House mouse plagues in Australia

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Introduced Rodent Pests in Australia

House Mouse

(*Mus musculus*)

Black Rat

(*Rattus rattus*)

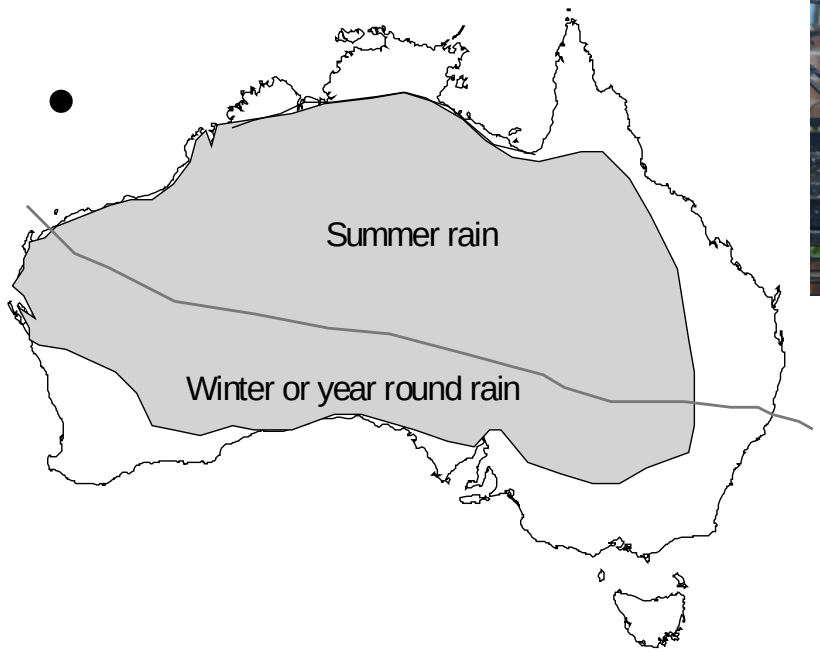
Brown Rat

(*Rattus norvegicus*)

Mus musculus in Australia

- Arrived with European settlement (225 years ago)?
- Now continent-wide
- A pest in wheat-growing areas in southern regions
- Outcompeted by native mice elsewhere
- Prey source for owls, introduced and native mammalian carnivores

Australian environments - 1



Australian environments - 2

Australian fauna – 1







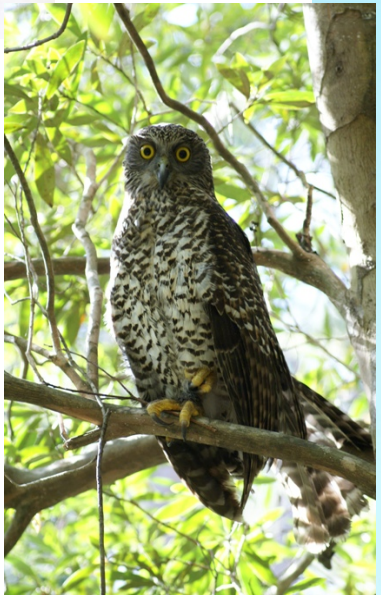
Australian fauna – 2







Australian fauna – predators



House Mouse life-history

- Exist in small demes for long periods
- These demes are in refuge sites: water, food, shelter
- Rapid population turnover
- Populations irrupt within 3-4 months when conditions are good, collapse within a year
- Characteristics of an invasive species

House Mouse reproduction

- Gestation = 19 days
- Sexual maturity = 5 – 6 weeks
- Postpartum oestrus, 3-4 weeks between litters
- Litter size = 1 –13
- Can breed year-round but not much in winter
- Survival rates are low (<5%) during dry times, >40% after rain

