TEACHERS AND RESEARCHERS EXPLORING AND COLLABORATING

POLAR TREC

Welcome to *PolarConnect*

Growing Up on Ice

With PolarTREC Teacher Bridget Ward

& Team Researcher Heather Liwanag

November 4, 2019

Photos ACA Permit number 2018-013 M#1 MMPA Permit Number 21006-01

Participant Introductions

In the Chat box, please introduce yourself by typing in your:

- ✓ Name
- ✓ School or Institution
- ✓ The number of students and adults participating with you in the same location

What is PolarTREC?

- Since 2004, the Arctic Research Consortium of the United States (ARCUS), a non-profit organization, has been administrating the PolarTREC Program.

- PolarTREC is professional development for K-12 teachers. They are paired with researchers for 2-6 week research experiences in the polar regions.

- Over 150 teachers from around the United States have joined scientists in the Arctic and Antarctica to learn about science, the polar regions, and to share what they have learned with their students and communities.

ARCUS
ARCTIC RESEARCH CONSORTIUM OF THE UNITED STATES

25 Years of Connecting Arctic Research
www.arcus.org

Questions

During the Presentation:

- Type your question in the text chat box

At the End of the Presentation, two options:

1. Type your question in the text chat box, or
2. Raise your hand with the "hand button".

- PolarTREC staff will call on you and activate your microphone.
- Speak loud and clear, directly into the computer microphone or the phone to ask your question.

Growing Up on Ice: Early Development of Weddell Seal Pups

Team B-030

Photo: National Geographic

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TEACHERS AND RESEARCHERS EXPLORING AND COLLABORATING

CAL POLY SAN LUIS OBISPO

The Marine Mammal Center

NSF

UNITED STATES ANTARCTIC PROGRAM NATIONAL SCIENCE FOUNDATION

Heather Liwanag

Linnea Pearson

Heather Harris

Emily Whitmer

Emma Weitzner

Erin Brodie

Bridget Ward

Team B-030

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Lars Tomanek

Shawn Johnson

Sophie Whoriskey

Melissa Voisinet

The Brewster Brothers

Team B-030

Thank you!

NSF Program Officers: Chris Fritsen, Karla Heidelberg

NSF Science Implementers: Liz Kauffman, Liz Widen, Curt LaBombard

ASC Contractors & Staff

B-009: Dr. Jay Rotella, Kaitlin, Jesse, Shane, Alissa, Aubrey, Kit, Heather, Holly, Victor, Brandon

Photo ACA Permit number 2018-013 M#1 MMPA Permit Number 21006-01

Thank you, B-009!

www.weddelsealscience.com

FB: Weddell Seal Science

How did I get here?

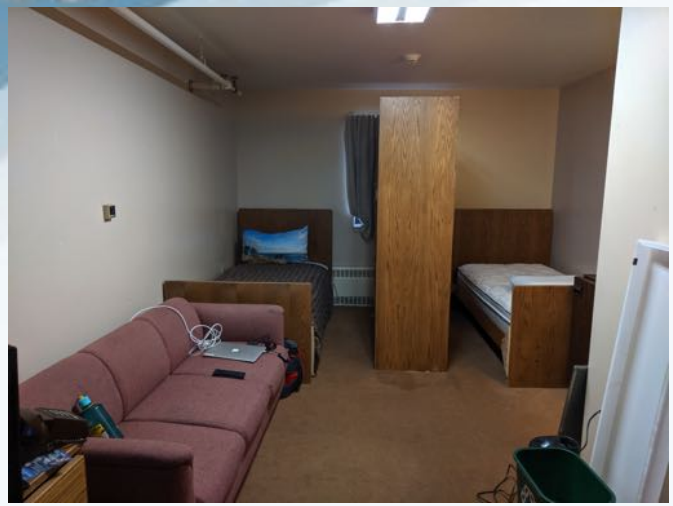
C-17 Landed on the Ross Ice Shelf

The Ross Ice Shelf is approximately the size of France and about 1,100 feet thick!

