

# Rub a Dub Dub: The Physiology of Washing Sea Otters

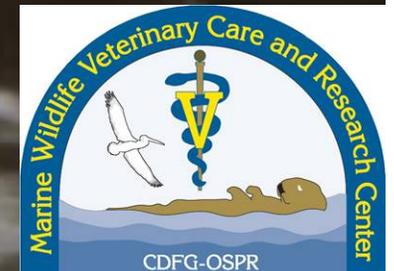
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# Sea otters are one of the most vulnerable marine animals to oil spills



- Several killed at Avila.
- Several have died in CA due to natural seep and unidentified oil.
- Several thousand killed due to Exxon Valdez.
- AK. population recovery has been slow, possibly due to remaining benthic oil and cobble beaches.

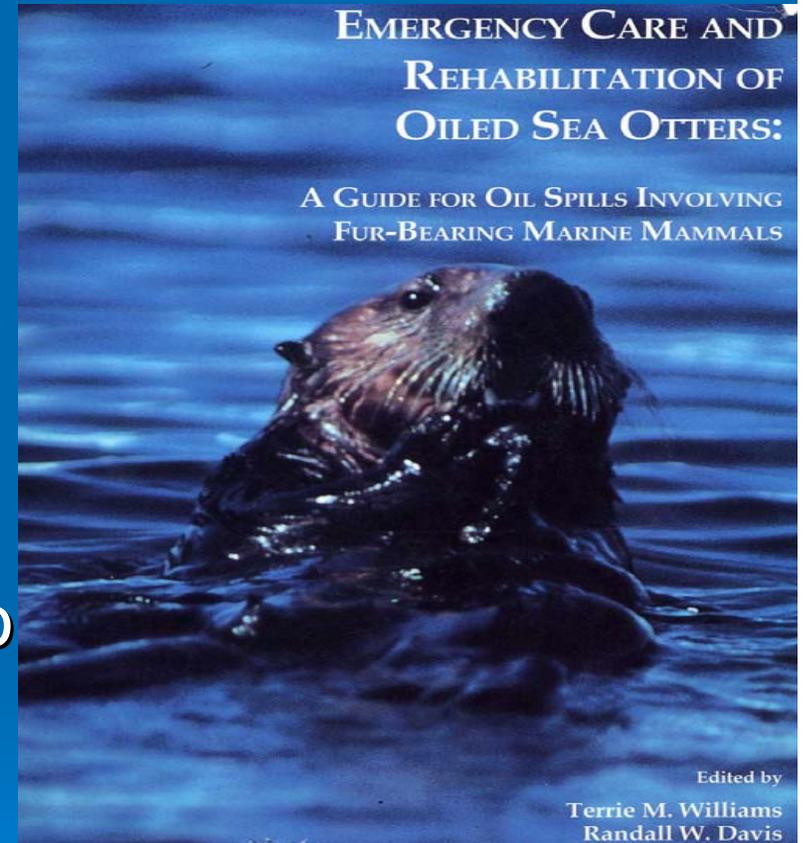
# Why ? Because of their ecological specialization and physiology.

- Obligate nearshore predator, no escape.
- Complete dependence on fur (and trapped air) for insulation from the ocean, little body fat, no blubber.
- High surface to volume ratio.
- Very high metabolic rate: must consume 25-20% of body weight per day (15-20 pounds) in shellfish (ultimate Adkins diet).



