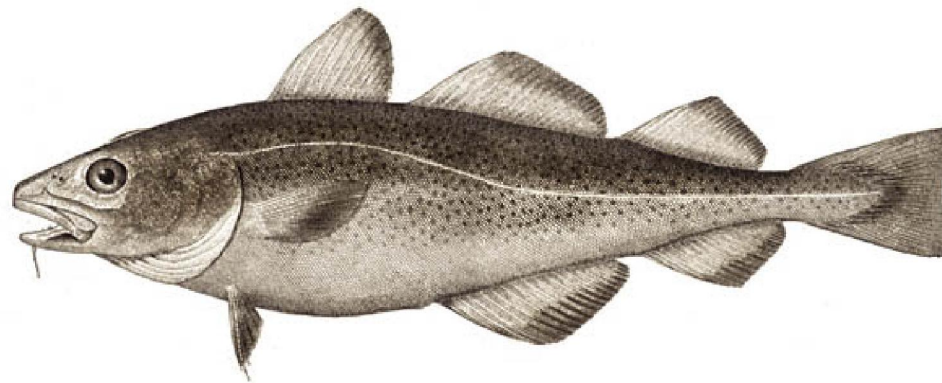# Using GPS collars to monitor the activity and habitat use of Canada lynx in Minnesota

Julie Palakovich Carr

My Journey from Fish to Lynx and Back

Julie Palakovich Carr

Outline

- Undergraduate – Boston University
  - Restored oyster reefs
  - Atlantic cod recruitment
- Graduate – University of Minnesota
  - Canada lynx activity and habitat use
- Knauss Fellowship – Senator Maria Cantwell

The effects of a restored oyster reef on water quality in a subestuary of the Chesapeake Bay

- University of Maryland, Horns Point Lab, Dr. Mike Roman
- What effect does a restored oyster reef have on water quality?
    - Largest restored reef in MD waters
- Measured:
    - Plankton abundance and size No effect
    - Turbidity No effect

Estimating the importance of maternal age, size, and spawning experience to recruitment of Atlantic cod (*Gadus morhua)*

- Boston University, Dr. Les Kaufman
- What impact does maternal age, size, and spawning experience have on the number of offspring that recruit to a population?
- Created model in Stella
  - Based on Stellwagen Bank Atlantic cod population

Methods

- Classified population by spawning experience and age (1-11 years)
  - Differences in:
    - Fecundity
    - Natural mortality to eggs and larvae
- Cannibalism
- Recorded number of juveniles surviving to age 1

Large Differences in Recruitment

| Spawner Experience	Recruits/ Spawner	% of Female Biomass	% of # Female of Cod
First (1-5 years)	0.00	6.5	22.6
Second (2-6 years)	1.08	6.5	19.4
Third (3-9 years)	9.47	60.9	48.4
Experienced (10-11 years)	66.88	26.1	9.7

Using GPS collars to monitor the activity and habitat use of Canada lynx in Minnesota

- University of Minnesota, Dr. Jerry Niemi and Dr. Ron Moen
- Canada lynx habitat use and hunting have been well studied
  - Hunt snowshoe hares in regenerating and mature forest stands
  - Avoid open areas
- Habitat use may vary regionally
- Activity patterns not yet studied

Determining Activity Remotely

- ¡ GPS collars record:
  - ¡ Animal's location
  - ¡ Head position (up vs. down) or
  - ¡ Head movement
- ¡ Data recorded as numerical activity index
 - l Need behavioral observational study to interpret values
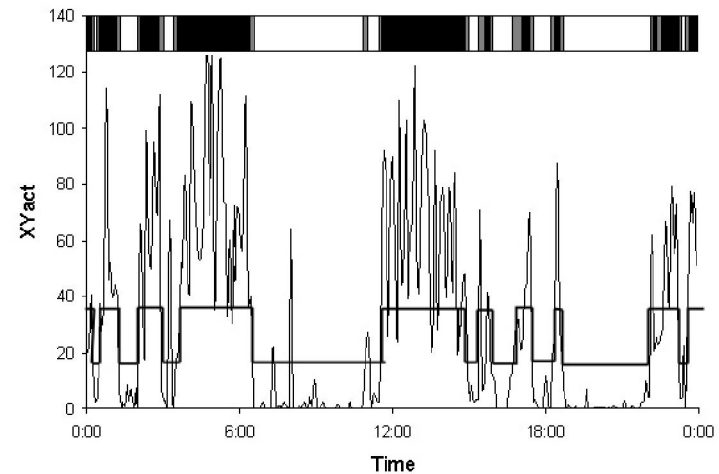
Goals