McMurdo Station

Photo by Heather Liwanag

Life at the Station



Dorm

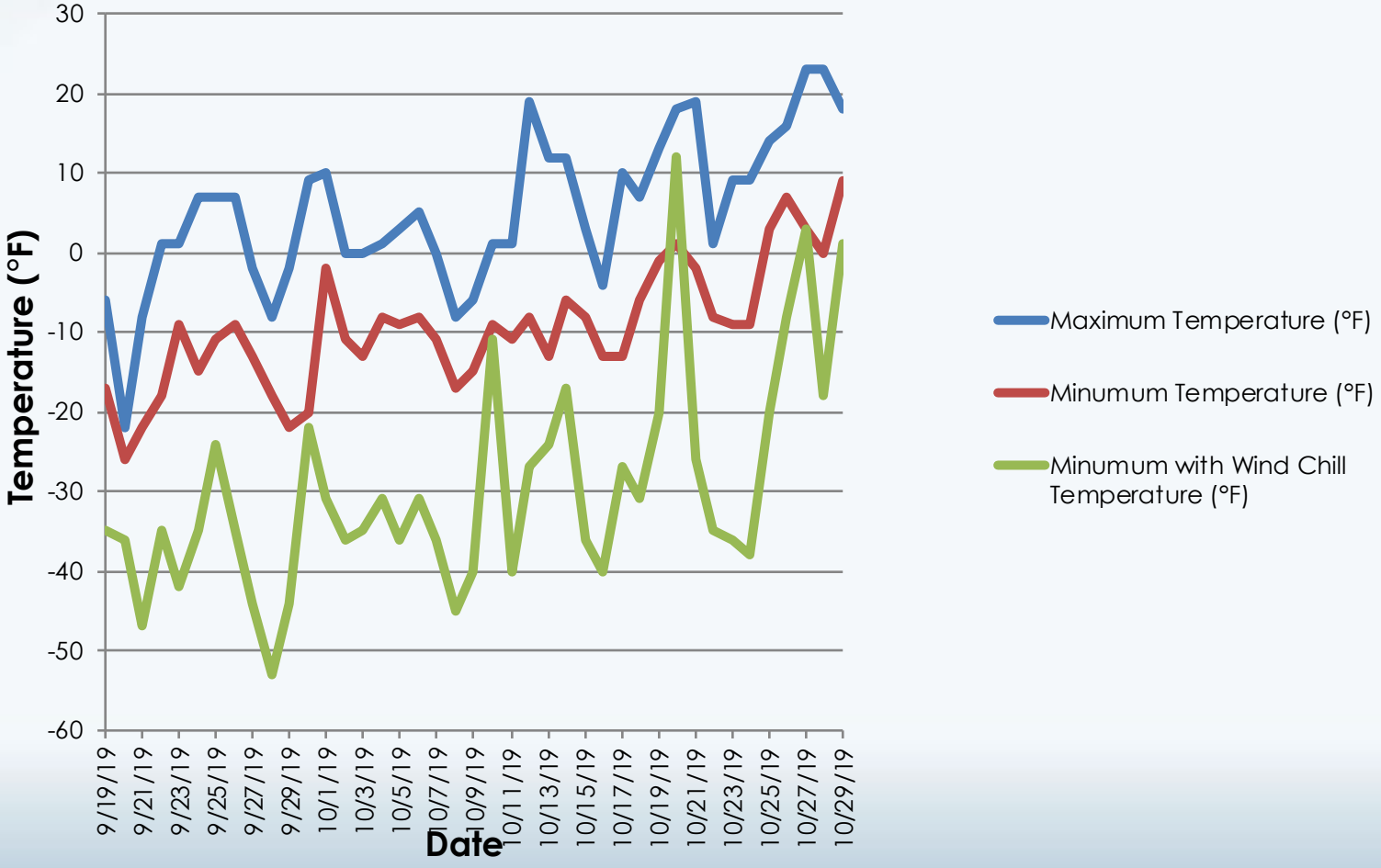
Lounge

Galley

Lab

Weather

Temperature at McMurdo Station Antarctica



What do I wear?