# Most sea otters that died during Exxon Valdez

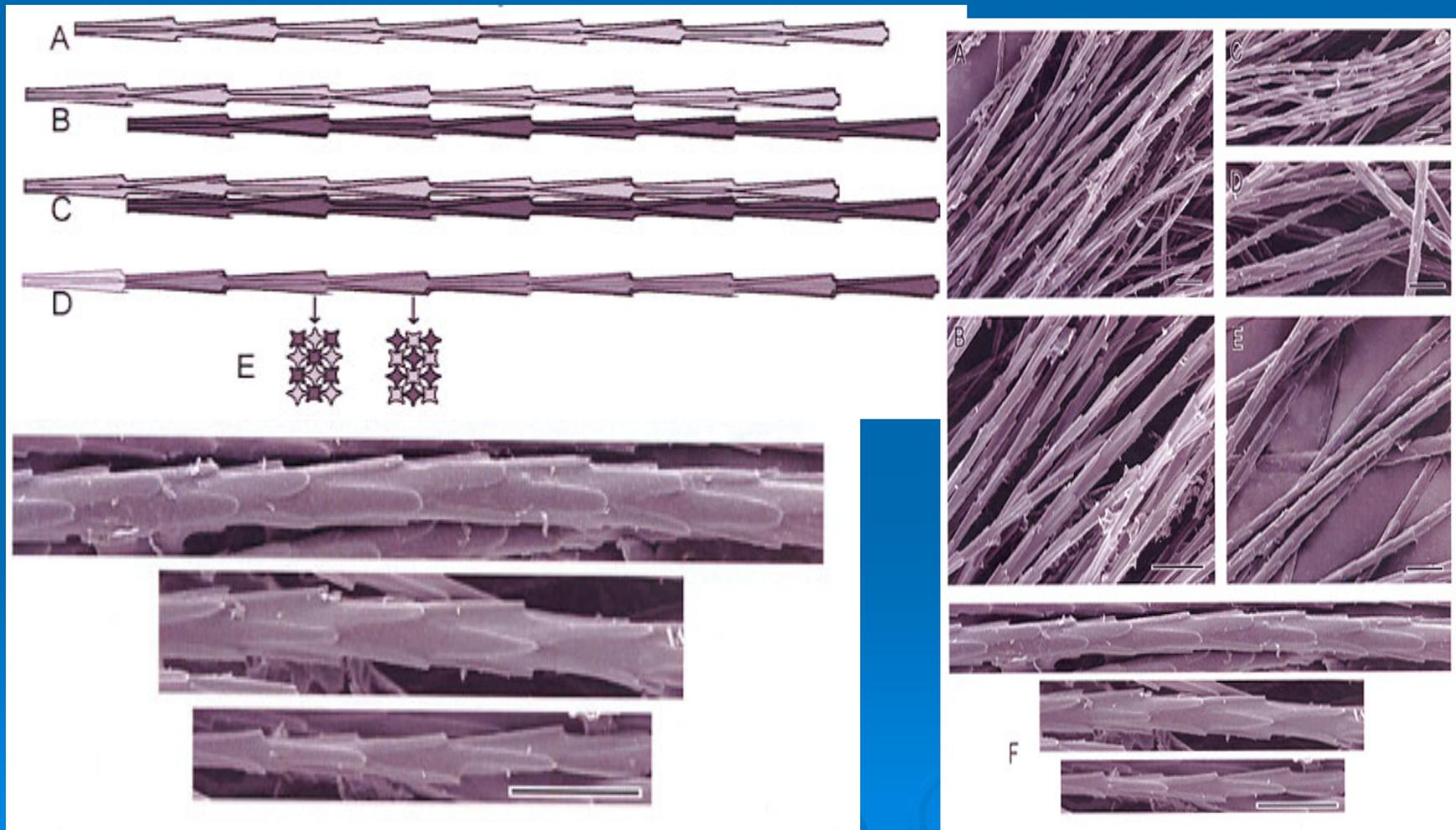
- Were oiled and ability to retain heat, dive, swim, forage was compromised.
- Hypothermia and shock
- Hypoglycemia and shock
- Toxic effects of inhaled oil fumes on lungs, brain and to a lesser extent liver and kidney.
- Simple measures to keep warm and hydrated, raise blood sugar and treat symptomatically most effective



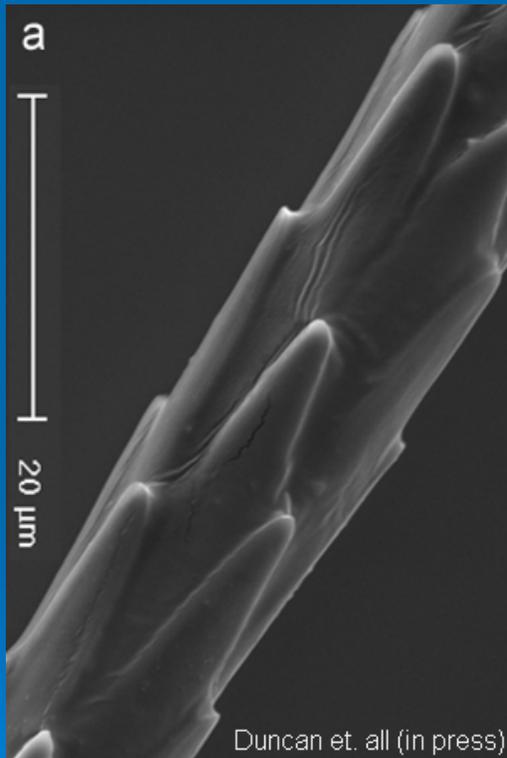
# OSPR funded project to investigate physiologic effects of washing sea otters

- Joint effort of CDFG-OSPR-MWVCRC, U.C. Santa Cruz-Long Marine Lab, Monterey Bay Aquarium, with help and support from USGS/BRD and U.C. Davis, Wildlife Health Center and OWCN.
- OSPR supplies program focus, funding, equipment and facilities, program supervision.
- UCSC provides animal care staff.
- UC Davis provides grad student to help with data analysis, IR camera collaboration.
- MBA provides feed for animals (about \$10,000 per animal per year) and staff participation.
- USGS provided input on program design and may help with analysis.

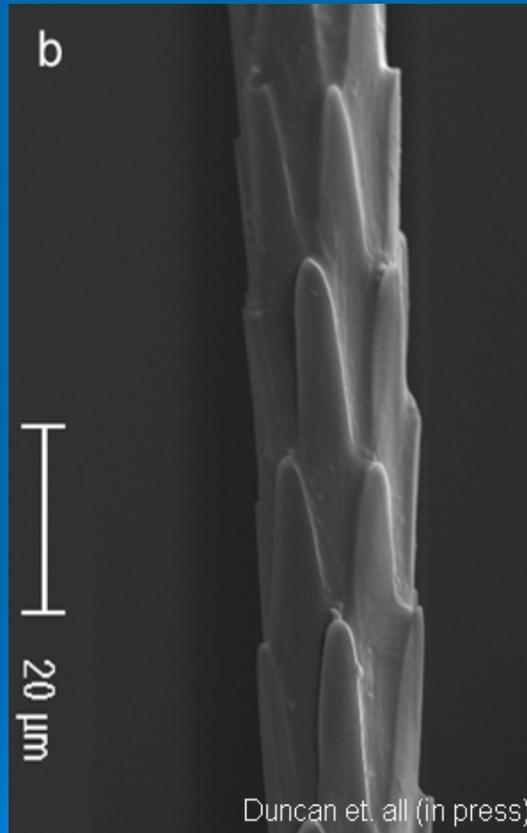
Previous work: otter fur, like bird feathers, is 3 D structured and it is that structure and water surface tension that keeps water out and air trapped.