¡ Develop methods to categorize activity counts from GPS collars

¡ Apply methods to free-ranging lynx to determine lynx activity level within particular habitats

¡ Determine lynx habitat preference according to activity level

Lotek GPS_3300 collar

X Y

Records activity counts of 0 to 255 every 5 minutes
Higher value indicates more activity
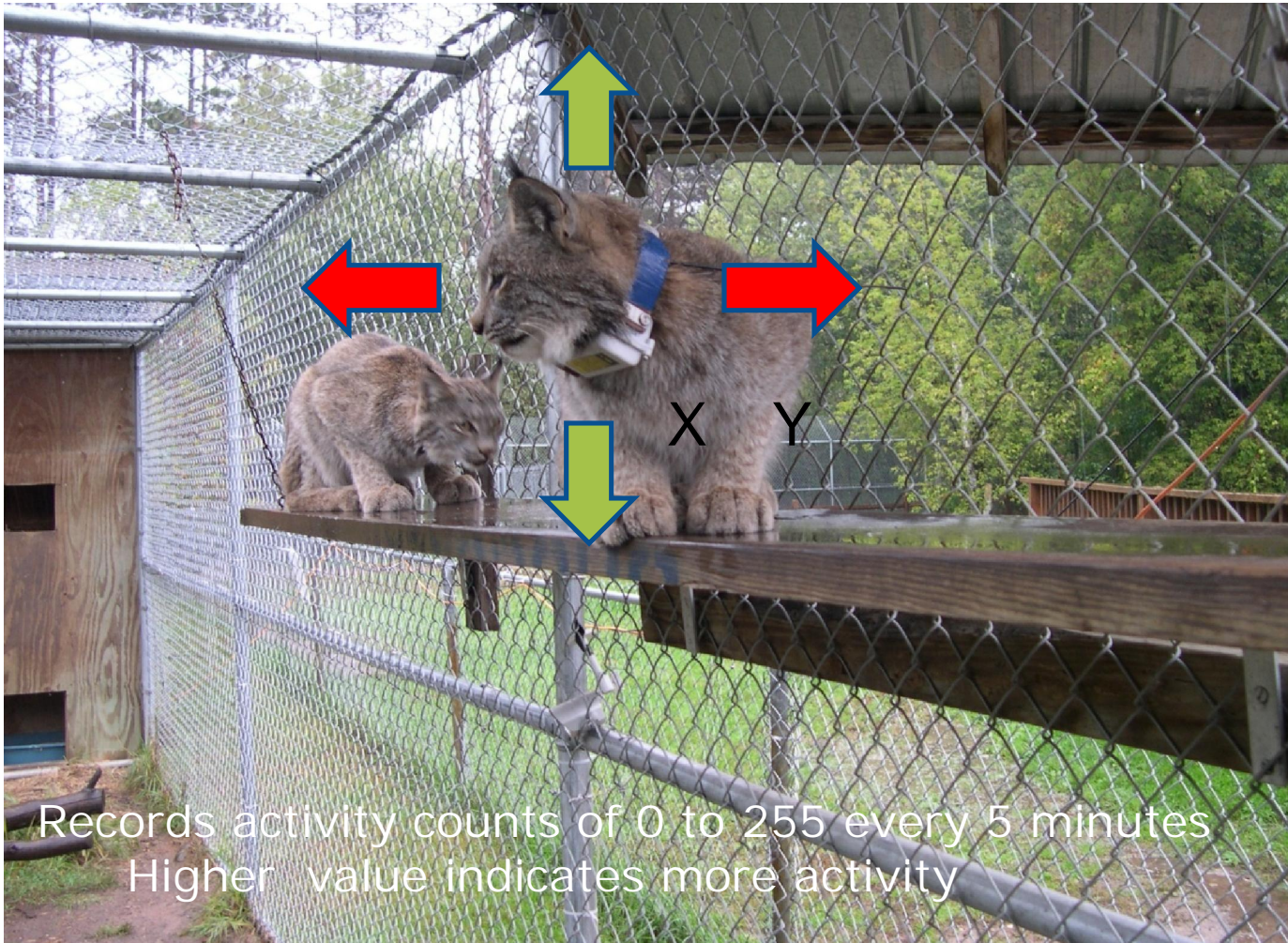
Methods

