

## Sea Otters of the North Pacific Ocean



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## Marine Mammals

Cetacea



Carnivora



Sirenia




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## Sea otter (*Enhydra lutris*) Order- Carnivora, Family- Mustelidae




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Marine mammals retain the basic characteristics common to all mammals

- endothermic homeothermy
- hair
- live birth
- nourish young with milk




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Sea Otter Distribution and Estimated Population



Mid 1700s: 150,000-300,000  
 <1000 prior to the 1911 International Fur Seal Treaty  
 Aleutian Islands, AK = 53,000 (1970s)  
 → 6000 (1999)  
 Prince William Sound, AK = 6,500 (1994)  
 Bering Island, Russia = 3,400 (1995)  
 California = 2,000 (2001)

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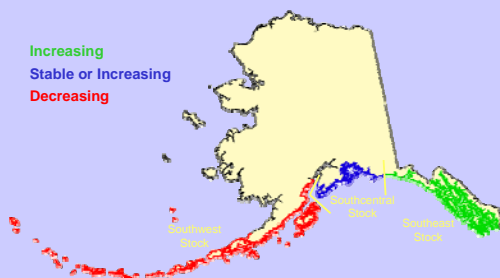
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Current Sea Otter Population Trends

Increasing  
 Stable or Increasing  
 Decreasing




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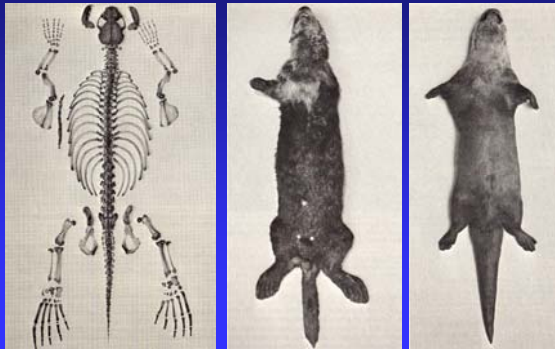
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### Gross anatomy



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### Head morphology



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### Skull morphology



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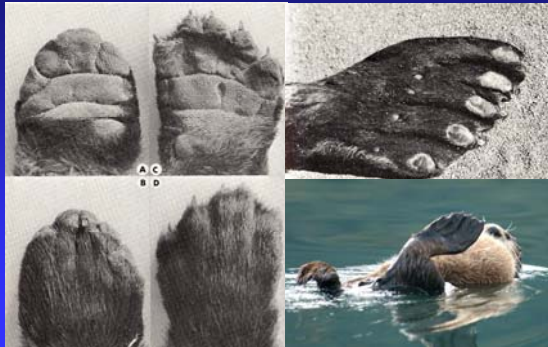
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Sea otter fore and hind limbs



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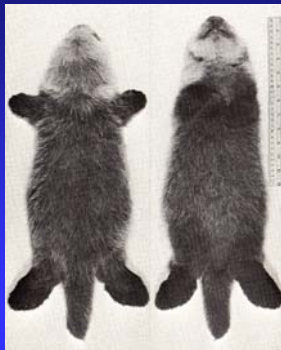
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Pup gross anatomy



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Structure and Function of Fur



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Fur is the sole source of thermal insulation in sea otters



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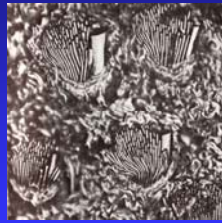
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Cross sectional view of sea otter fur and microscopic view of shaved hair follicles



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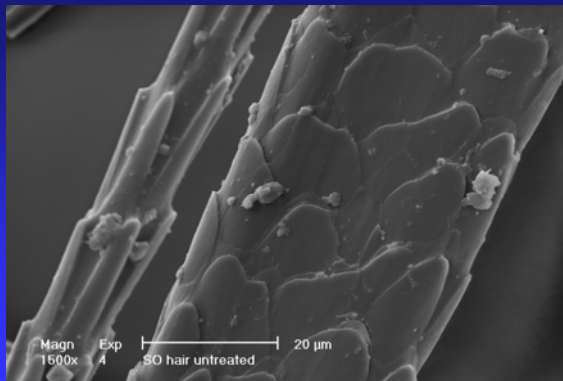
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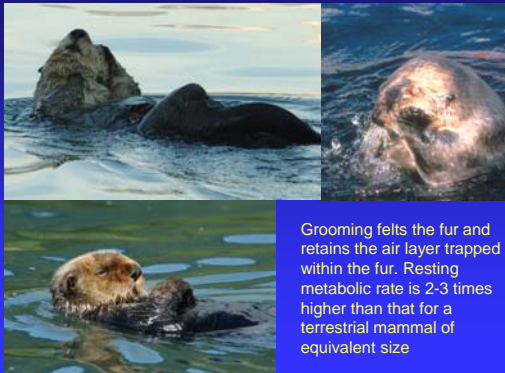
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Grooming felts the fur and retains the air layer trapped within the fur. Resting metabolic rate is 2-3 times higher than that for a terrestrial mammal of equivalent size