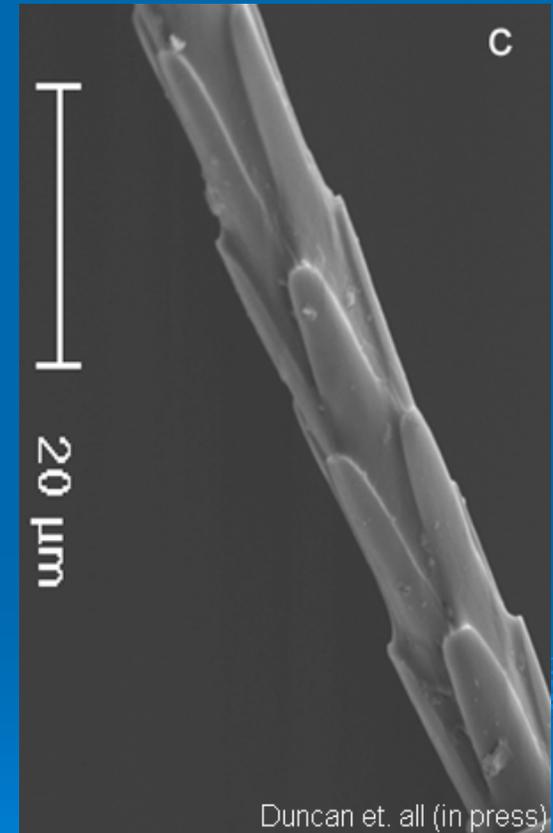
# UNTREATED FUR: From OWCN supported UCSC MS thesis of Laura Yeates.



**Mink**

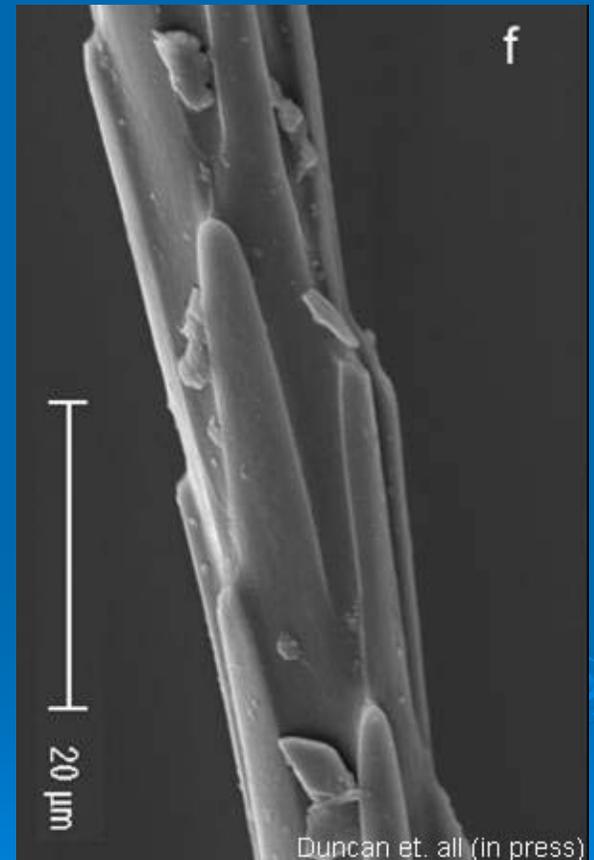
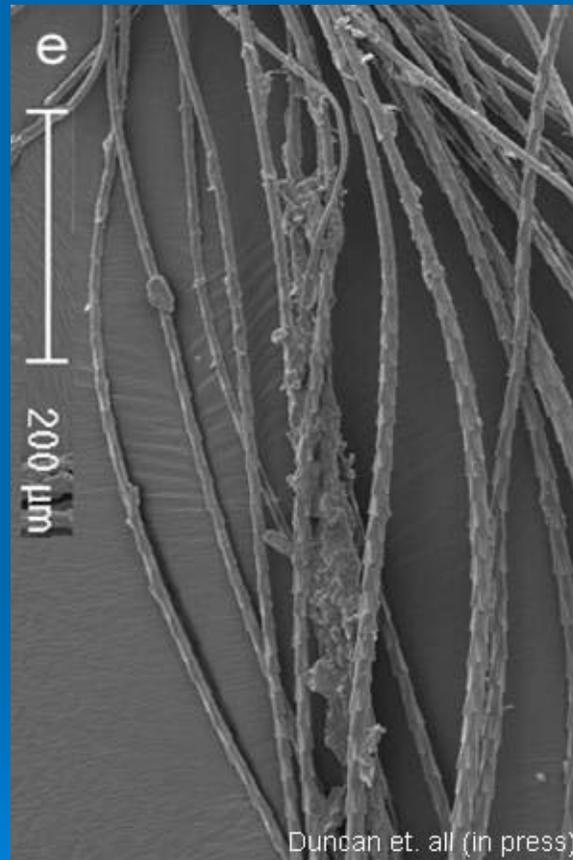
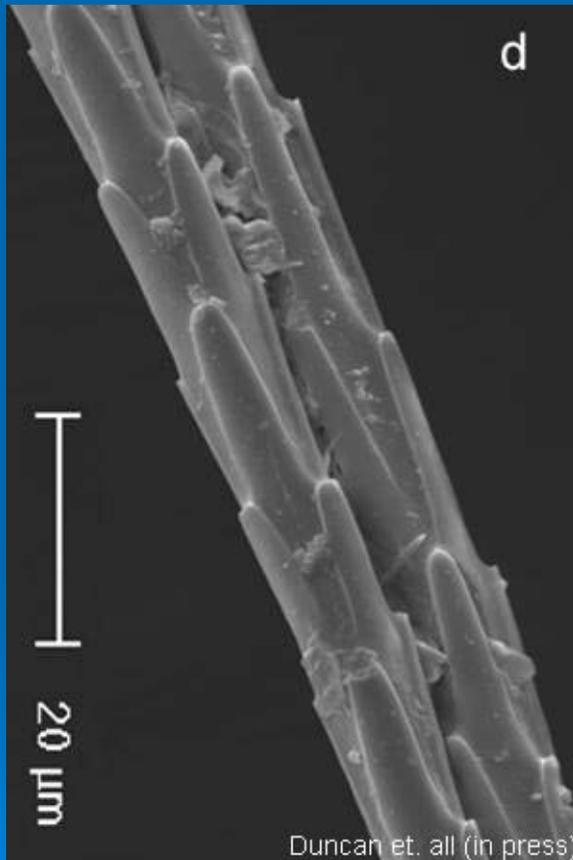


