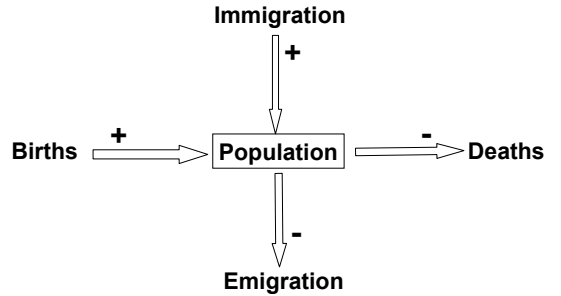
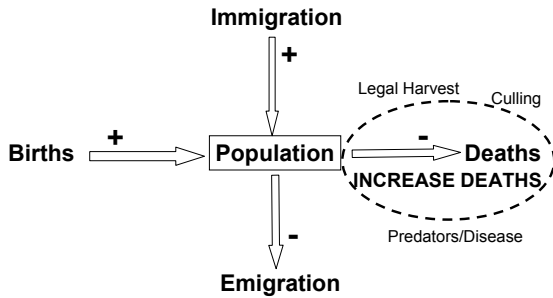


## Management Toolbox: Harvest and Alternatives

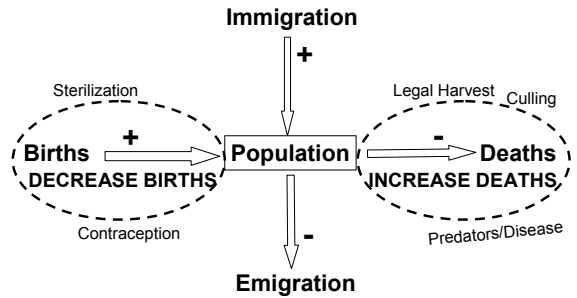
## Population Dynamics



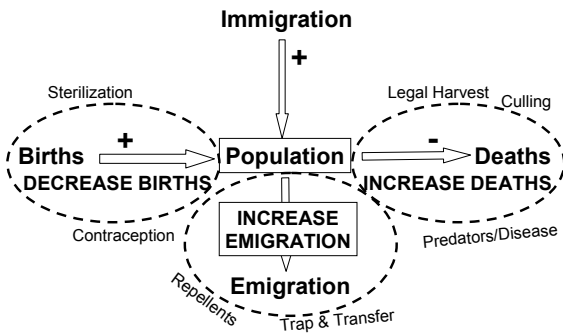
## Population Dynamics



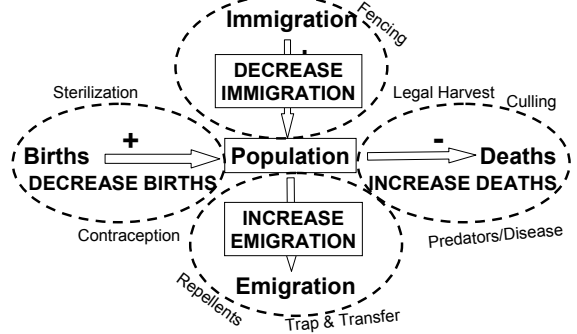
## Population Dynamics



## Population Dynamics



## Population Dynamics



## Options for Managing Overabundant Wildlife

- Legal harvest by hunters/trappers
- “Culling” – using professionals paid by management agency to kill animals
- Contraception
- Trap & Transfer
- Repellents & fencing
- Introduce Predators / Diseases
  - **Biological Control**
- Supplemental feeding

## Legal Hunting/Trapping

### Advantages:

- generates \$\$ for management agencies and local economies
- motivated, self-training labor pool
- provides data for understanding populations (check stations, surveys)

### Disadvantages:

- disapproval by non-hunting public
- Incomplete control over gender/age/species and # that are killed
- safety concerns in human population centers
- trespassing concerns
- can be costly / infeasible in suburban areas

## Culling (“Sharpshooters”)

### Advantages:

- slightly higher approval than public harvest
- greater control over #s and types killed
- slightly lower safety concerns in population centers

### Disadvantages:

- \$\$ -- \$100-300 per kill
- need to dispose of carcasses (sometimes donated)
- disapproval by non-hunting public
- safety concerns remain

## Contraception

### Advantages:

- nonlethal -- high public approval
- minimal safety concerns (except for hormone-based methods)
- no need to dispose of carcasses

### Disadvantages:

- costs of training and doing the job can be very high (\$300-400 per animal)
- increased regulatory bureaucracy: FDA and Humane Society involved
- current contraceptive methods require boosters
- <100% effective
- infertile animals survive longer
- provides little data for understanding populations

Most feasible and cost-effective for small geographic areas and in human population centers

## Trap And Transfer

### Advantages:

- “nonlethal” -- high public approval
  - Some species (e.g., raccons) survive well
- no safety concerns

### Disadvantages:

- costs of training and doing the job are extremely high
- mortality of translocated animals is high for some species
  - up to 85% mortality for deer, >50% for beavers
- moving the problem from one place to another
- highly mobile animals may return

Can be useful for particular instances of ecological or economic damage involving small areas and few individuals

## Repellents & Fencing

### Advantages:

- “nonlethal” -- high public approval
- little safety concerns

### Disadvantages:

- \$\$\$
- moving the problem from one place to another
- not always effective
- can impact nontarget migratory species