20 pounds of clothing

Photos by Heather Liwanag

What do I wear?

Pants:
1 pair of wind breaker pants "bibs"
3 pairs of heavy thermals
1-2 pairs of fleece pants
1 pair of silk liners

Tops:
1 parka "big red"
1 fleece jacket
1 down vest
3 pairs of heavy thermals
1 silk liner

Feet:
1 pair light weight hiking socks
1 pair 8-hour toe warmers
1 pair smart wool thick wool socks
Bunny boots

Head:
1-2 balaclavas
1 neck gaiter
1 pair goggles or sunglasses
1 hat
sunscreen

Hands:
1 pair of glove liners / light weight gloves
Hand warmers
1 pair of bigger gloves or bear paws

Daily Schedule

06:30: Wake Up
07:00: Breakfast, prep for the day, and get fully dressed
08:00: Exit the lab building

Commute: 45 minutes – 2 hours depending on transportation

Snack / Lunch / Bathroom

2-3 hours or 4-6 hours: Field Work

Snack / Bathroom

1 hour: Clean up and Respiration rates data collection

Commute: 45 minutes – 2 hours depending on transportation

30 minutes: Refuel and unpack

1-2 hours: Process samples and data / prep for the next day

Daily Commute

Snowmobile

PistenBully

Right photo by Emily Whitmer

Field Sites

Hutton Cliffs

Turtle Rock

Photos by Heather Harris

Weddell seal facts

- Named for British sealing captain James Weddell
- Southernmost breeding mammal
- Distribution: all around Antarctica (fast ice)
- Food: Antarctic cod, Antarctic silverfish, squid, octopus, krill
- Adult size: 8-11 feet, 900-1300 pounds

Weddell seal facts

Habitat:	Fast ice
Weaning:	35-52 days
Insulation:	Lanugo fur
Milk fat:	50%
Birth mass:	70 lb
Mass gain:	4 lb/day

Photo ACA Permit number 2018-013 M#1 MMPA Permit Number 21006-01

Research questions

1. How do the pups stay warm
2. How do they develop into amazing divers?

Photo by Linnea Pearson NMFS permit #21006, ACA permit #2018-013

Sampling development

- 1 week – early dependency
- 3 weeks – learning to swim
- 5 weeks – more independent
- 7 weeks – fully weaned

Nursing for ~6 weeks

How do the pups stay warm?

