Weddell Seals

Adaptations to an extreme environment
Antarctica

Is the:

Highest
Driest
Windiest
and Coldest

continent on Earth!
The animals survival depend on special and unique adaptations.
Weddel Seals

- The most southerly dwelling mammal on Earth
- Live on fast ice, floating ice that is attached to land. Enter the water through cracks in the ice
- Spend most of the year in the water, coming out in the summer (Nov-Jan) for pupping, breeding and molting (and soaking up sun!)
- Can dive for over an hour, and up to 600 meters deep!
seasonal ice cover around Antarctica
general range of the Weddell Seal
How do Weddell seals stay warm in such a cold environment?

Adaptations

- Blubber vs. Fur
- Basking in the sun
- Very rich milk

Photo by Brian Locket
Obesity problem? Or perfect adaptation?

Photo by Jennifer Burns

That is a lot of seal!
Obesity problem? Or perfect adaptation?

Blubber is warmer than fur!

30-40% of body weight is blubber. That means, up to 240 kg in the largest seals, is pure blubber! Over 5 cm thick!

Photos by Michelle Shero
What is the fur for?

Blubber is warmer!

**Fur is more for protection than insulation.**

Pups, however, are born with a soft, downy fur coat—lanugo, which keeps them warm while they build up blubber from Mama’s milk!

Photo by Alex Eilers
**Milk or ice cream?**

Weddell seal milk is 60% fat! Human milk is 4% fat.

Weddell seal babies consume 5900 grams of fat per day. That’s 53,100 calories!

Breastfed human babies consume 40 grams of fat per day. That’s only 360 calories!
How do Weddell seals get around in the dark of winter under the ice?

Long whiskers

Special teeth

Huge eyes
special teeth!

Weddell seals can open their mouth very wide.

There are large canines, typical of carnivores

The incisors jut forward for a special purpose – to keep the breathing hole open

Photos by Jennifer Burns

Weddell seal shaving ice with teeth to maintain breathing hole Video

Credit: BBC Natural History Unit, Arkive
Wild Whiskers or *vibrissae*

Functions:
- To help find food
- To help navigate

Special features of whiskers:
- Each vibrissa can move independently
- They have many sensitive nerve fibers to detect water movement from passing prey
- Whiskers are shed periodically, and new ones grow

Whiskers can be relaxed (on land) or stiff and erect when they sense movement.
Huge eyes

- Very large iris – the part of the eye that gathers light. Notice there is no visible white on the seal’s eye.
- Large number of rods, photoreceptors that allow vision in poor light

The tapetum lucidum is a reflective layer behind the retina that reflects light back to the retina for a second go around and more light absorption!
Huge eyes

The cornea loses 87% of its refractive power in water! The light is then focused behind the retina, resulting in hyperopia (far-sightedness).

Seals make up for this with a very round lens, which bends the light more than the flat lens that humans have. This gives the seal good vision under water. On land, they are myopic (near-sighted).
How do Weddell seals dive so deep and for so long?

Adaptations

- Blood stores a lot of oxygen
- Muscle stores a lot of oxygen
- Collapsible lungs for diving deep

Weddell seals can dive for over an hour, and go as deep as 600 meters! Their dives can range 5km from their breathing hole!
Blood

The Weddell seal’s blood is all about holding the most oxygen possible!

Weddell seals have a high volume of blood – 20% of body volume!

They have a very high hematocrit of 50-70% – that is the % volume of blood that is red blood cells. This is caused by very large blood cells.

Hemoglobin range (red)

have 30-50% more hemoglobin than human blood.

Hemoglobin is the oxygen carrying protein in blood.
Myoglobin

What is the difference between hemoglobin and myoglobin?

They are both similar molecules that carry oxygen.

Heme = blood, myo = muscle, globin – the name of the protein portion of the molecules.

Myoglobin is the oxygen carrying protein in muscles.

The darker the muscle, the more oxygen it can carry, which means it can sustain more activity for a longer period of time.
Collapsible lungs

A seal depends entirely on oxygen stored in the muscles and blood to carry it through the dive!

No oxygen exchange happens in the lungs during a dive!

The oxygen storing capacity of the blood and muscles are important in supporting the seal during deep dives, because.....the chest cavity of Weddell seals collapses when diving, and the air within them compresses.


The alveolar sac and lobule collapse when the seal dives.
More interesting adaptations

- Delayed implantation of up to 90 days after breeding. Fertilized eggs don’t start developing until January.
- Have strong nostril muscles that snap shut when diving.
- Bask in the sun in summer, saving energy for pupping, breeding, and molting.
- Pups grow fast, are weaned at 6-7 weeks (when the fast ice breaks up), and are on their own.
- Adapted to a habitat – the fast ice - that is hard for any predators to reach.
- Fusiform (torpedo) shape makes for very efficient swimming.
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