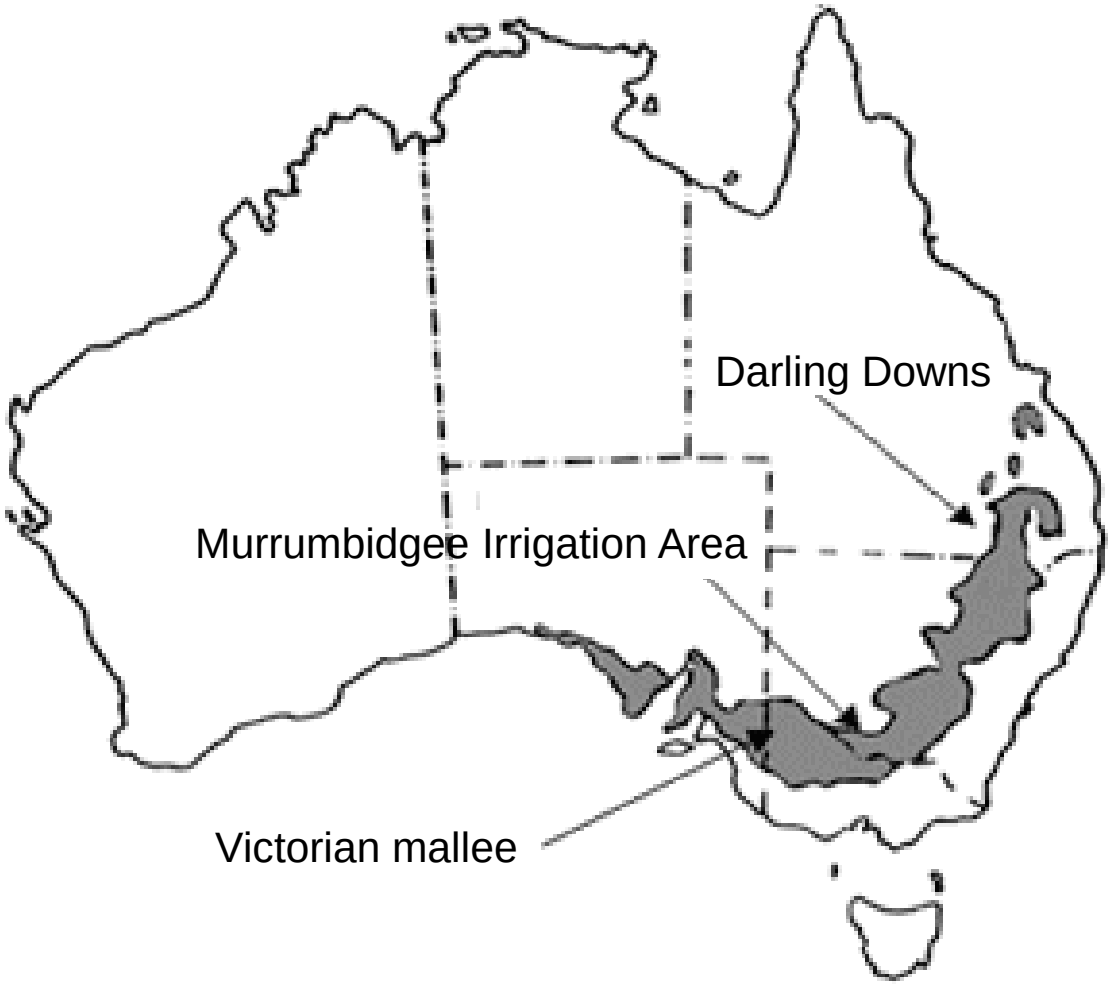
Mouse plagues in Australia

Grain Storage of Yesteryear – Mouse plague, 500,000 mice caught in four nights at Lascelles, Victoria, Australia, c1917.

Mouse plagues in Australia

- >750 mice per hectare (but typically >1000 mice per hectare)
- Since 1890 mouse plagues have been recorded ~ every 10 years, but the frequency is increasing to every 4 years

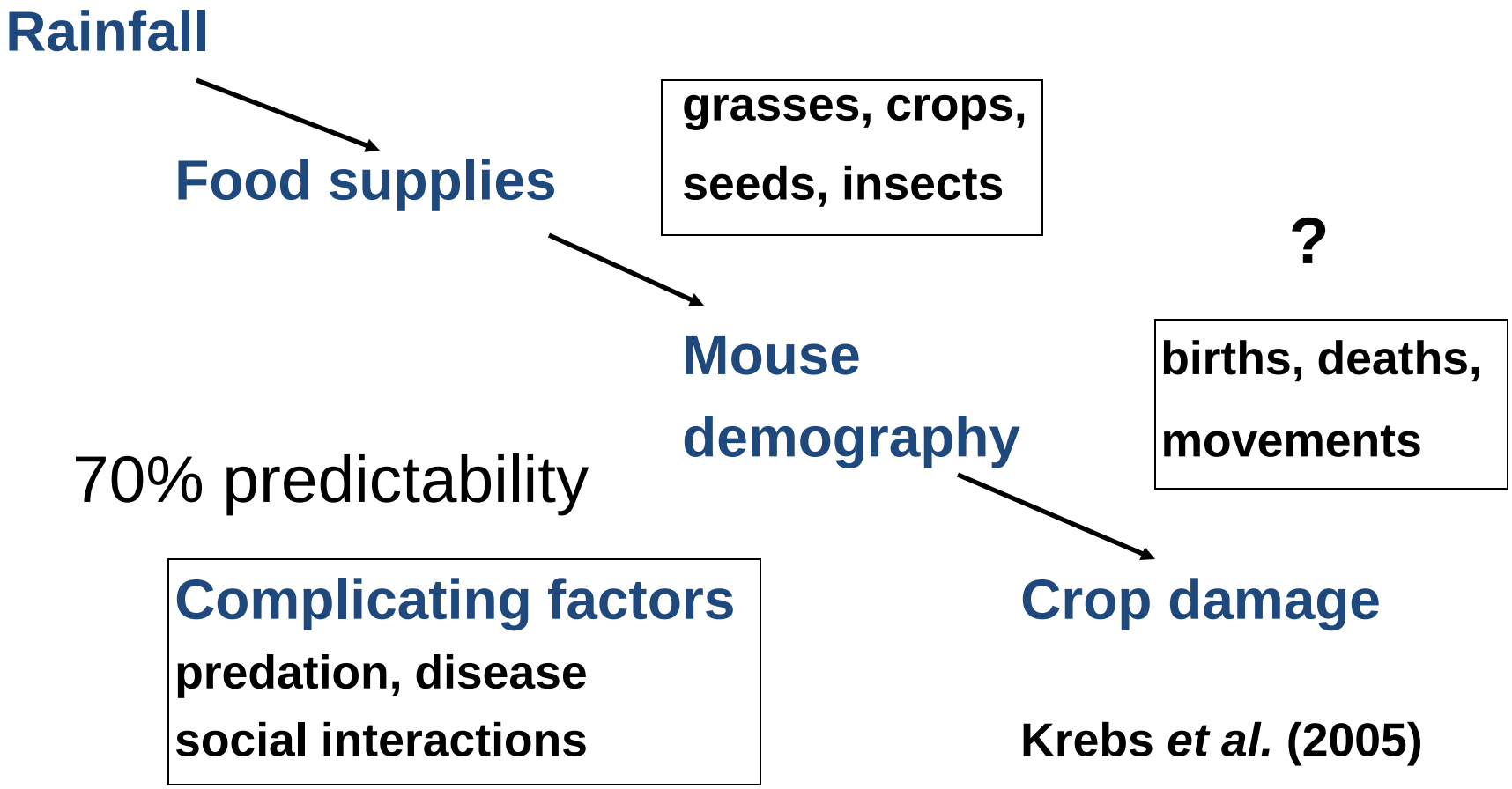
Where do mouse plagues occur?



