

Evaluating the Thermal Protection of a 3 mm Surfing Suit During Active Diving at a Water Temperature of 16 to 20°C

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Introduction

- Professional divers use 3-4 mm surfing suits (as opposed to the commonly used 5 mm suits), to improve mobility during diving and when out of the water.
- The decrease in thermal protection may place the diver at an increased risk of developing hypothermia.
- In addition, an increase may be expected in O₂ consumption and CO₂ production. The latter might contribute to an increased risk of developing CNS-oxygen toxicity, when O₂-enriched gas mixtures are in use.

Objective

- To determine the rate of the decrease in body temperature, and in psychomotor and cognitive function, during cold water diving with a 3-4 mm surfing suit.

Methods

- Six professional divers participated in the study. All subjects dove at each of three different water temperatures, 16, 18 and 20°C, for two hours.
- The dives took place in a swimming flume. Divers wore a 3-4 mm surfing suit (series Psycho, O'Neill ®) on each of the experimental days. 
- The divers used a rebreather and swam against a current of ~1 knot (~ 1.3 l/min).
- During the dives, core temperature (telemetric pills), skin temperature, heart rate, oxygen consumption, and cold perception were measured. 
- Before and immediately after the dives, subjects performed a series of cognitive tests, motor function tests, and force tests. Anthropometric measurements - skinfold thickness, weight, and height were carried out prior to the first dive. 

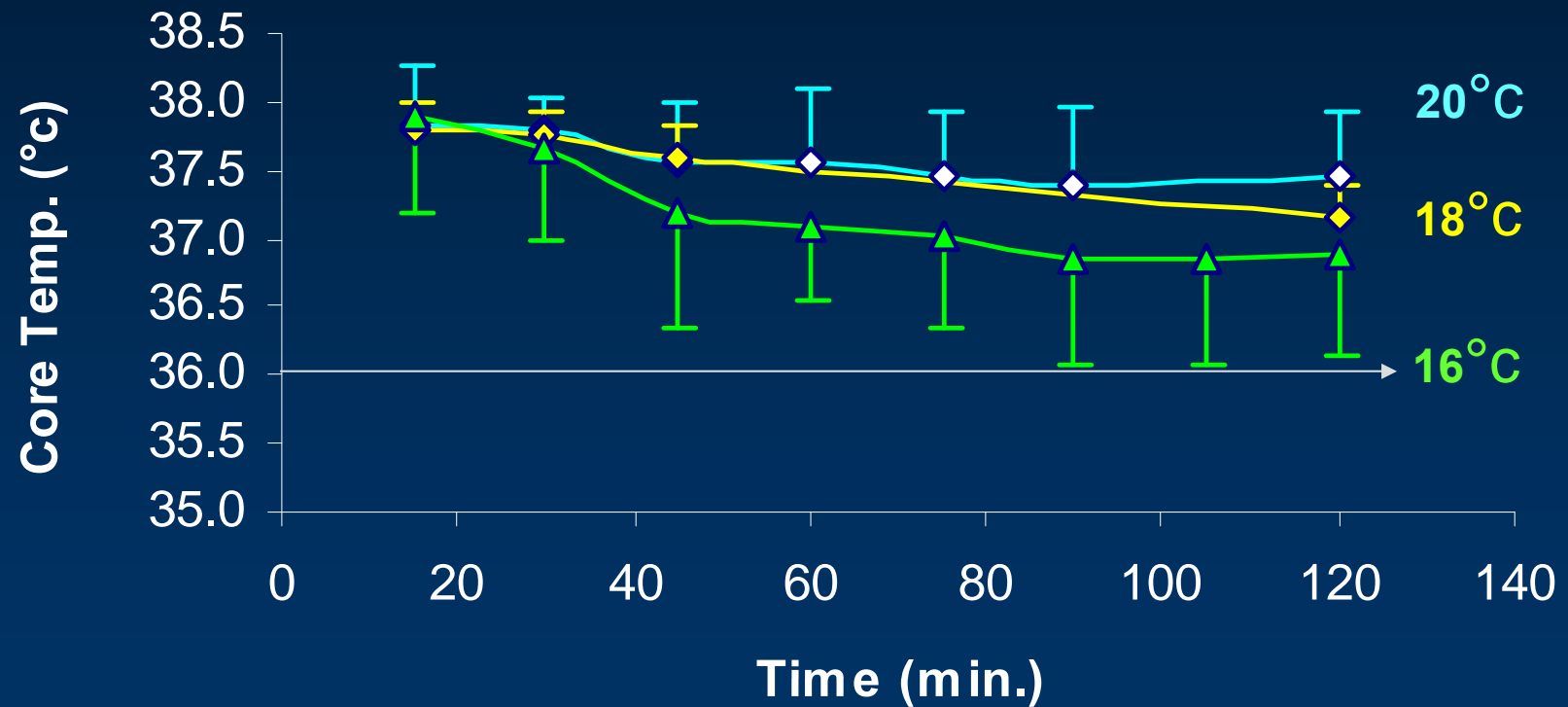
Anthropometric Data Taken from the Subjects