Insulation: Fur

Photo ACA Permit number 2018-013 M#1
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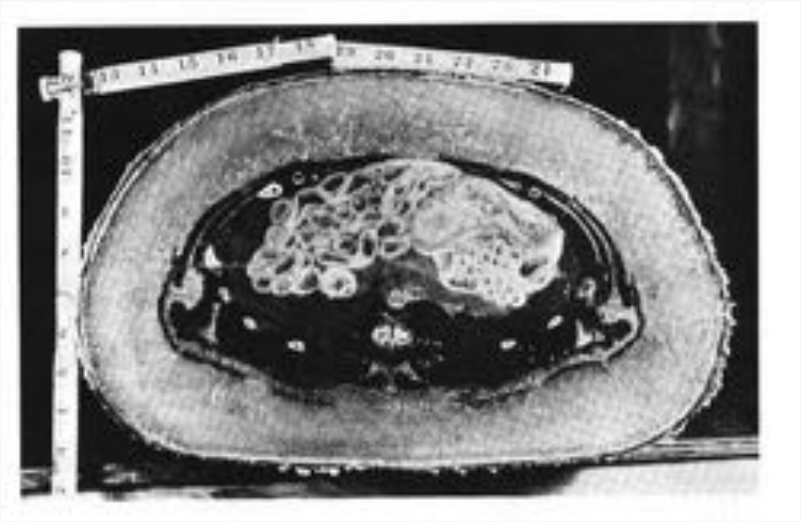
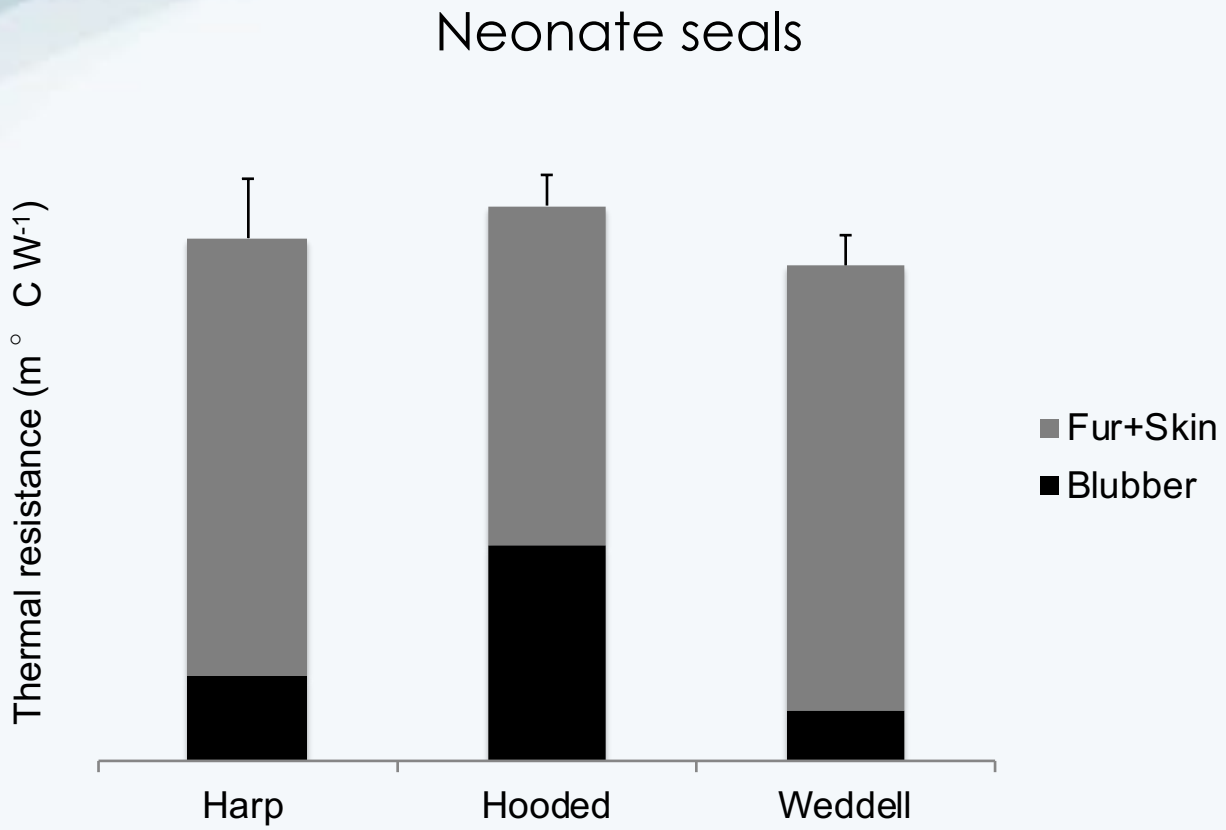
- Fur traps air among the hairs
- Air provides the insulation!

Insulation: Blubber



"continuous sheet of adipose tissue, reinforced by a network of collagen and elastic fibers"
Pabst et al. (1999)

Thermal development



Fur is more important than blubber when born.

Pearson et al. (2014)

Growing up…and out!