¡ Recorded behavior of a captive lynx wearing a GPS collar

¡ Compared observed behavior to activity count recorded by GPS collar

  ∣ Active behaviors associated with higher activity counts

  ∣ Inactive behaviors associated with lower activity counts

Establishing Threshold

Upper Threshold

Lower Threshold

0   Activity Counts   255

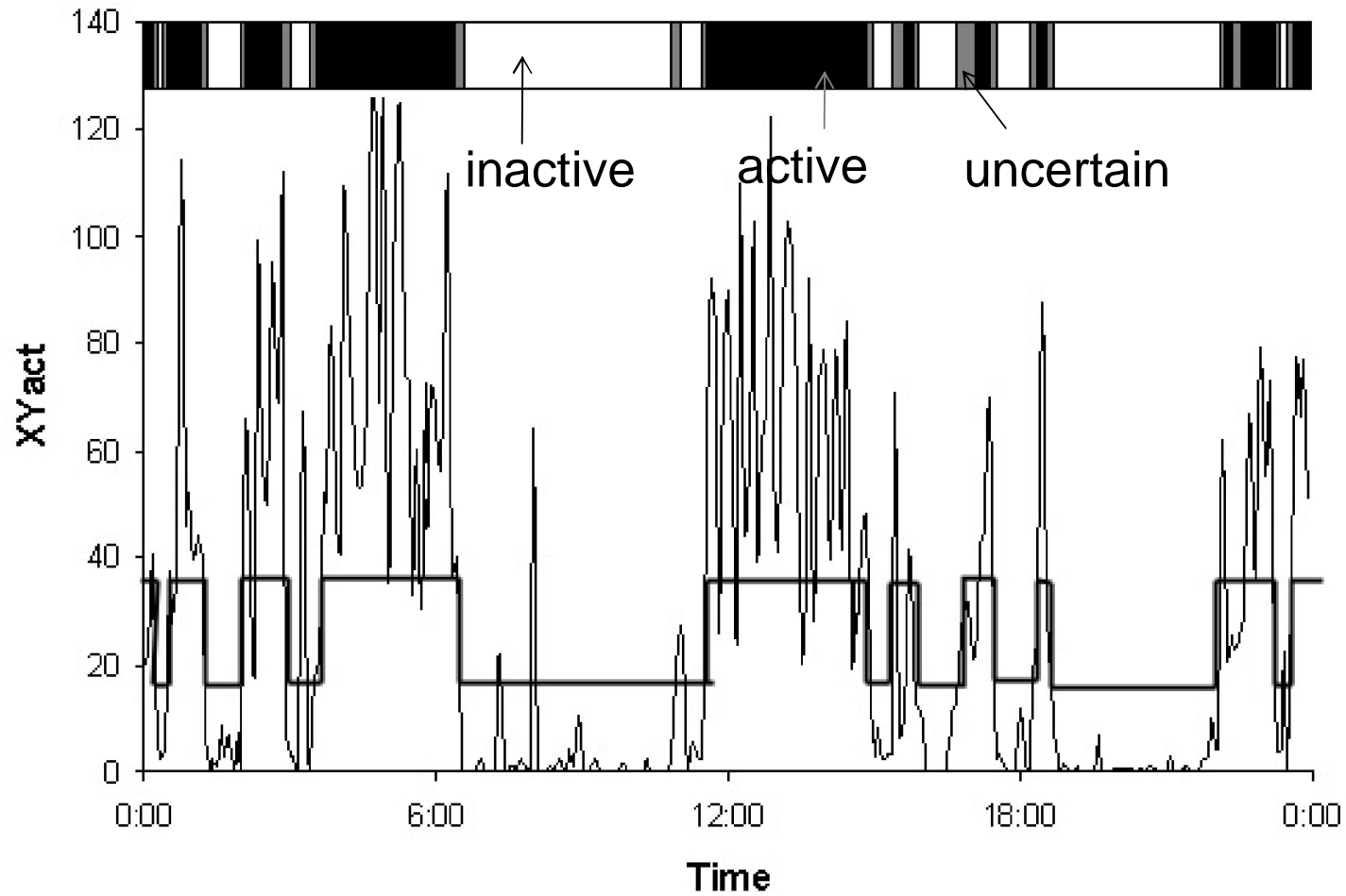Inactive   Uncertain   Active

76.6% accuracy   41.7% accuracy

Free-ranging Lynx

¡ Applied methods to 3 free-ranging lynx

¡ Average activity budget:

- 31.5% active
- 53.7% inactive
- 14.8% uncertain

¡ Comparable to Eurasian lynx:

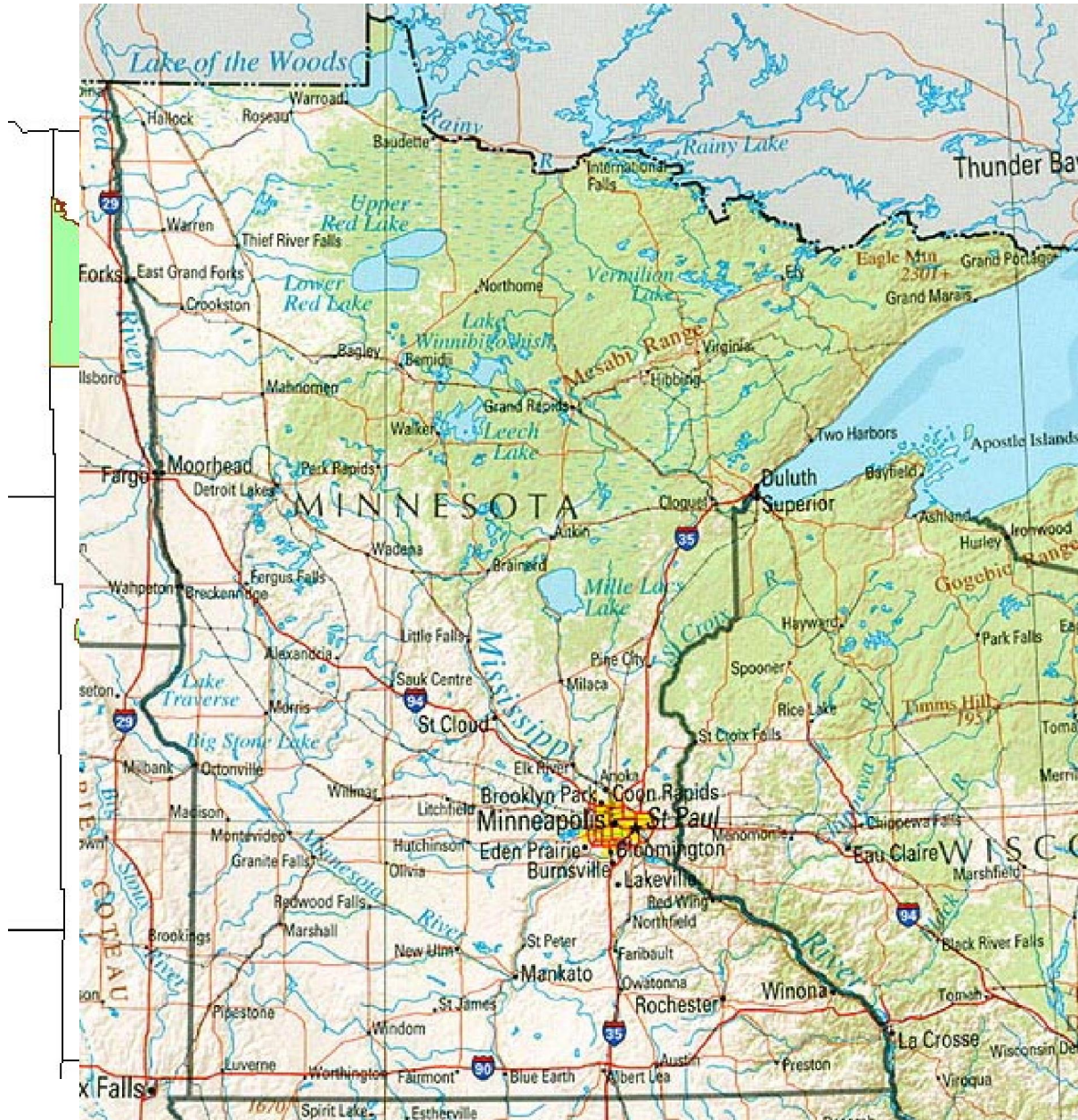- 29% and 35.5% activity (Schmidt 1999, Reinhart & Halle 1999)