Subject #	Age	Weight (kg)	Height (cm)	BMI	Fat (%)
1	23	76.5	183	22.8	12.3
2	22	70.0	177	22.3	16.6
3	22	91.5	180	28.2	21.0
4	22	70.0	180	21.6	13.5
5	21	76.0	183	22.7	13.1
6	23	72.0	176	23.2	20.8
Mean ± SD	22 ± 1	76.0 ± 8.1	180 ± 3	23.6 ± 2.4	16.2 ± 3.9

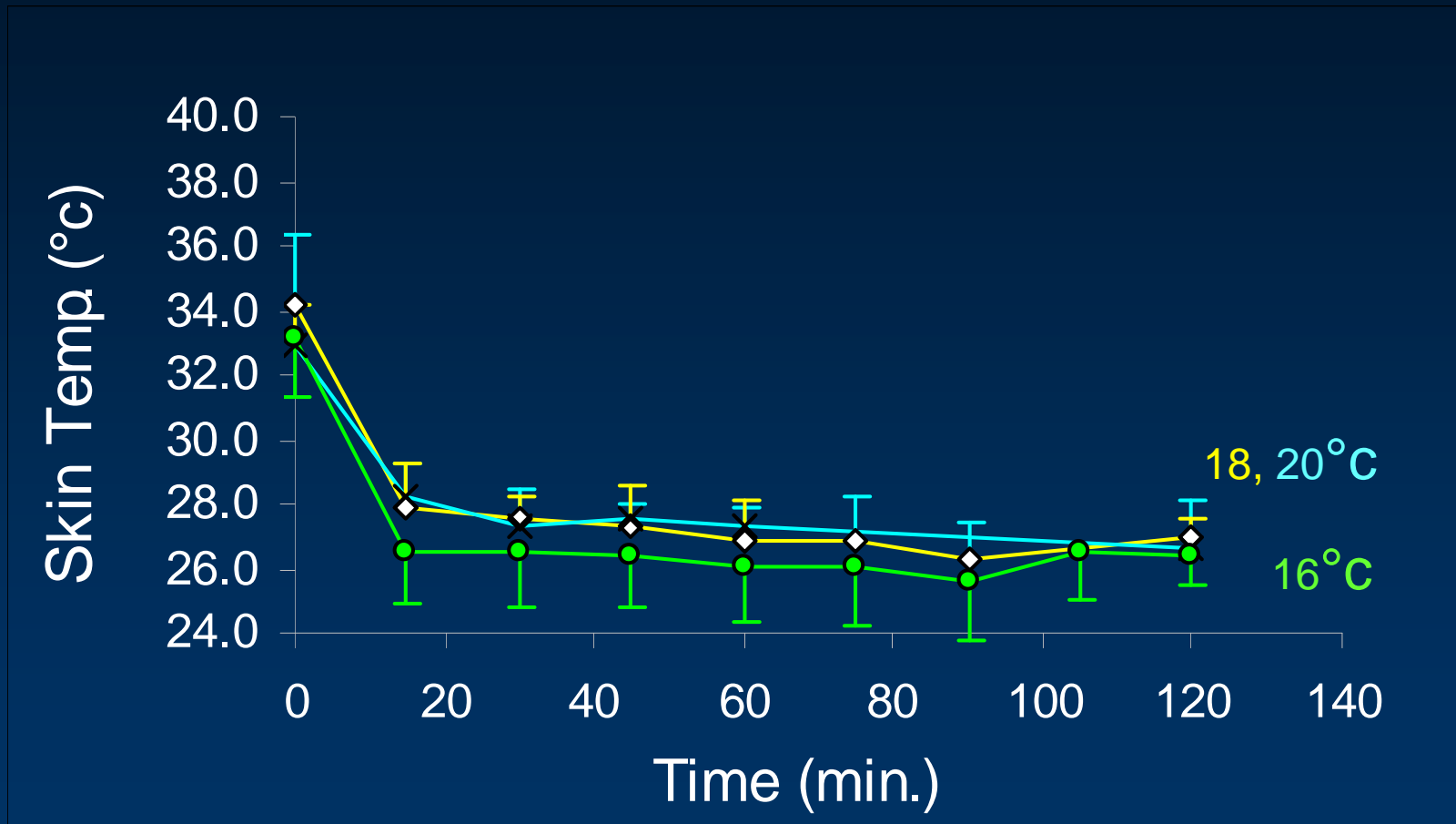
Oxygen Consumption (l/min) At Three Water Temperatures