How much is known about plague formation?

- 70% of mouse plagues can be predicted by current models
- **Rainfall** (early- *and* late-season rains), moderate temperatures, food availability, refuges are all important components of the current predictive models
- Models are simple: plagues occur in regions where all native rodents & most marsupials are extinct, and mammalian predators are controlled

Predicting house mouse plagues



Krebs *et al.* (2005)

Impacts of House Mice

- Economic costs
- Social costs
- Health costs
- Environmental costs

Economic costs

- Significant crop loss and damage to stored grain, damage to rural town businesses (*e.g.*, stock spoilage, destruction of electrical cabling)
- Outbreak in 1993 cost up to $Aus 100 million in losses, most costs borne by grain growers
- In South Australia, 350 000 ha baited with strychnine
- More-recent outbreaks have cost > $Aus 100 M

Farming practices and mouse plagues

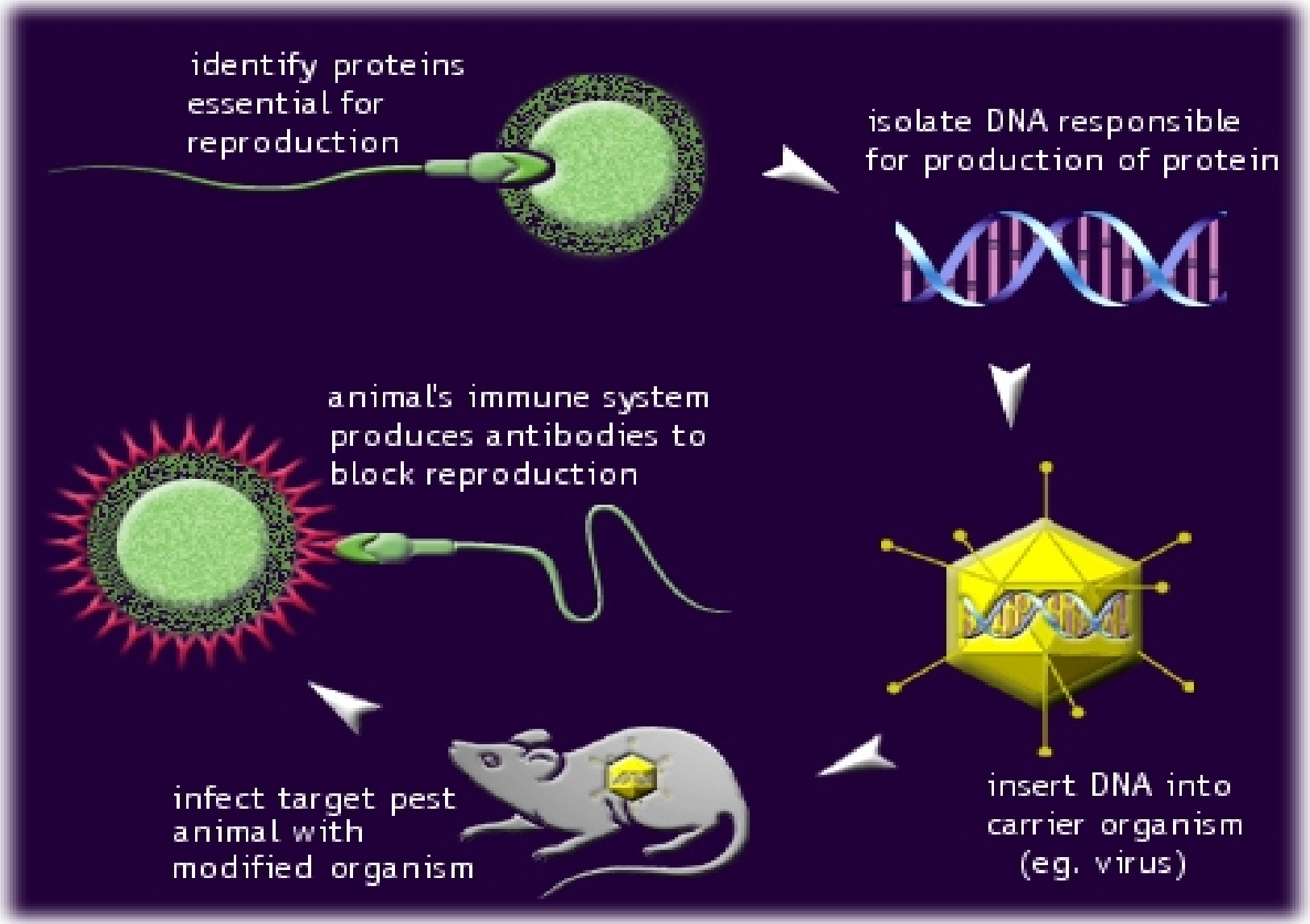
- Clearing remnant areas of native vegetation disadvantages predators
- Mammalian predators are culled
- Retaining ground cover to prevent soil loss and retain soil moisture lowers predation risk for mice
- Crop rotation and continuous cropping
- Irrigation provides permanently good conditions