Activity Pattern

inactive   active   uncertain

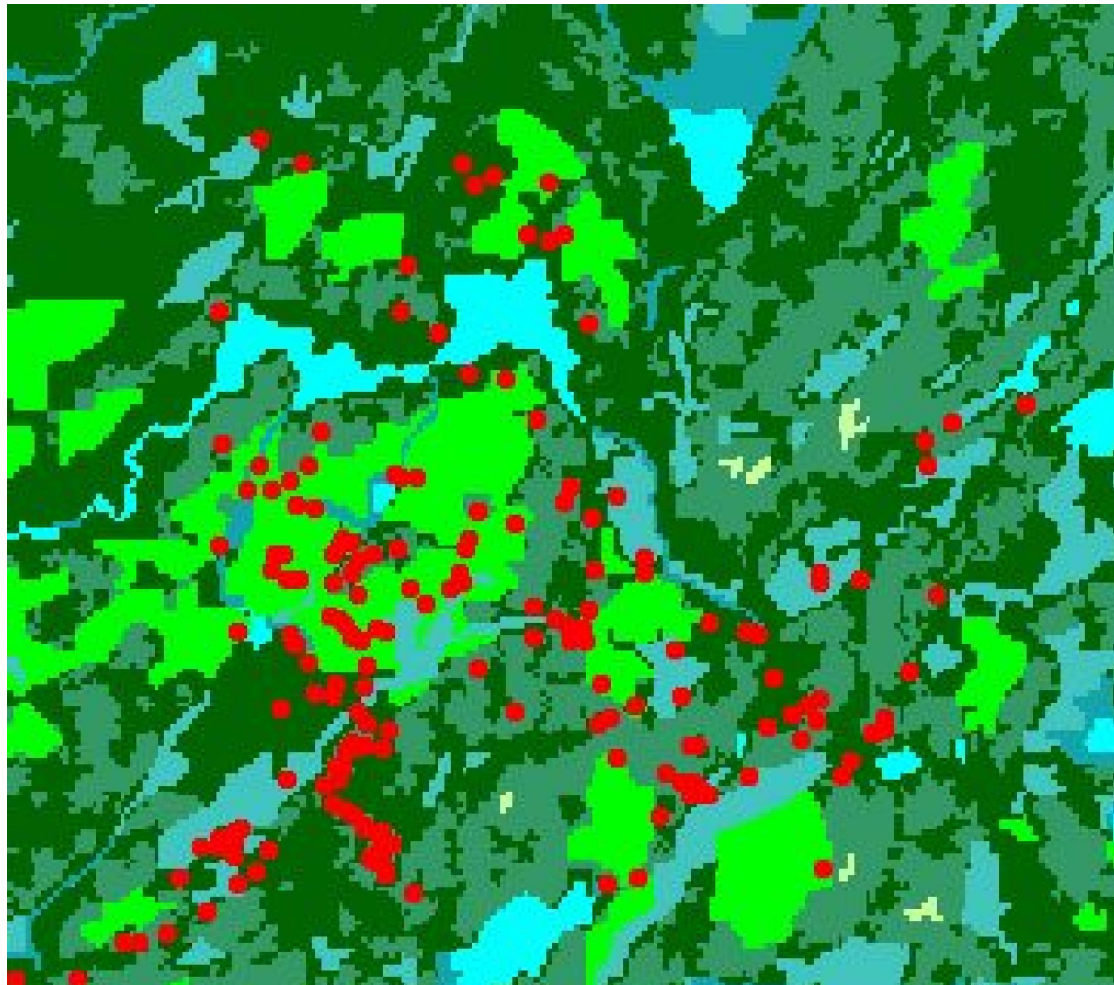# Canada lynx habitat use and selection in relation to activity level