Subject #	20°C	18°C	16°C
1	-	1.29 ± 0.45	1.53 ± 0.57
2	-	1.07 ± 0.58	1.35 ± 0.24
3	1.54 ± 0.26	1.25 ± 0.93	1.22 ± 0.17
4	1.18 ± 0.40	-	1.26 ± 0.48
5	1.51 ± 0.61	1.25 ± 0.55	1.44 ± 0.28
6	0.92 ± 0.34	1.06 ± 0.59	1.26 ± 0.00
Mean ± SD	1.29 ± 0.47	1.19 ± 0.51	1.35 ± 0.36

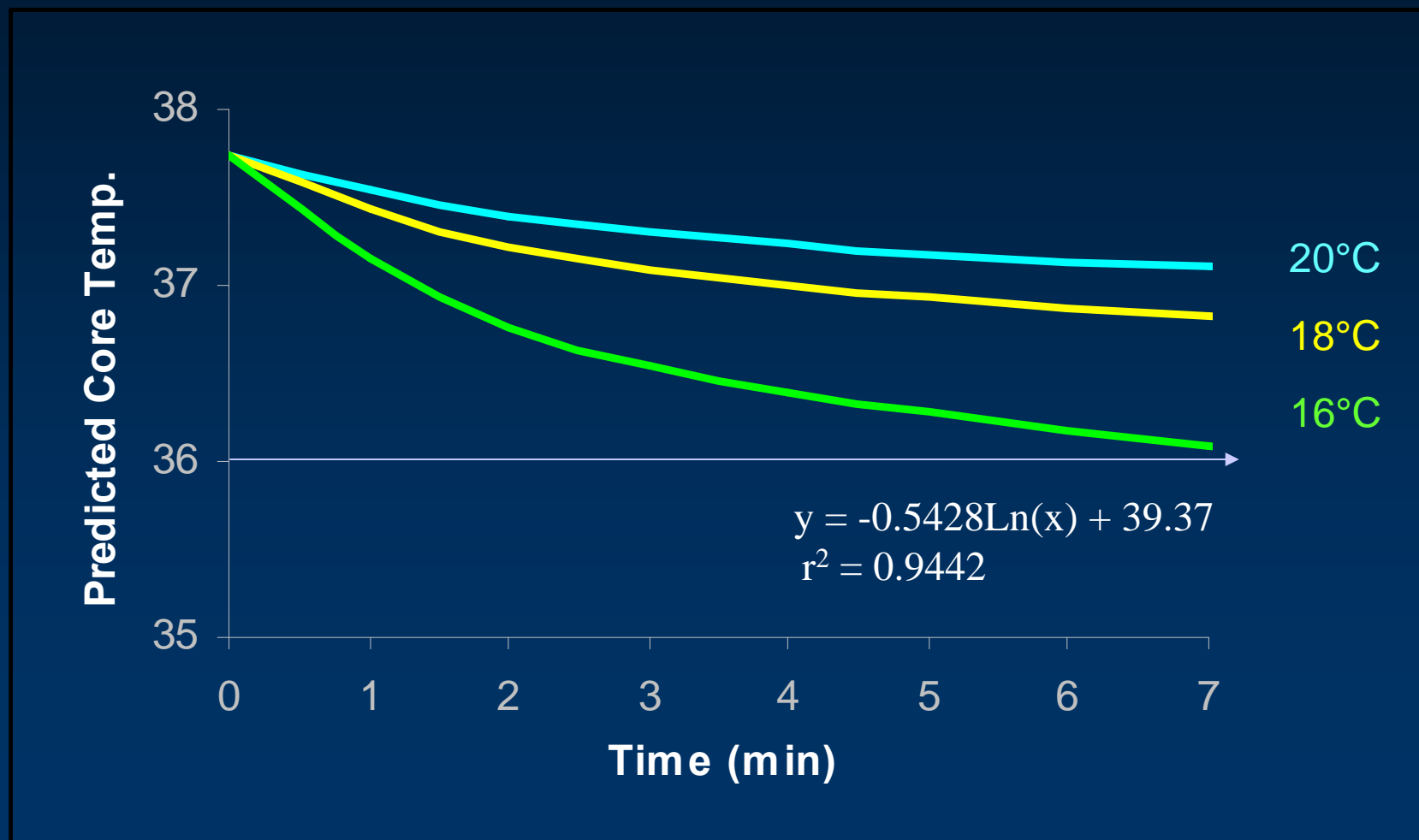
Core Temperature At Three Water Temperatures