1 week old:

Mass: 39 – 52kg (85 – 114lbs)

Avg. blubber depth: 1.5cm (0.59in)

Avg. composition: 25% blubber

7 weeks old:

Mass: 87.5 – 141kg (191 – 310lbs)

Avg. blubber depth: 3.5cm (1.4in)

Avg. composition: 38% blubber

Photos by Heather Liwanag
Taken under NMFS permit #21006 ACA permit #2018-013

Thermal development

Lanugo fur

Molting

Juvenile coat

1. Timing of the molt? – observations

Photos by Heather Liwanag
Taken under NMFS permit #21006 ACA permit #2018-013

Observations– Molt Surveys

Molt Code	Description
0	Not molting
1	Starting to molt – head/neck/dorsum/flippers
2	Molt progressing down flanks
3	Last patches of lanugo left on flanks
4	Fully molted

Photos by Heather Liwanag
Taken under NMFS permit #21006 ACA permit #2018-013

Thermal development

Lanugo fur

Molting

Juvenile coat

1. Timing of the molt? – observations
2. Mechanism for staying warm? – shivering?

Photos by Heather Liwanag
Taken under NMFS permit #21006 ACA permit #2018-013

Shivering – Accelerometer

Photo by Heather Liwanag
ACA Permit number 2018-013 M#1 MMPA Permit Number 21006-01

Thermal development

Lanugo fur

Molting

Juvenile coat

1. Timing of the molt? – observations
2. Mechanism for staying warm? – shivering?
3. When are they ready for water? – metabolism

Photo by Heather Liwanag
ACA Permit number 2018-013 M#1 MMPA Permit Number 21006-01

Why Metabolism?

- Two options in a cold environment:
  - ↑ Insulation (prevent heat loss)
  - ↑ Metabolic rate (produce more heat)

Metabolism – Measuring Metabolic rate

- Oxygen consumption
- Air is 20.95% O_2
- Measure what the animal uses
- Convert to metabolic rate (mL O_2 / min)

Photo by Heather Liwanag

Research questions

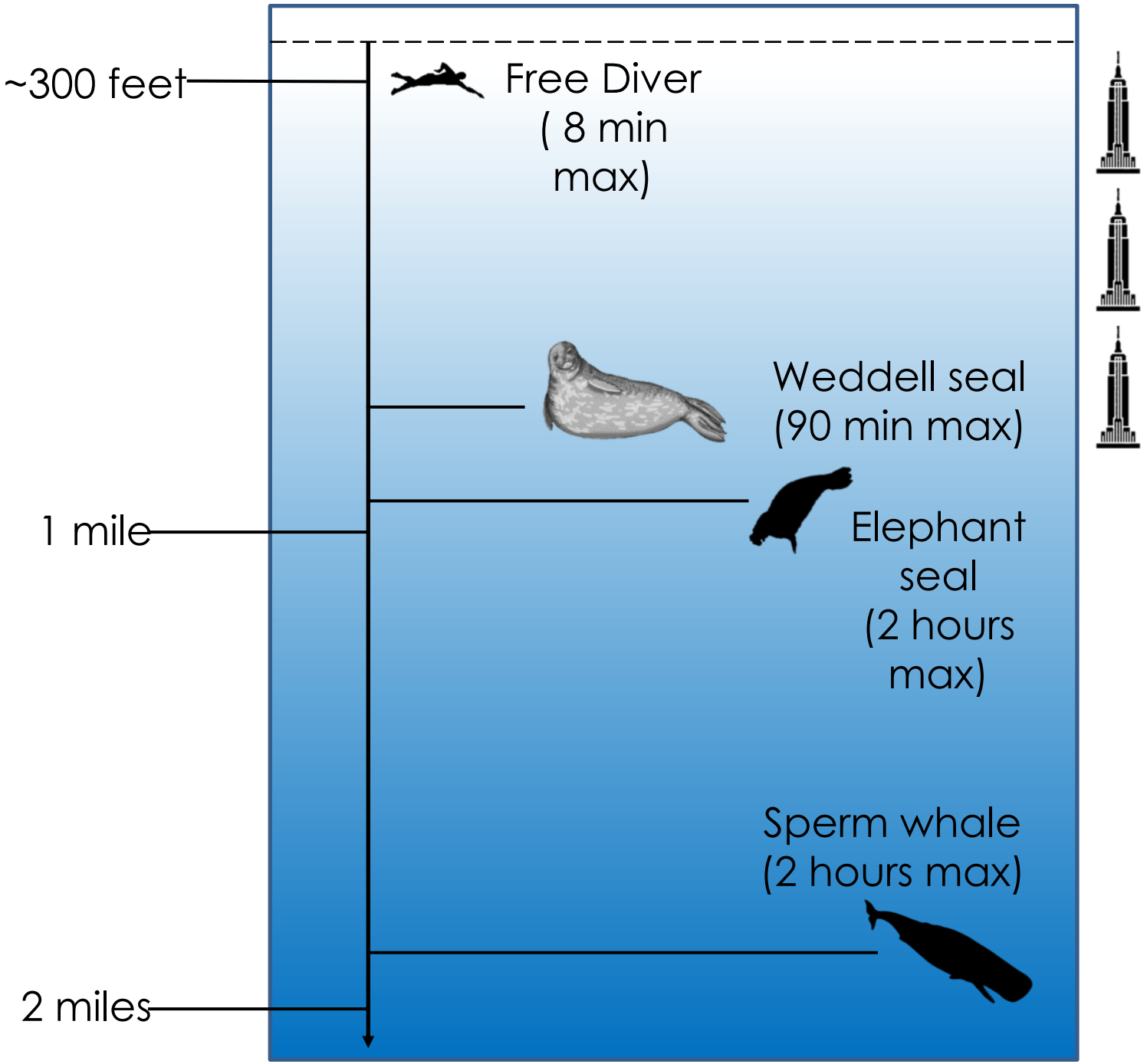
1. How do the pups stay warm?
2. How do they develop into amazing divers?