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## Recent Research on the Behavioral Ecology of Sea Otters in Prince William Sound

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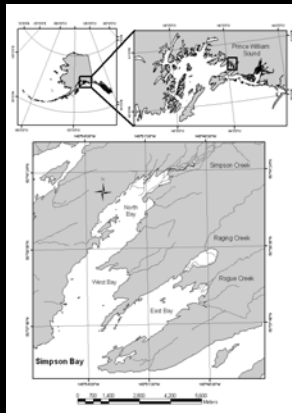
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## Prince William Sound and Simpson Bay




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### Simpson Bay



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### Foraging Behavior



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Because sea otters have a high (2-3x normal) resting metabolic rate, they eat 25% of their body mass in food each day to support their high metabolic rate. Most prey are benthic invertebrates, including crustaceans, molluscs, echinoderms and echiurids.



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Sea otters use tools to open invertebrate prey



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### Diving



Maximum recorded dive depth is 100 m for males and 76 m for females

Maximum recorded dive duration is ca. 4.5 min

Prey pits



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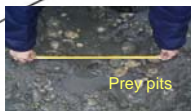
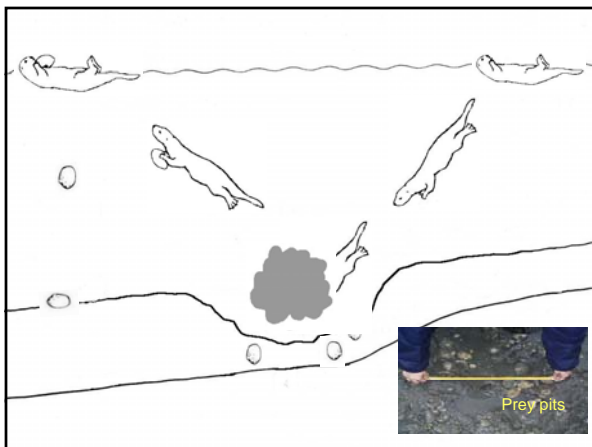
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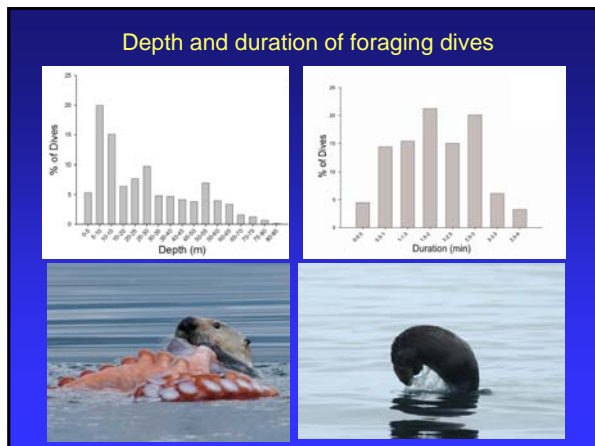
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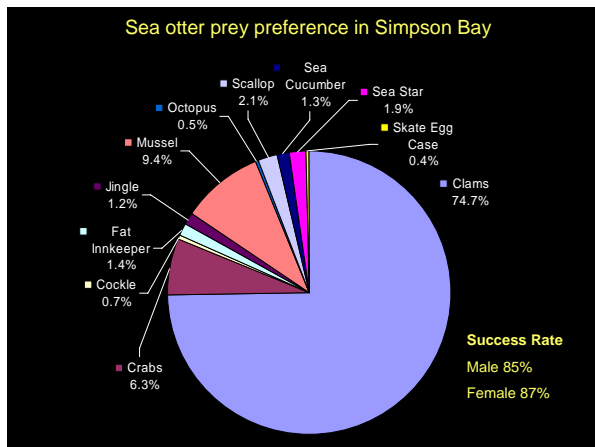
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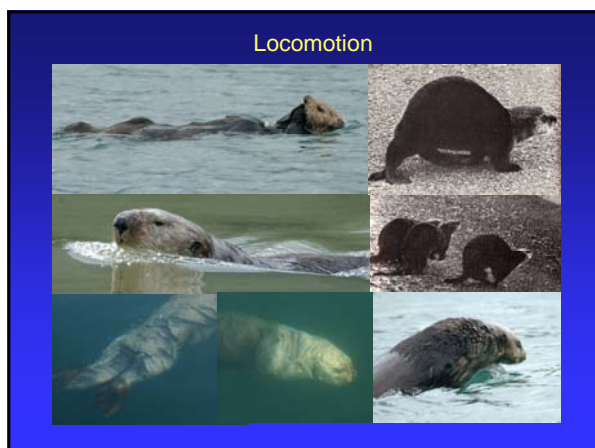
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## Social Structure