**River Otter**



**Sea Otter**

# TREATED FUR: After standard washing and rinsing of pelts crystals and some amorphous material remains on hair shafts



**River Otter**

**Mink**

**Sea Otter**

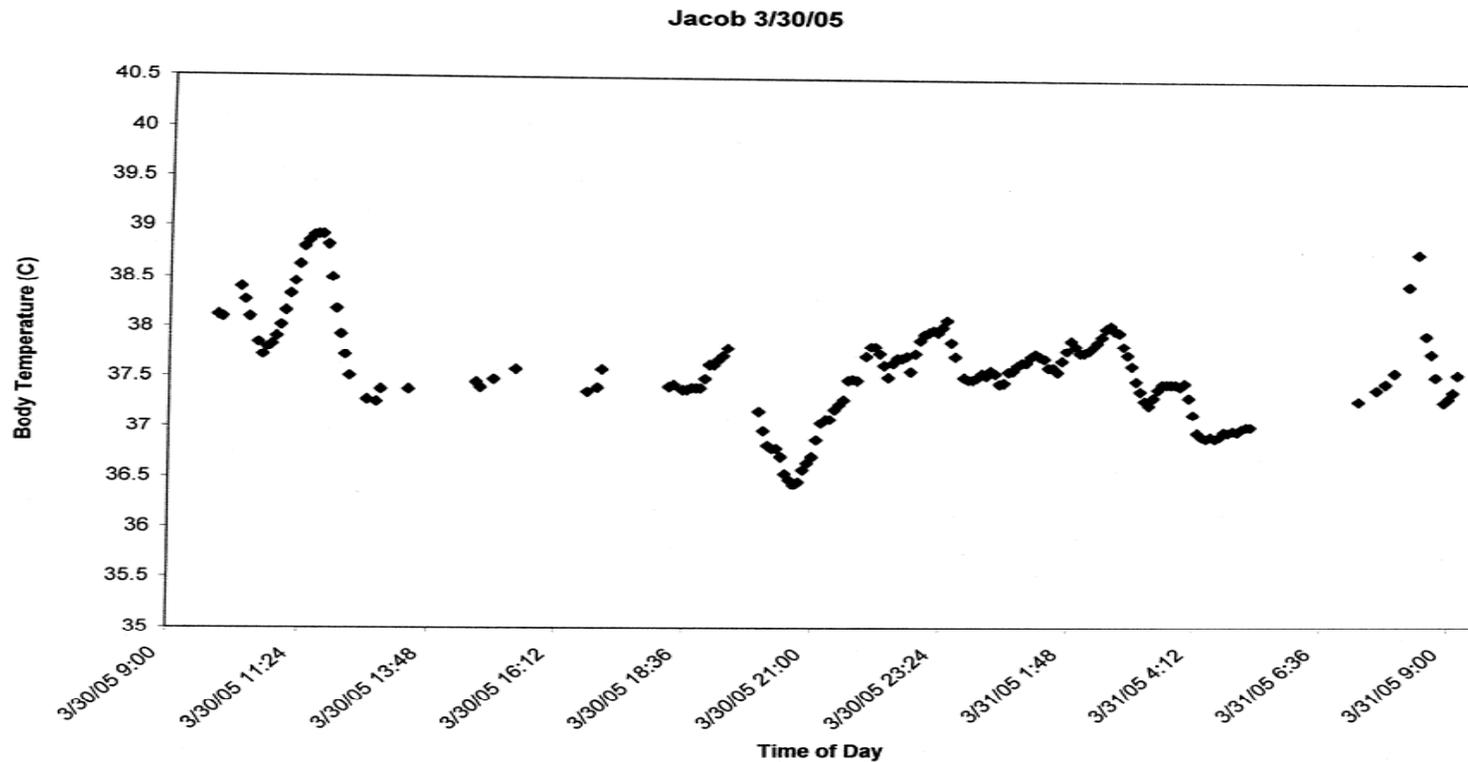
# First steps of Rub and Dub Dub (OSPR funded project on physiologic effects of washing sea otters)