Photo by Rup Robbins

How do they develop into amazing divers?

- Deepest dive: 1200 m (¾ mile!)
- Can hold breath for up to 90 minutes
- Dive on an <u>exhale</u>
- Store oxygen in blood and muscle

Photo by LSD Scuba

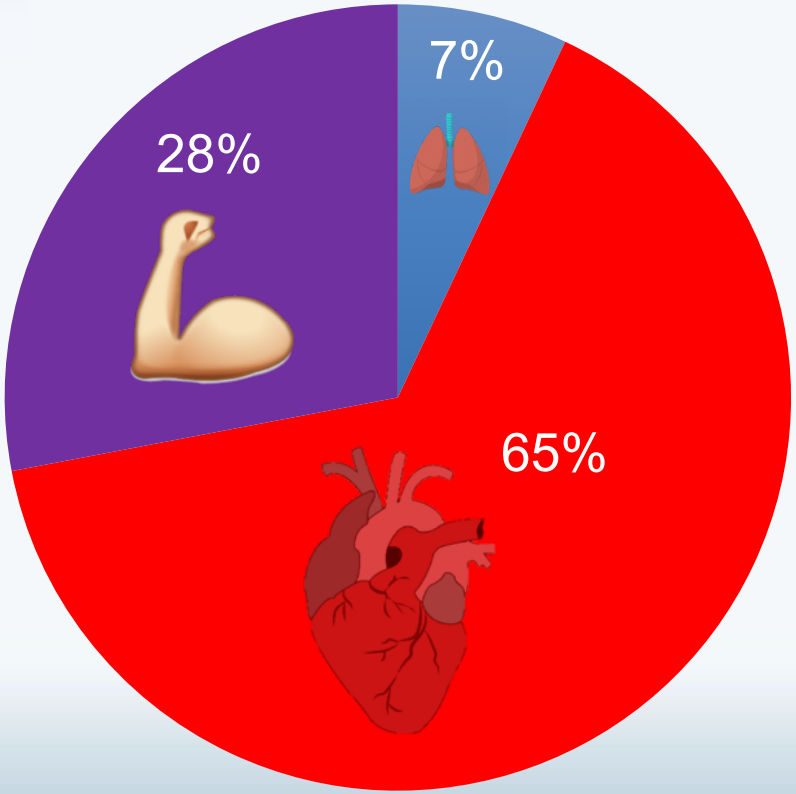

~300 feet
Free Diver
(8 min
max)
Weddell seal
(90 min max)
1 mile
Elephant
seal
(2 hours
max)
Sperm whale
(2 hours max)
2 miles