- (Pech *et al*. 1999; Kenney *et al*. 2003)

Rodenticides used in Australia

- Alphachlorlose (not used much)
- Bodifacoum
- Bromadiolone
- Cholecalciferol (withdrawn)
- Coumatetrayl
- Flocoumafen
- **Sodium monofluoacetate (1080)**
- Strychnine
- Thallium sulphate (withdrawn)
- Warfarin (Ratsak)
- Zinc phosphide

Immunocontraception



Dynamics of native mice

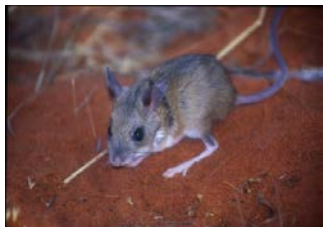
Lessons for mouse plagues?

- NE Simpson Desert, Queensland
- Spinifex-dominated dunefields
- Rainfall 150-200 mm year^{-1}
- Temperatures -7 to 50°C
- Fire return interval ~25 years
- Long-term data 1990-present
- > 25,000 mammal captures, ~22,000 lizard captures, ~9,500 frogs

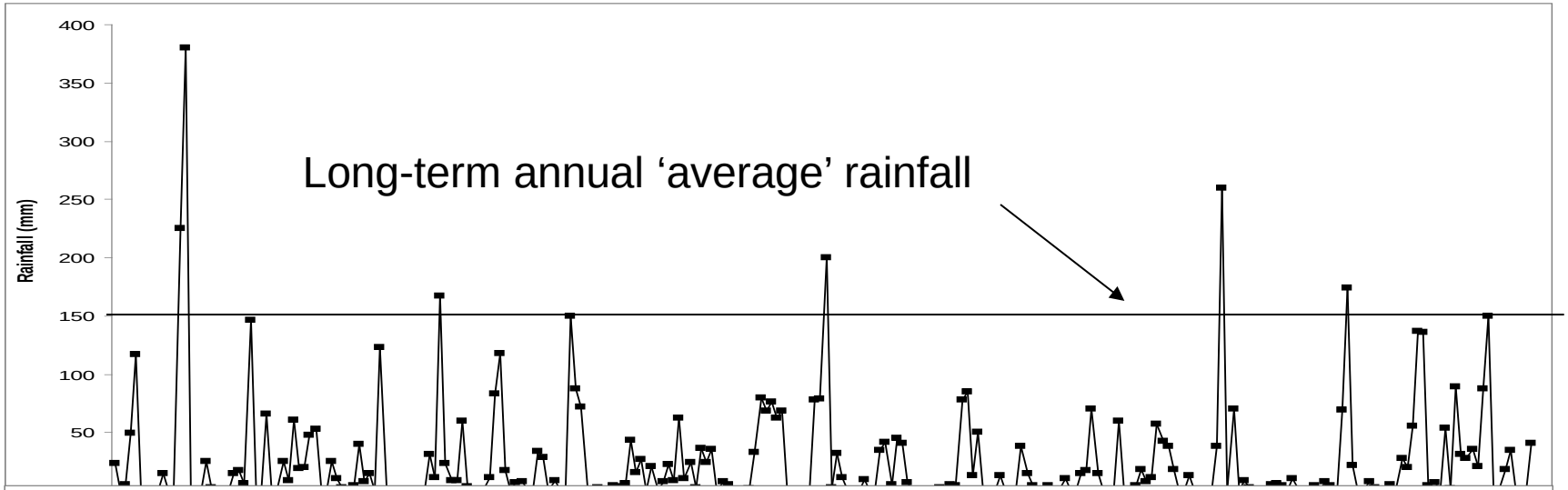
Boom and bust dynamics – native mice

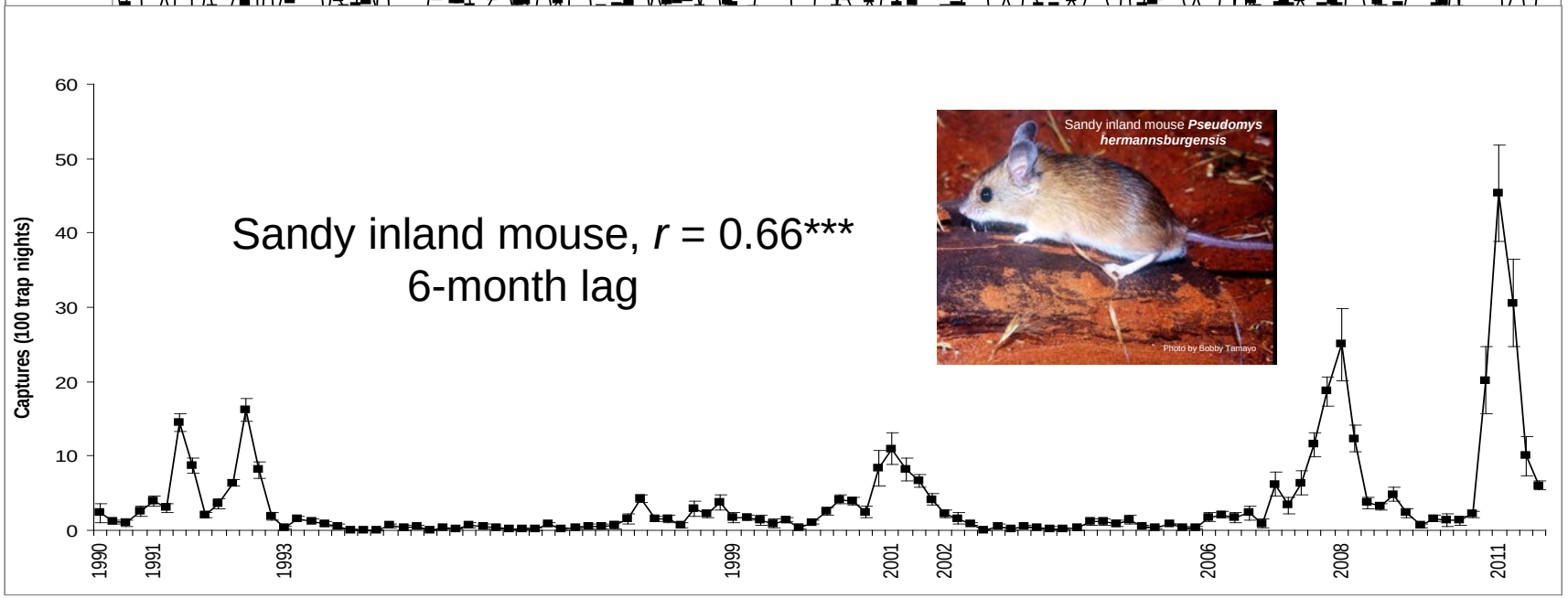
Sandy inland mouse

Spinifex hopping-mouse

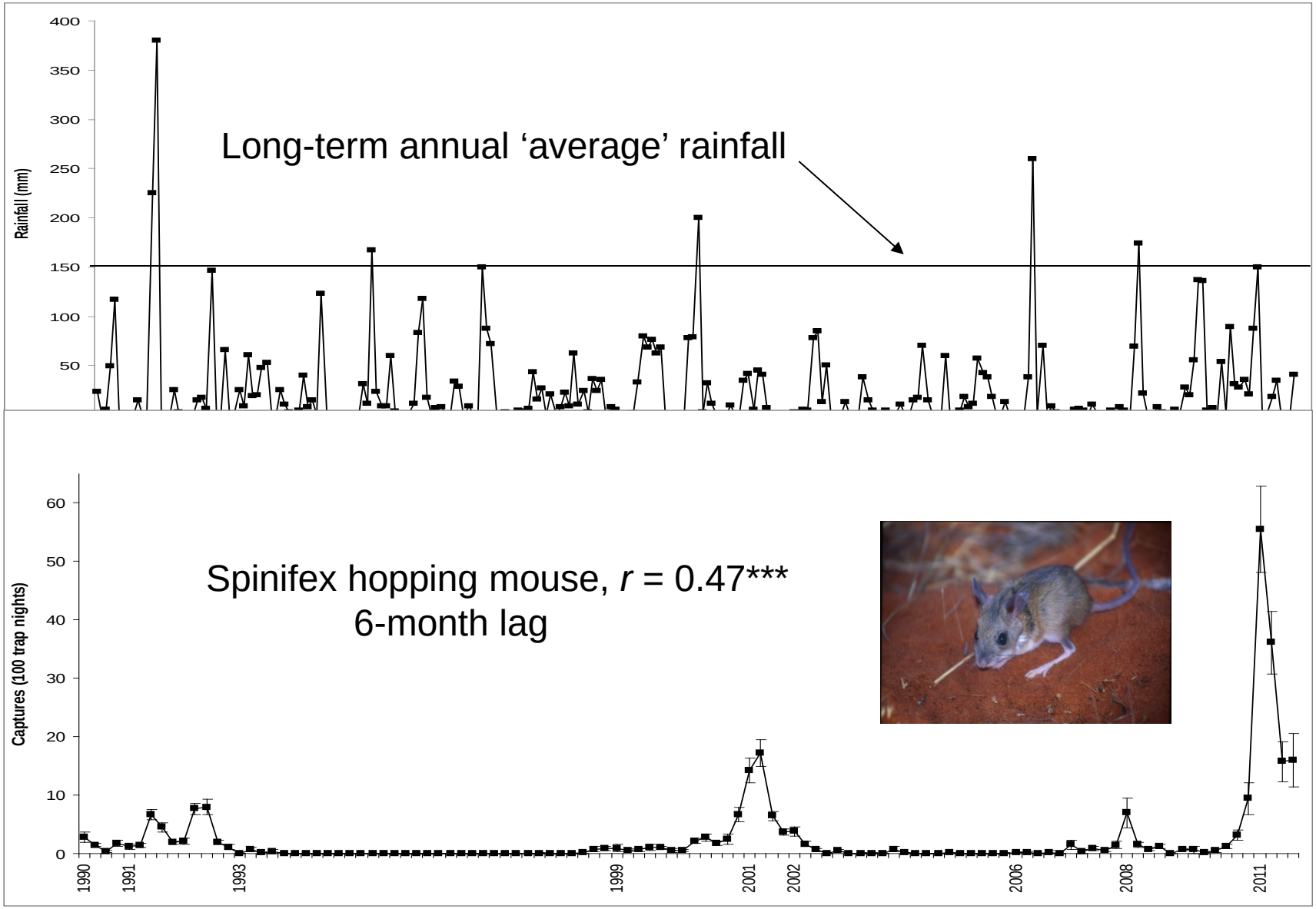


Native mice: effects of rain – 1

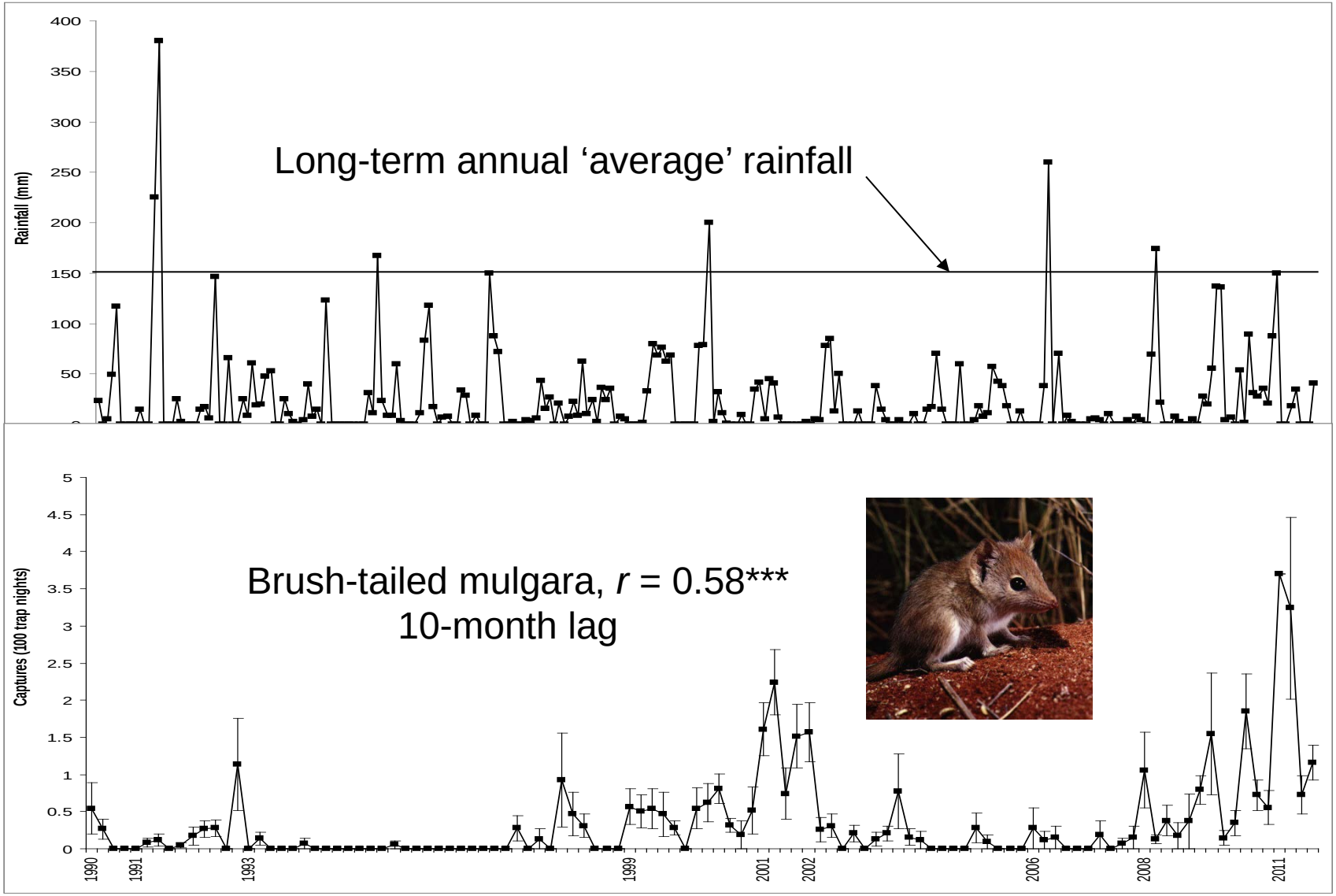




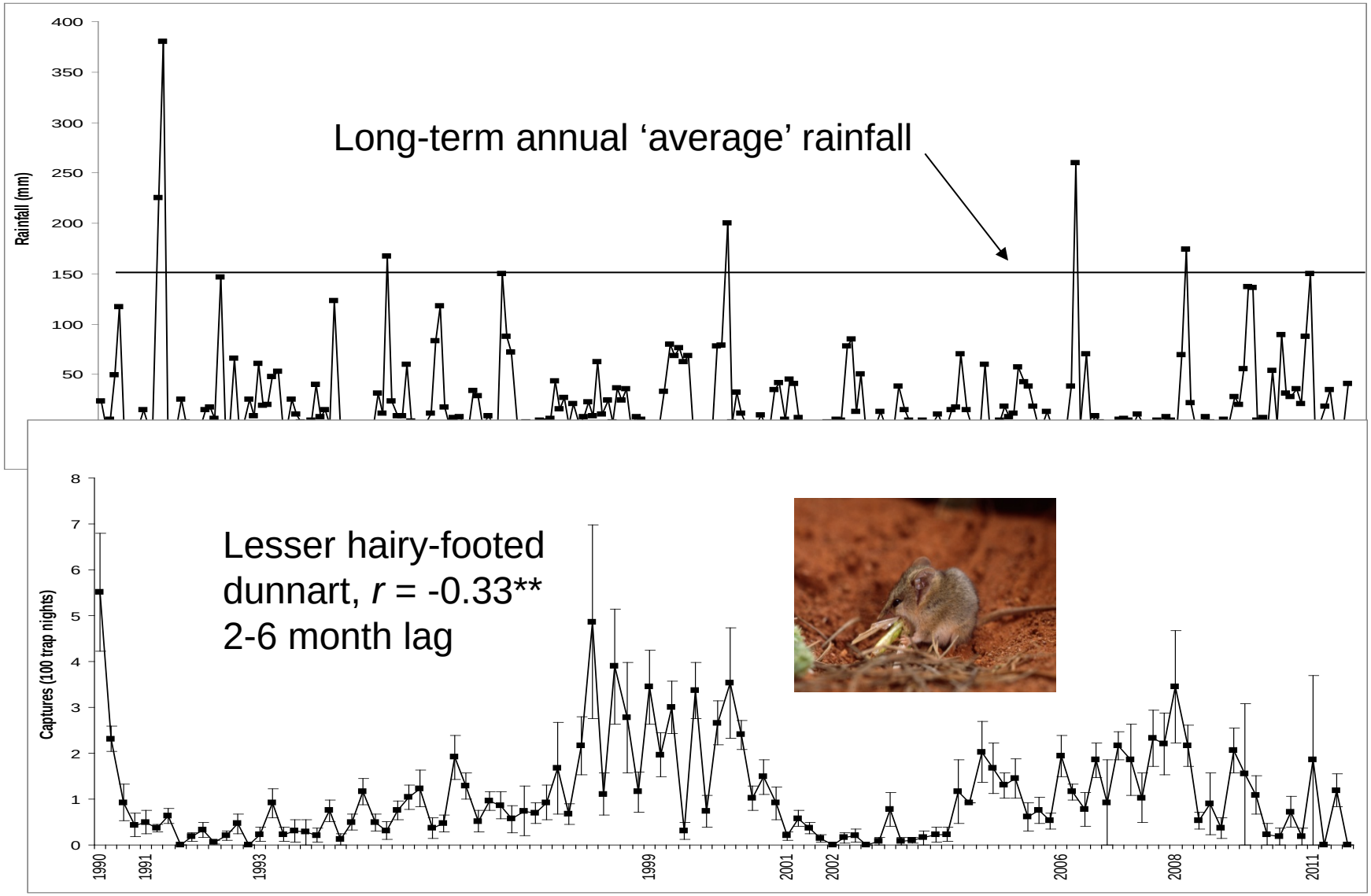
