estimated by Bayesian analyses using 14 microsatellite loci. Analyses were conducted using BAPS 5.1 (Talbot, Sage, and Farley 2010)

Brown bear management strategies across the spectrum of sustained yields, and implications for Kenai brown bear management.

Alaska populations: 4-6%

Province of British Columbia: 3.5-6%

Sweden: 8-11%

Guidelines used for management in British Columbia

Regular population estimation is conducted in all areas and the methods may involve mark-recapture, periodic aerial surveys, and/or a multiple regression model.

An upper limit of 4-6% human-caused mortality is applied to the harvest.

The final harvest is limited such that no more than 30% (of the harvest) will be adult females.

Rates are averaged over 5 year periods.

What is the acceptable sustained harvest rate for brown bears?

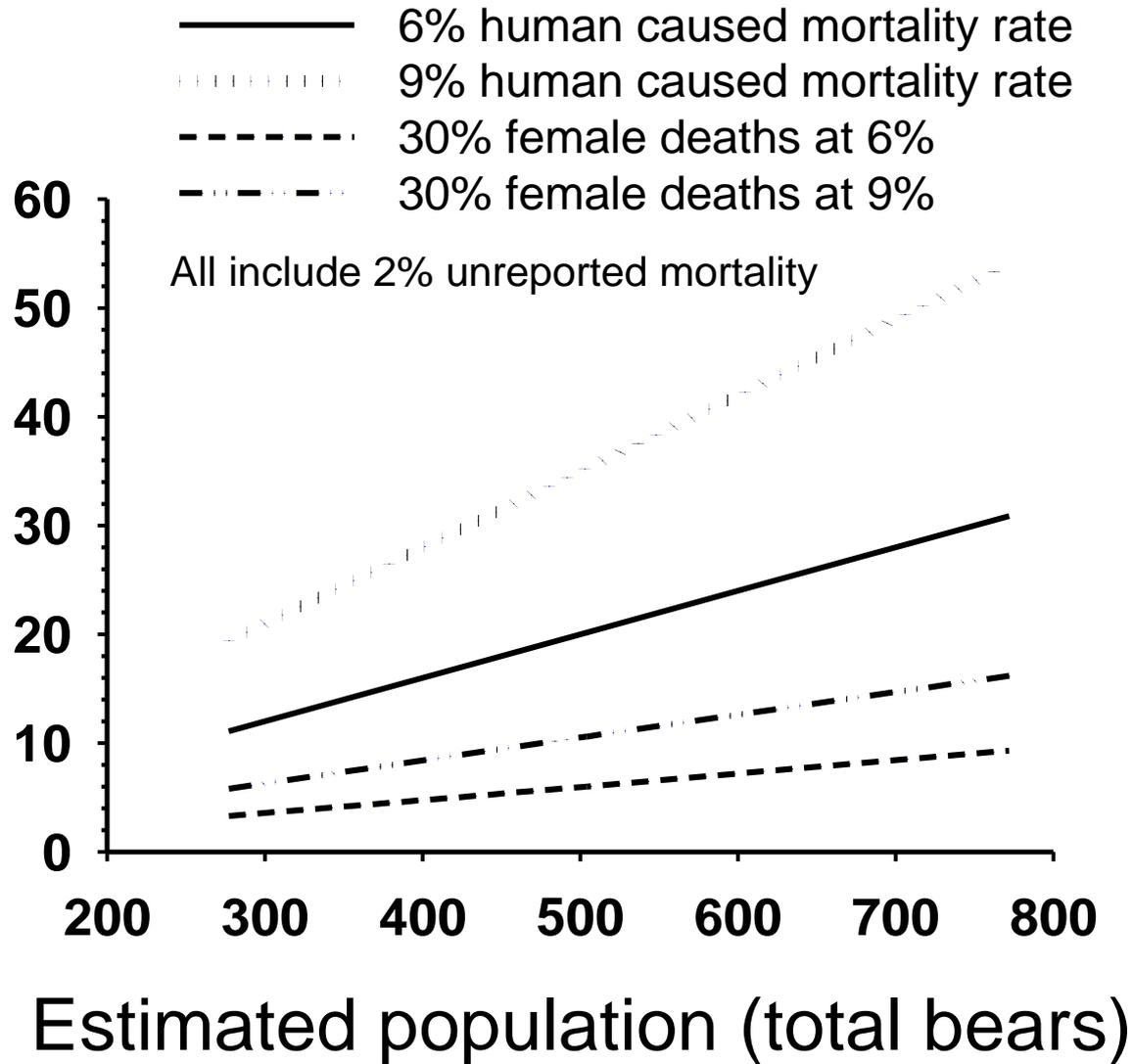
6 or 9%?

Bischof and Swenson (2009) report sustainable harvest of Swedish brown bears at 8 and 10%, but with strong caveats.

They did not consider density effects (recognized in paper), and thus survival estimates are likely biased high. They note that unreported mortality likely biases overall mortality low. Taken together these factors will drive up estimated sustainable harvest rates.