Limiting factor: oxygen

Internal oxygen stores

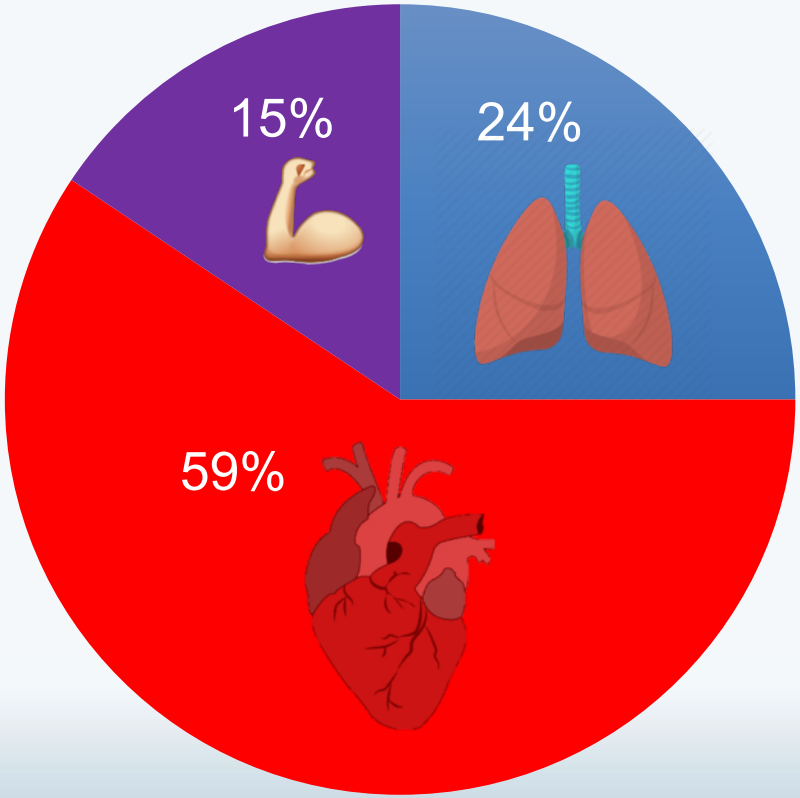
87 mL $O_2 \cdot kg^{-1}$

Adult Weddell Seal



20 mL $O_2 \cdot kg^{-1}$

Human



Weitzner (2019)

Blood Muscl Lung

Dive behavior

Time-depth recorders

Photos by Sophie Whoriskey NMFS permit #21006, ACA permit #2018-013

Questions?

Join PolarTREC!

www.polartrec.com/about/join

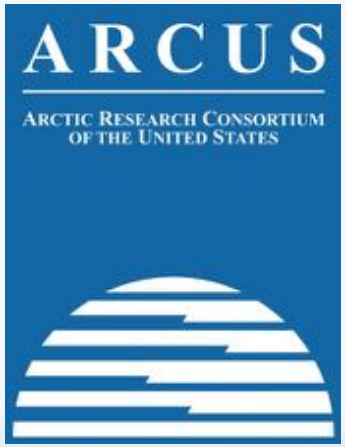
Everyone can participate in different ways:

- **Follow Expeditions**
- **Participate in PolarConnect Events**
- **Join the Polar Education Email List**
- **Check out the great resources**
- **Become a PolarTREC Teacher or Researcher**
- **Become a member of ARCUS**

Thank You!

An archive of the event will be available shortly.

http://www.polartrec.com/polar-connect/archive



25 Years of Connecting Arctic Research
www.arcus.org