- Obtain and install closed circuit digital video and VHF data loggers to monitor behaviors and internal body temperatures 24/7 to assure animal welfare.
- Obtain USFWS permits and USDA Animal Welfare approval and up to 5 non-releasable sea otters for this research (MBA rehabilitation program dropouts).
- Surgically implant each otter with a temperature sensitive VHF radio transmitter and establish baseline health, physiology and behaviors.
- Obtain FLIR infra red (IR) camera.
- Train otters and for physiologic, medical and measuring behaviors.
- Just washing, but may add oiling (olive or canola) step depending on adequate progress in trials, otter response and subject to USFWS and USDA permit.

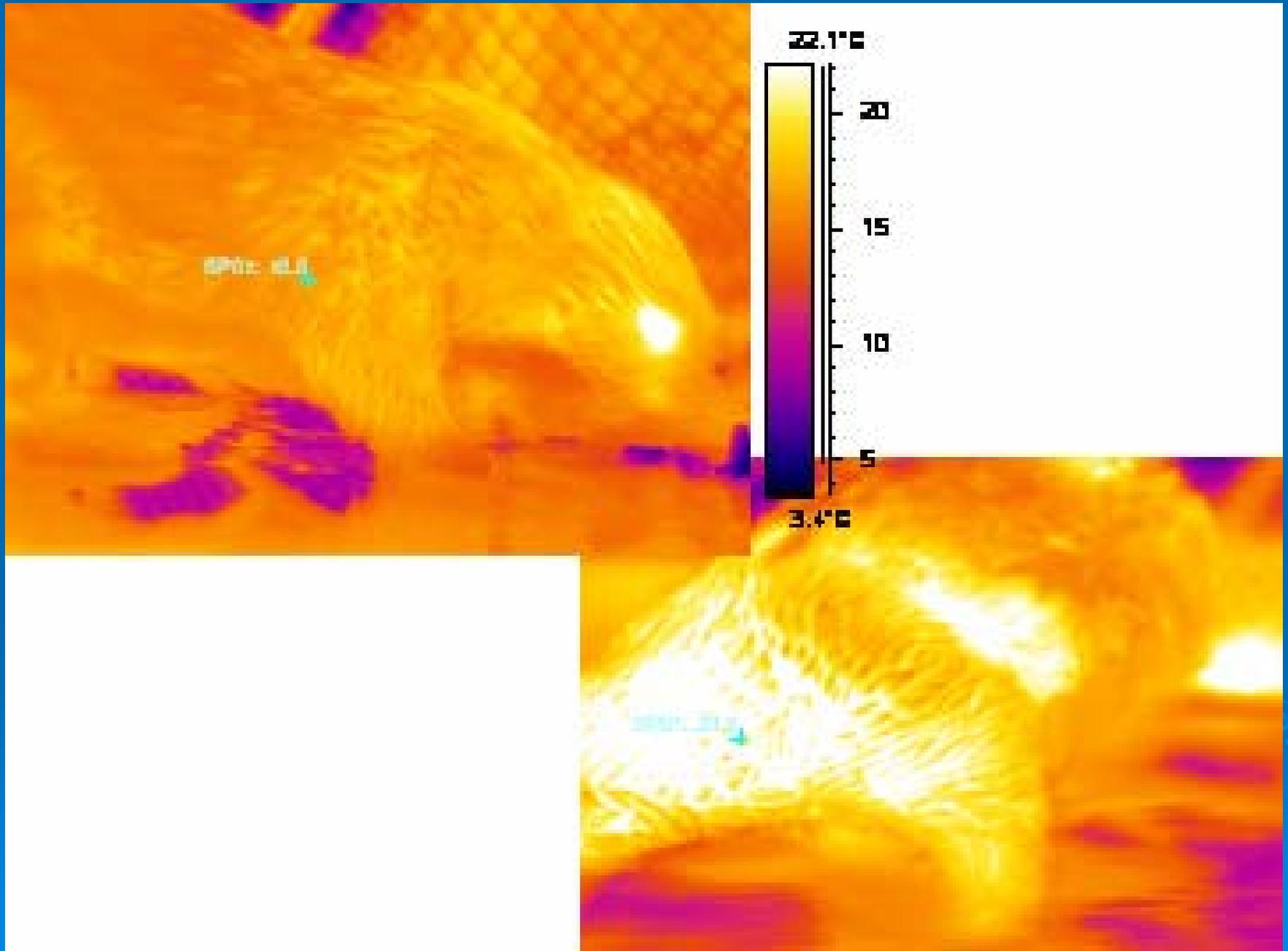
# Overview of sea otter washing trials (aka rub a dub dub).

- Obtain unreleasable sea otters (checked past).
- After training and implant, establish baseline health and behavior for each otter, daily temperature cycles, IR document heat loss patterns, fur characteristics by EM, .
- Follow any changes in these parameters with 1) simple anesthesia for 2 hours, 2) anesthesia and rinsing at 80 F and than at 90 F.
- Follow changes with washing in 8 % Dawn, rinsing at optimal rinse temp (above) and recovery in ambient temp salt water.
- Follow changes in above with recovery in, warm (65F) salt water, then in warm soft fresh water.
- Rechecks, oiling if warranted, data analysis.