National Forest

d from
3 to March 2006

GPS Locations

- Seven lynx (mean = 246 days)
- Locations separated by 4+ hours
  - Uniform distribution throughout the day
- Total locations = 4,971 for all lynx

Habitat Classification

- ☐ Mixed forest
- ☐ Conifer forest
- ☐ Regeneration
- ☐ Bog
- ☐ Marsh & fens
- ☐ Open water

Methods & Results

- Regressions of daily habitat use for each lynx vs. daily activity
  - Cover type did not predict activity or inactivity
  - Highest R^2 was 0.15
- Tested for differences in proportion of locations occurring in each habitat by activity level with ANOVA
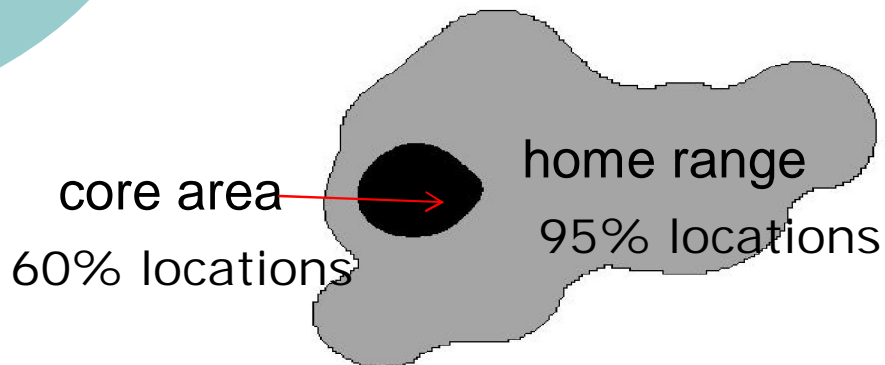
Habitat Use by Activity Level
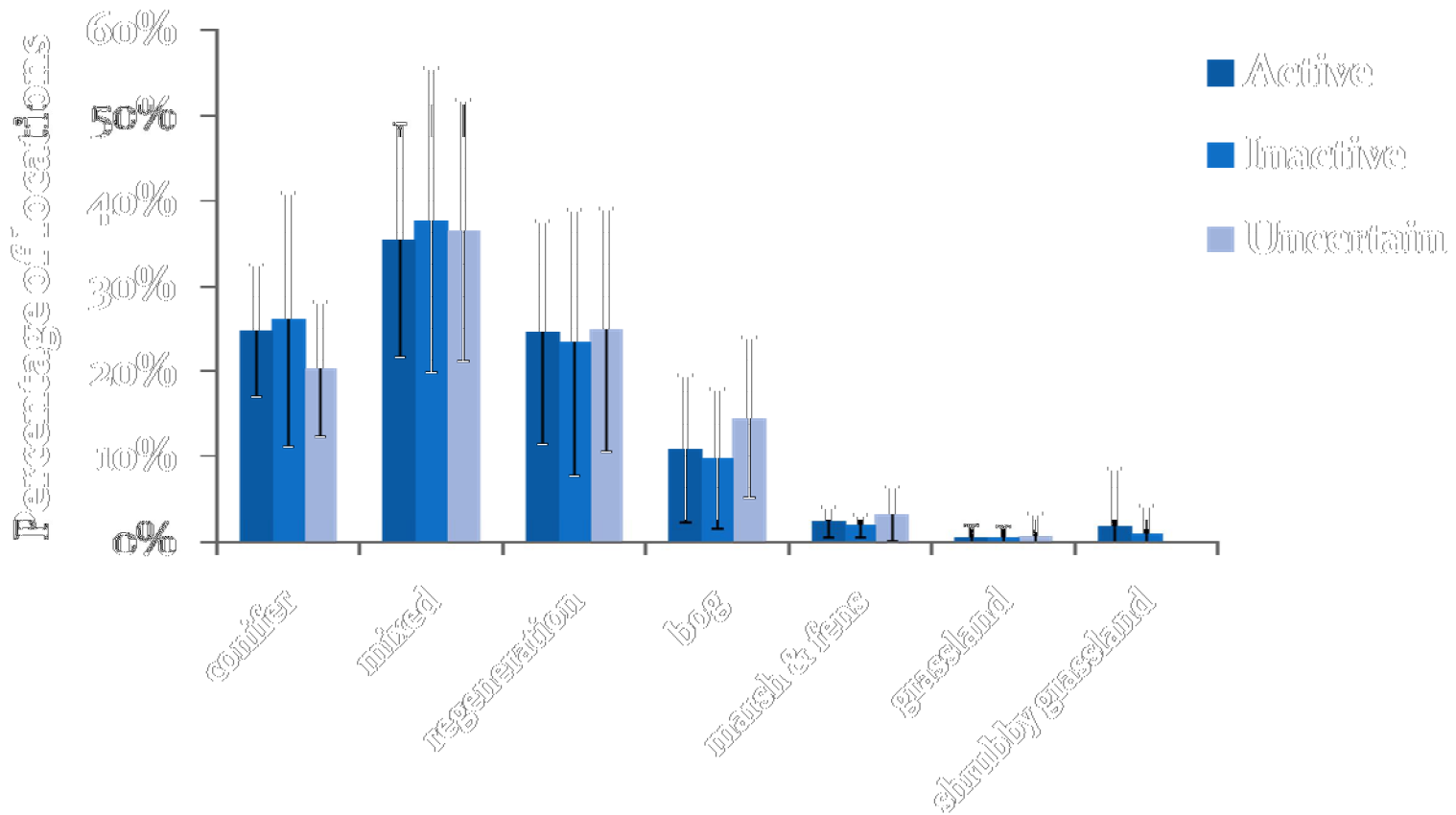
Habitat Preference

ᵢ Selection and avoidance determined for each activity level and use area

Habitat preference generally the same when active and inactive

Habitat preference did not differ between core area and home range

core area → home range

60% locations   95% locations

Burdett et al. 2007

Conclusions

¡ Lynx activity does not appear to affect habitat use

¡ Methods to differentiate resting and hunting from ambush beds are needed

Knauss Fellowship

¡ Senator Maria Cantwell
  | Commerce Subcommittee on Oceans, Atmosphere, Fisheries and Coast Guard

¡ Issues:
  | Aquaculture   -NOAA satellites
  | Ballast water   -Ocean acidification
  | Coast Guard budget   -Ocean governance
  | Deepwater   -Orca recovery
  | Fisheries management   -Pacific salmon
  | Harmful algal blooms   -Polar icebreakers
  | Marine sanctuaries   -Puget Sound
  | MMPA   -Ship strikes
  | Navy sonar   -Whaling
  | NEPA   -2010 Census
  | NOAA budget

Questions?