### Most feasible for small-scales

examples: fencing nests of piping plovers and turtles

Large scale: “dingo fence” in Australia – >9000 km long

## Introduce Predators/Diseases

### Advantages:

- self-reproducing after start-up
- "natural" method of population control

### Disadvantages:

- difficult to control age/sex/species and # killed
- potential harm to nontarget species
- potential harm to people & property
- start up costs can be high
- provides no data on prey populations

### Examples:

Wolves in Yellowstone  
 Myxomatosis for rabbits in Australia  
 Mongooses for rats in Caribbean & Hawaii  
 Cane toads for agricultural pests in Australia

## Supplemental Food

### Advantages:

- nonlethal

### Disadvantages:

- can increase population
- \$\$\$
- can cause disease outbreaks
- provides no data on populations

Example: National Elk Refuge in Jackson Hole, WY

## National Elk Refuge, WY

- Wintering range for ~7500 elk
- Fed with alfalfa pellets ~ 2.5 months / yr
- 30 tons / day

## Options

	Cheap	Nonlethal	Safety Concerns	Control	Data
Harvest	+	-	-	+	+
Culling	-	-	-	+	+
Contraception	-	+	+	+	-
Trap & transfer	-	?	+	+	+
Repellents & Fencing	-	+	+	-	-
Predators & diseases	-	-	-	-	-

+ = advantage, - = disadvantage

## Contraception

- Surgical sterilization
- Hormonal contraception
- Anti-hormonal contraception
  - Gonadotropin releasing hormone agonist
- Immunocontraception
  - make the immune system disrupt reproduction

## GnRH Agonist

- Leuprolide interferes with gonadotropin-releasing hormone (GnRH)
  - GnRH stimulates production of follicle stimulating hormone (FSH) and luteinizing hormone (LH), both of which are needed for ovulation
- Controlled-release leuprolide injections have 100% contraceptive efficacy in elk and deer (Baker et al. 2004, Conner et al. 2007)
  - Requires capture or darting (30-yard range)
- No negative health effects
- Treatment only works for 1 breeding season
  - Reversible

## Immunocontraception: Porcine Zona Pellucida Vaccine

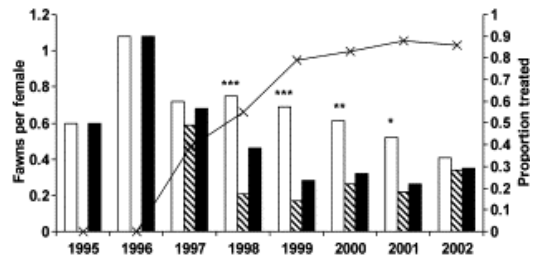
- Causes mammal's immune system to attack the zona pellucida (outer coating of egg)
- Requires 2 treatments in first year, then yearly boosters
- ~90% effective
- No hormones – no transfer to predators or humans eating the meat
- Essentially no negative health effects
  - treated animals are generally healthier and survive longer
- Somewhat reversible

## Immunocontraception: Porcine Zona Pellucida Vaccine

- Treatment requires darting or treated baits
  - baiting can affect nontarget animals
  - darts have limited range (about 30 yards)
- Effective treatment requires identifying individuals
- For deer, about 85% or more of females must be treated to stabilize the population.

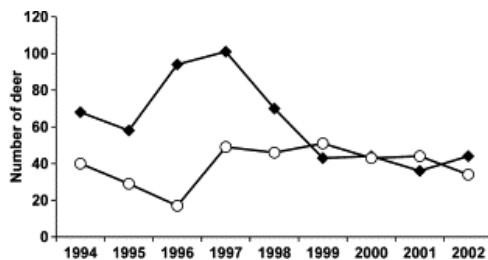
## Contraception: Porcine Zona Pellucida Vaccine

- Has been used to control particular populations:
  - Feral horses on Assateague Island (12 years) & in Nevada
  - Elephants in South Africa
  - Koalas in Australia
  - Localized deer populations
    - Fire Island, NY
    - Gaithersburg, MD (NIST campus)

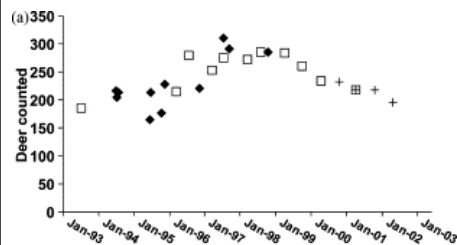


Effects of PZP vaccine on deer natality in Gaithersburg, MD (National Institute of Standards and Technology)

Rutberg et al. 2003, Biol. Conservation 116:243-250.



Births (black) and deaths (white) of deer treated with PZP in Gaithersburg, MD  
Rutberg et al. 2003, Biol. Conservation 116:243-250.



Effects of PZP treatment on deer abundance in Gaithersburg, MD  
Rutberg et al. 2003, Biol. Conservation 116:243-250.

## Things to Remember

- Advantages and disadvantages of harvest & alternatives, especially
  - cost
  - public approval / safety
  - feasibility for human residential areas
- Immunocontraception by PZP vaccine:
  - how does it work?
  - how is it used?