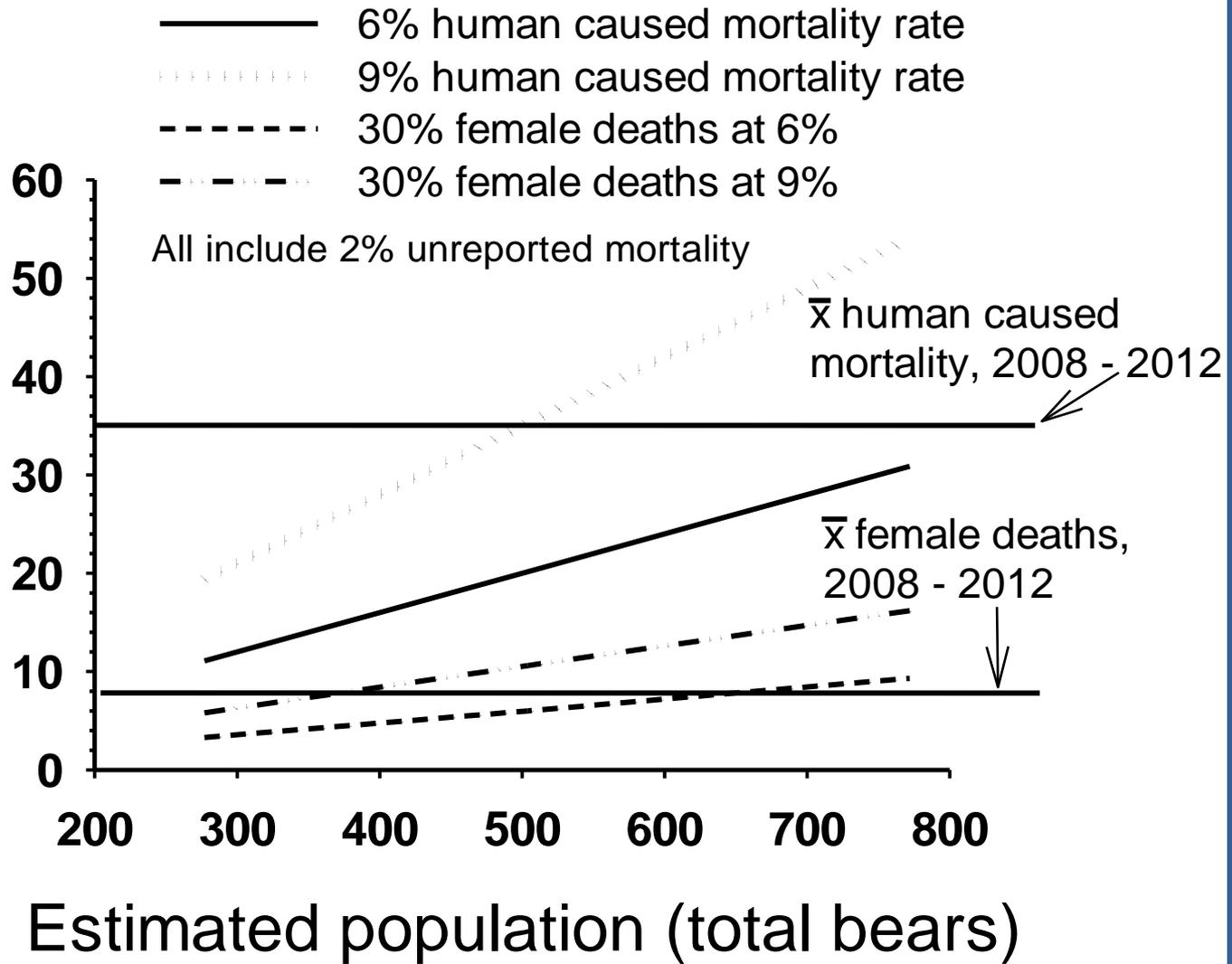
Kenai Peninsula

allowable deaths (total animals)



Kenai Peninsula

allowable deaths (total animals)



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Kenai Peninsula brown bear research has been shaped by changing societal, political, and biological issues over the years.

At this point all indications are that this is a healthy and productive population that is currently being managed for sustained yield.

However, we need to be cautious when managing this isolated, relatively small brown bear population so that we do not overharvest to the point of serious population decline, bringing about conservation concerns.

Review of Kenai Peninsula Brown Bear Research

Local pilots Jose DeCreeft, Mike Litzen, Jonathon Larrivee, Joe Fieldman, Rick Ernst, and others have made working on Kenai brown bear a safe, enjoyable, and productive endeavor.

There has been strong support for many of the projects over time from the Alaska Department of Fish and Game, the U. S. Fish and Wildlife Service, U. S. Forest Service, U.S. Geological Survey, National Park Service, private organizations, and many graduate students.

Dr. Sandra Talbot of the U.S.G.S. Molecular Ecology Laboratory has been instrumental in improving our understanding of Kenai brown bear genetics.