Native mice: effects of rain – 2



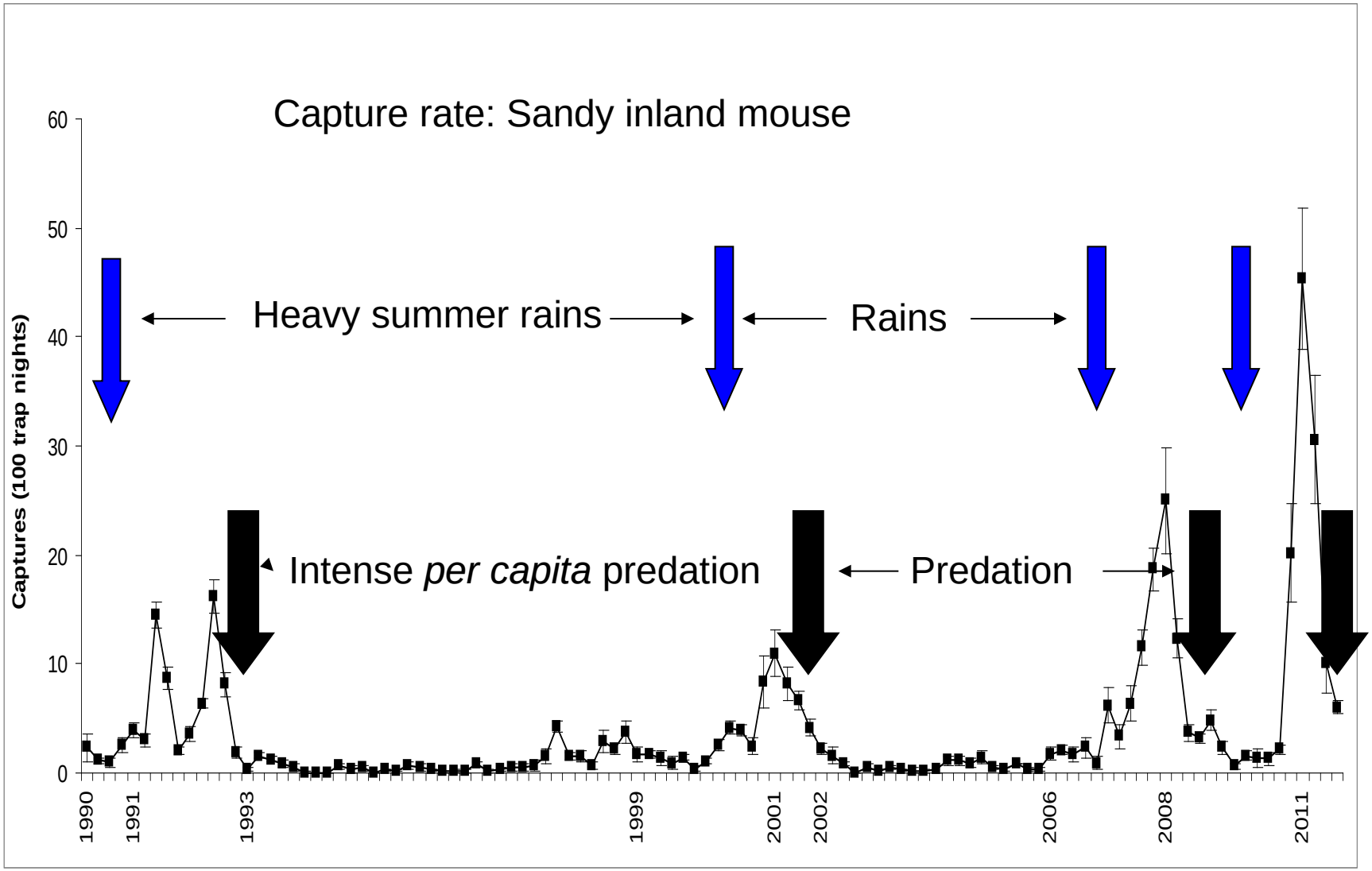
Marsupials: effects of rain – 1



Marsupials: effects of rain – 2



Effects of predators



Conclusions

- Invasive rodents such as house mice show many of the characteristics of invasive species
- Plagues are predictable: shelter, rainfall → food allows increased breeding & survival
- Ecological, economic, health and broader environmental coats are immense
- Traditional control techniques have variable (and often questionable) effects
- Need for new control measures – lessons from native rodent dynamics

References

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