# Monitor body temp 24/7 and correlate with behavior.



- Note: sea otters are poikilothermic, not strictly homeothermic,  $2.5C = 5F$



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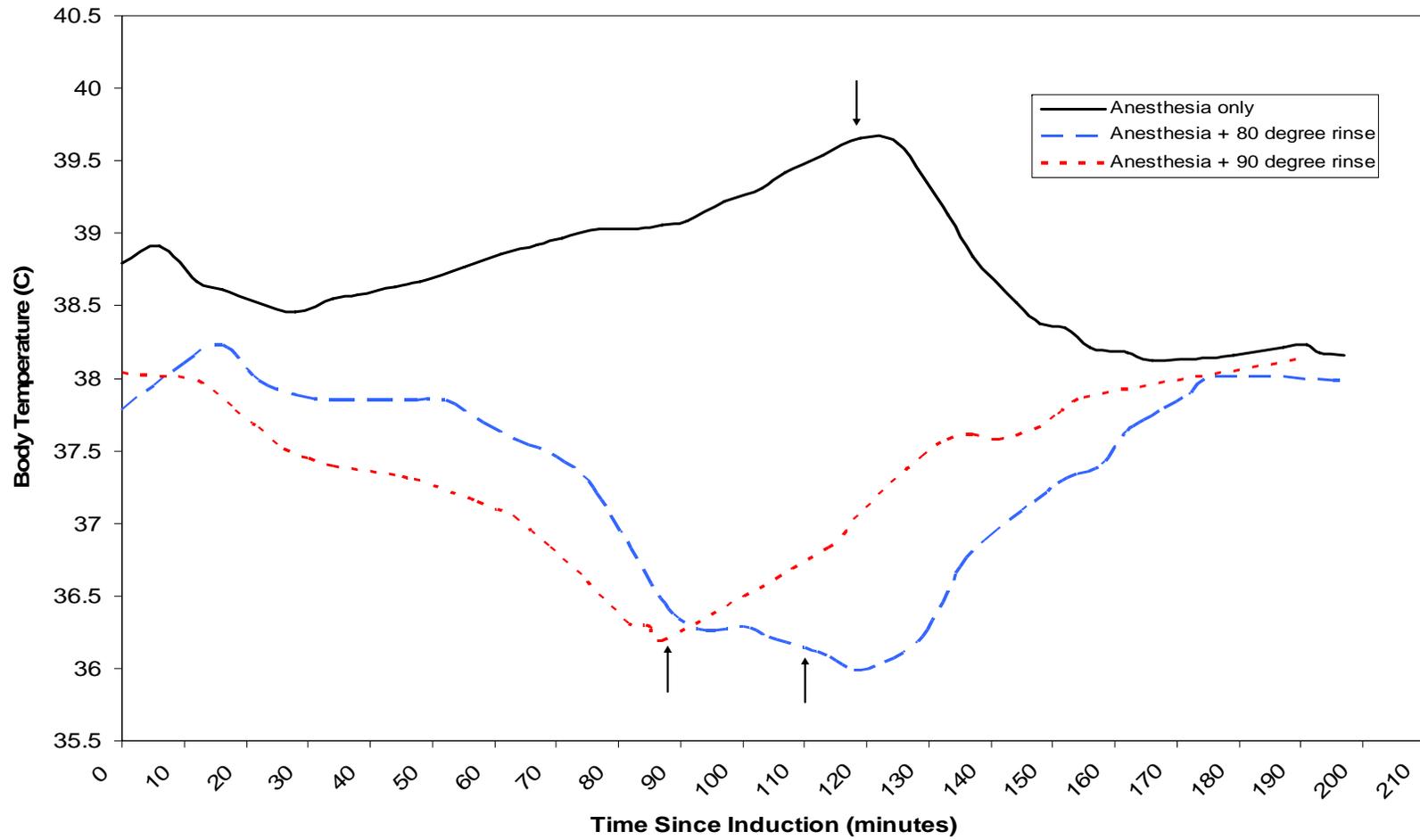