- Social unit = a raft
- Sexual segregation
- Male territories
- Polygyny

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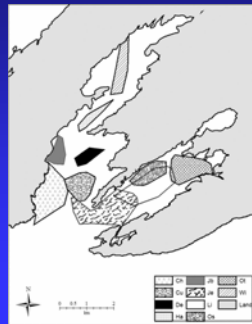
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## Territorial Males

- Adult males defend territories from which they exclude other males
- A territorial male will attempt to mate with each receptive female that enters his territory
- Females may be attracted to certain territories based on food resources, resting areas, and/or shelter from wind and waves



Territories of male sea otters in Simpson Bay, summer 2003




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## Identification of Territorial Males

Penile ridge or scrotum  
Patrolling or mating behavior




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### Reproductive Behavior




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### Females with pups




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### Allocation of Time




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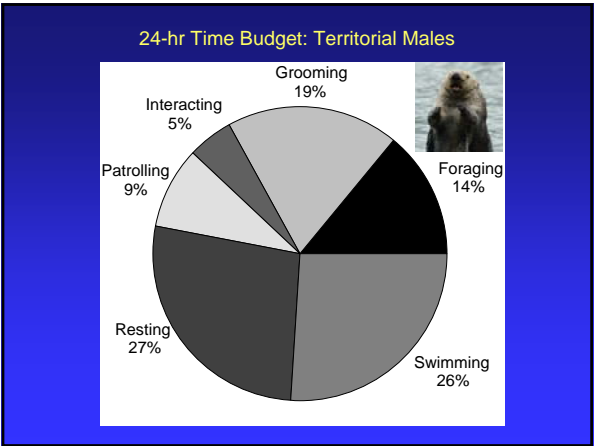
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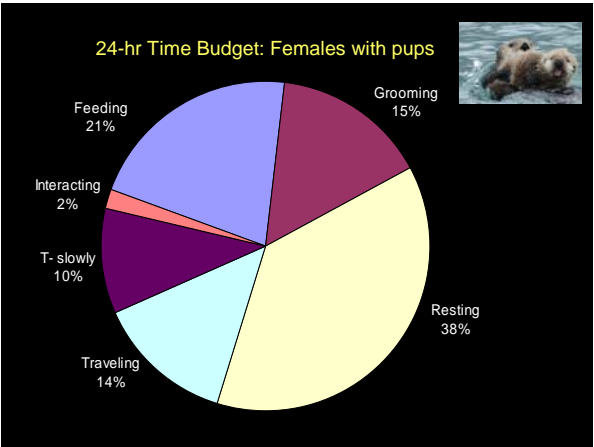
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24 hour Time Budget: Males vs. Females

Behavior	Territorial males	Females with pups
Feeding	14%	21%
Grooming	19%	15%
Resting	27%	38%
Swimming (traveling)	26%	28%
Interacting	5%	2%
Patrolling	9%	N/A

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### Predation



Bald Eagles



Sharks



Killer whales

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### Effects of Oil on Sea Otter Fur



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The most immediate and detrimental effect of an oil spill on sea otters is fur contamination



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### 1989 Exxon Valdez oil spill



Killed ~ 2,500 otters in Prince William Sound



The oily, clumped fur loses most of its insulation and the otter is subject to lethal hypothermia

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The hydrophobic surface of the cuticle and the large surface area of the fur trap the oil and make it impossible for the otter to clean itself



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To offset the increased heat loss and maintain a normal core body temperature, oiled otters must further increase their normally high metabolic rate to prevent hypothermia



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Alternatively, they can reduce heat loss by leaving the water. However, this prevents foraging, and dehydration and starvation occur rapidly



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Sea otters that are covered over 20% of their body with oil that has eliminated the insulating air layer will probably require capture and cleaning



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