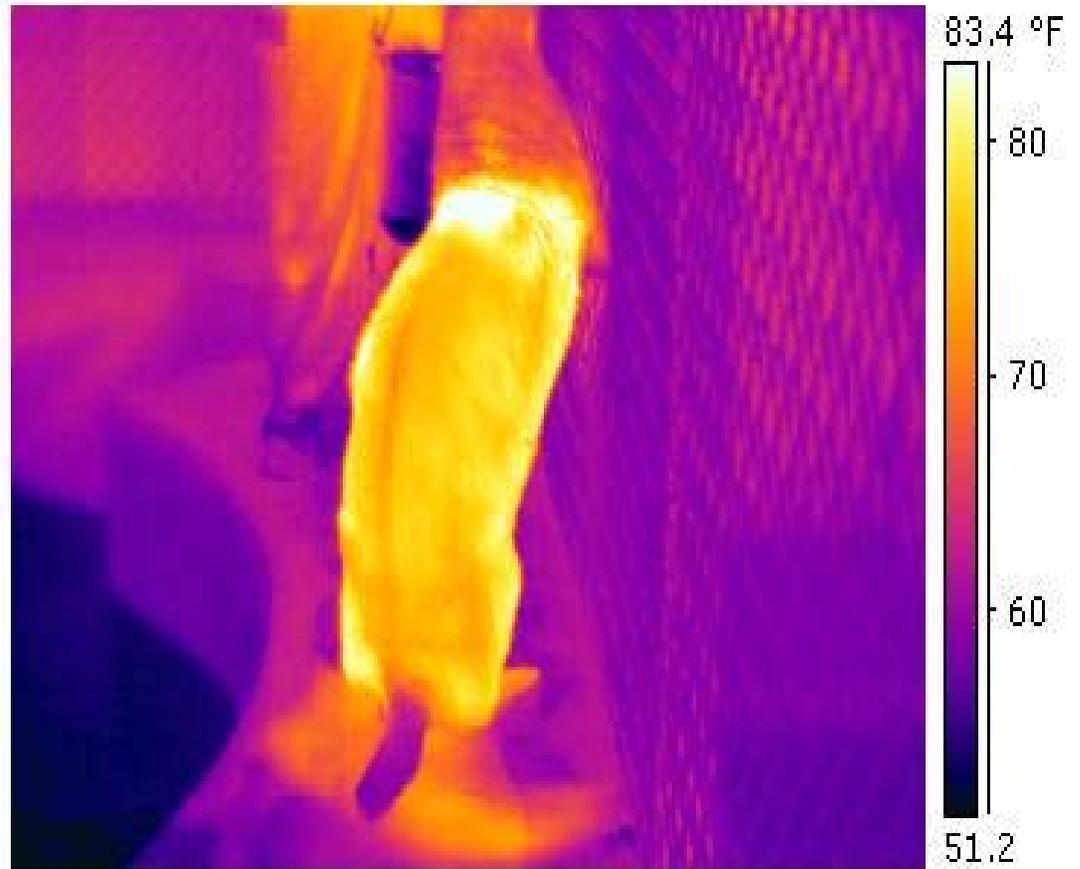
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**"Jacob" Anesthesia and Rinse Temperature Comparison**

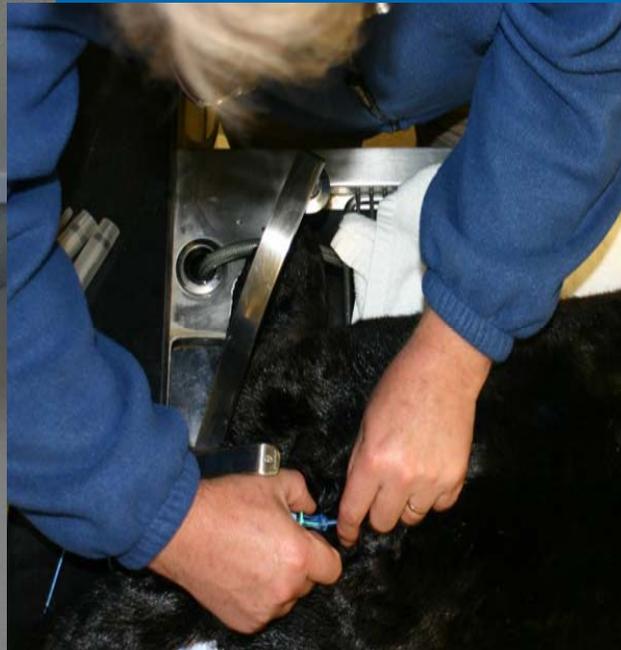


# Thermal imaging to identify and quantify heat loss due to reduced air insulation after washing with Dawn

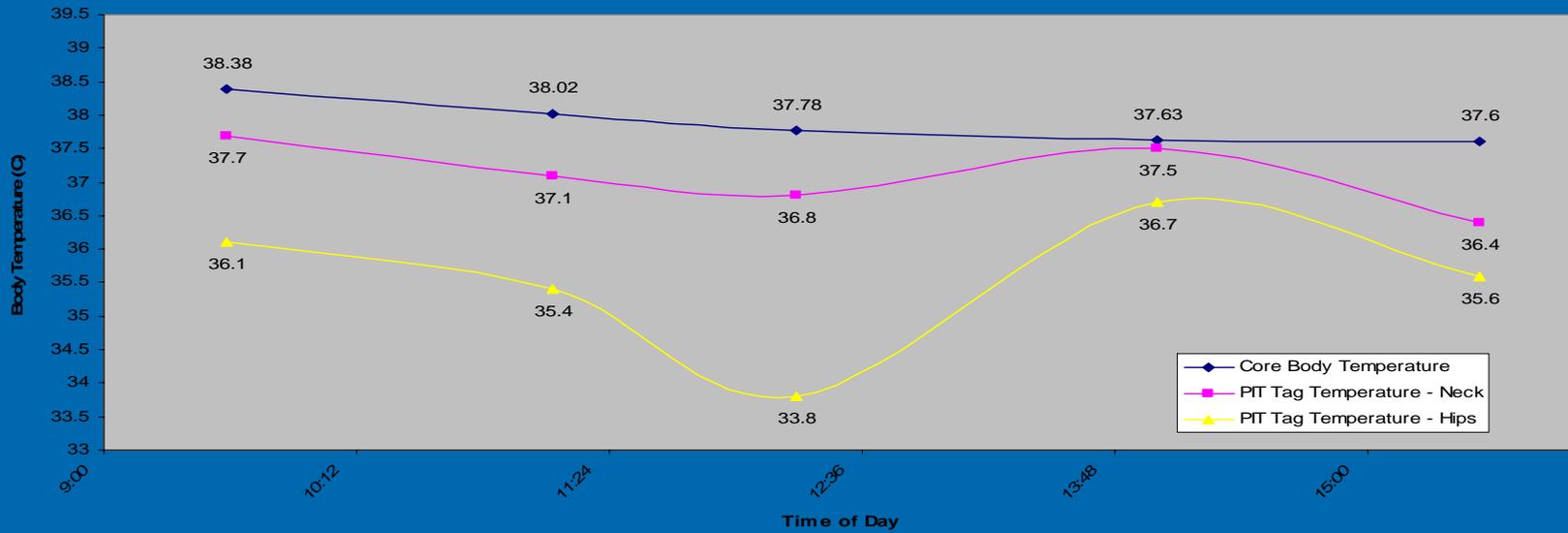


- Initial Observations: Core temp recovered and rose over 4 days post wash, they groomed a lot and shivered.

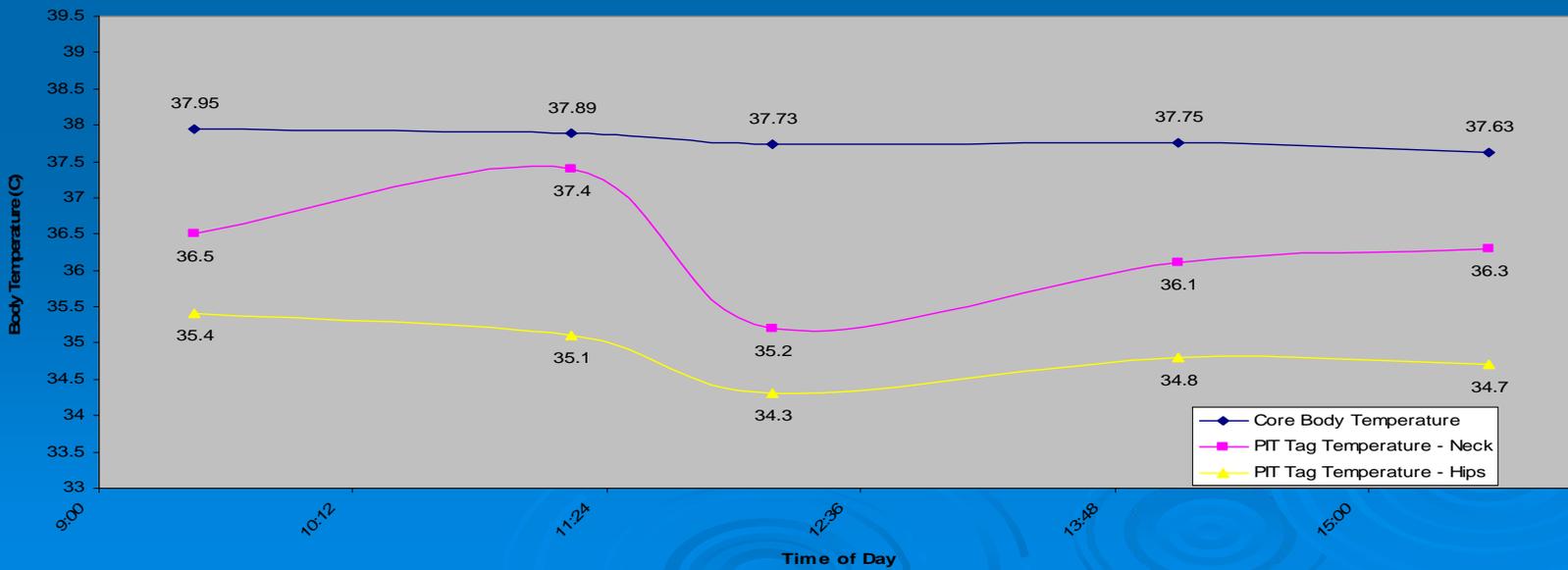
The problem:  
need to determine  
subcutaneous  
temperature  
response as well  
as core  
temperature.



"Jacob" Body Temperature Comparison  
5/11/06



"Taylor" Body Temperature Comparison  
5/11/06



# Long term goals

- Improve our understanding of sea otter physiology, thermal stability, and thus CDFG-OSPR ability to successfully wash and care for oiled sea otters.
- Save more sea otters in the event of an oil spill and operate our facility more efficiently.
- Improve infrastructure at MWVCRC and spill readiness.
- Develop a well trained and practiced cadre of sea otter care personnel with experience washing sea otters.
- Provide OWCN and OSPR with video and other teaching materials.
- Develop a cooperative captive sea otter training and research program with UCSC and MBA and in full compliance with AWA.

# **ACKNOWLEDGEMENTS:**

- **CDFG-OSPR-SSEP Program for funding**
- **Supplemental funding, equipment and support; UC Davis, Wildlife Health Center-OWCN**
- **Monterey Bay Aquarium-SORAC**
- **Brett, Traci and the whole UCSC-Marine Mammal Training Program**
- **Bryant Austin for images and IACUC assistance**
- **Miles Reed for technical help with IR and video**
- **Debbie Brownstein, Sharon Toy-Choutka and MWVCRC staff for great attitude and productivity**