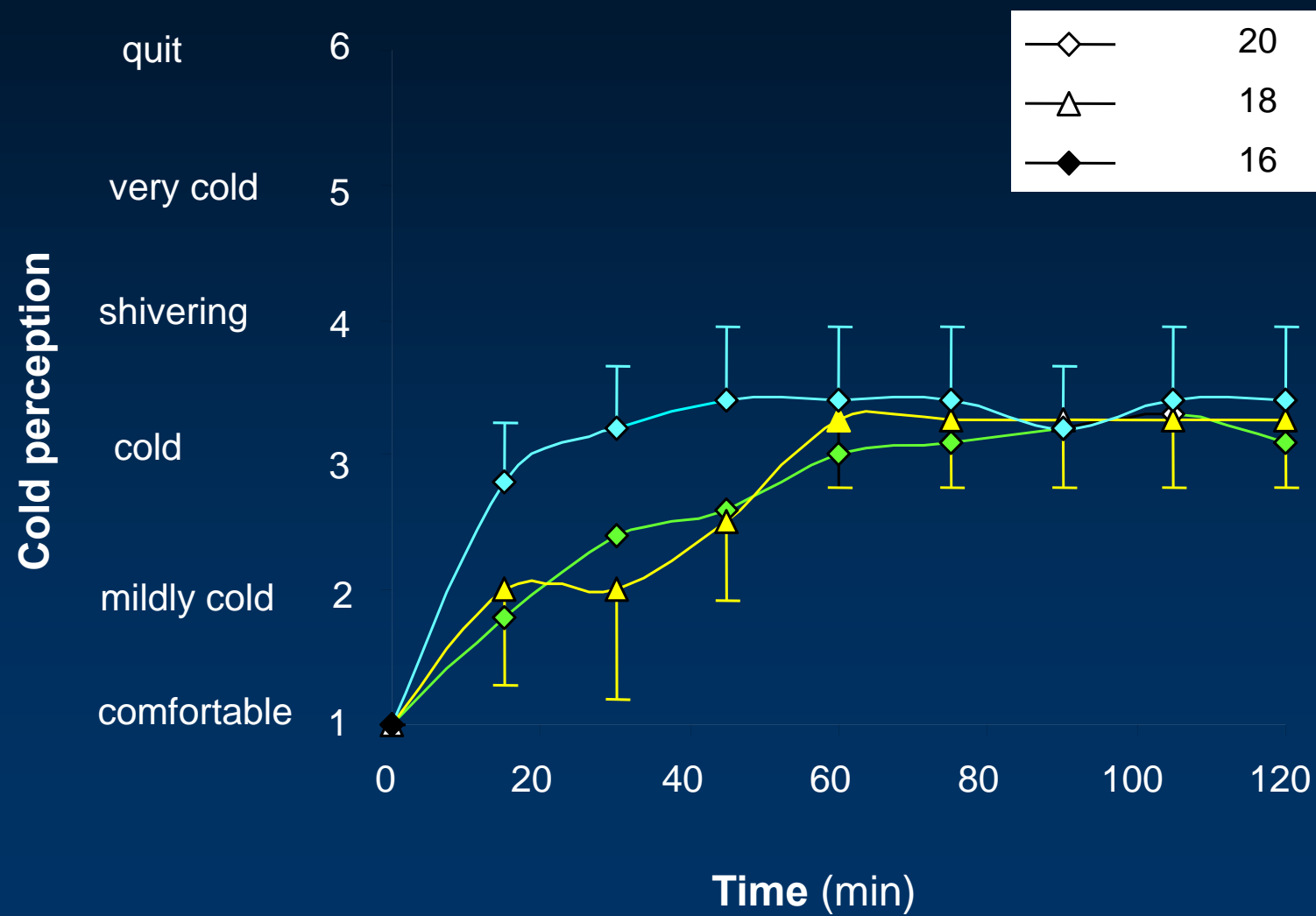
Skin Temperature



Predicted Core Temperature at Water Temperatures of 16, 18, and 20°C



Cold Perception



Effect of Cold Water on Hand Psychomotor Function

Water Temp.	Time Before Diving (sec)	Time After Diving (sec)	Δ
20 (n = 6)	44.2 \pm 4.4	57.8 \pm 4.7*	13.8 \pm 7.0
18 (n = 5)	43.8 \pm 2.5	56.3 \pm 4.6*	12.4 \pm 2.2
16 (n = 6)	42.5 \pm 3.4	58.3 \pm 4.8*	15.8 \pm 5.5

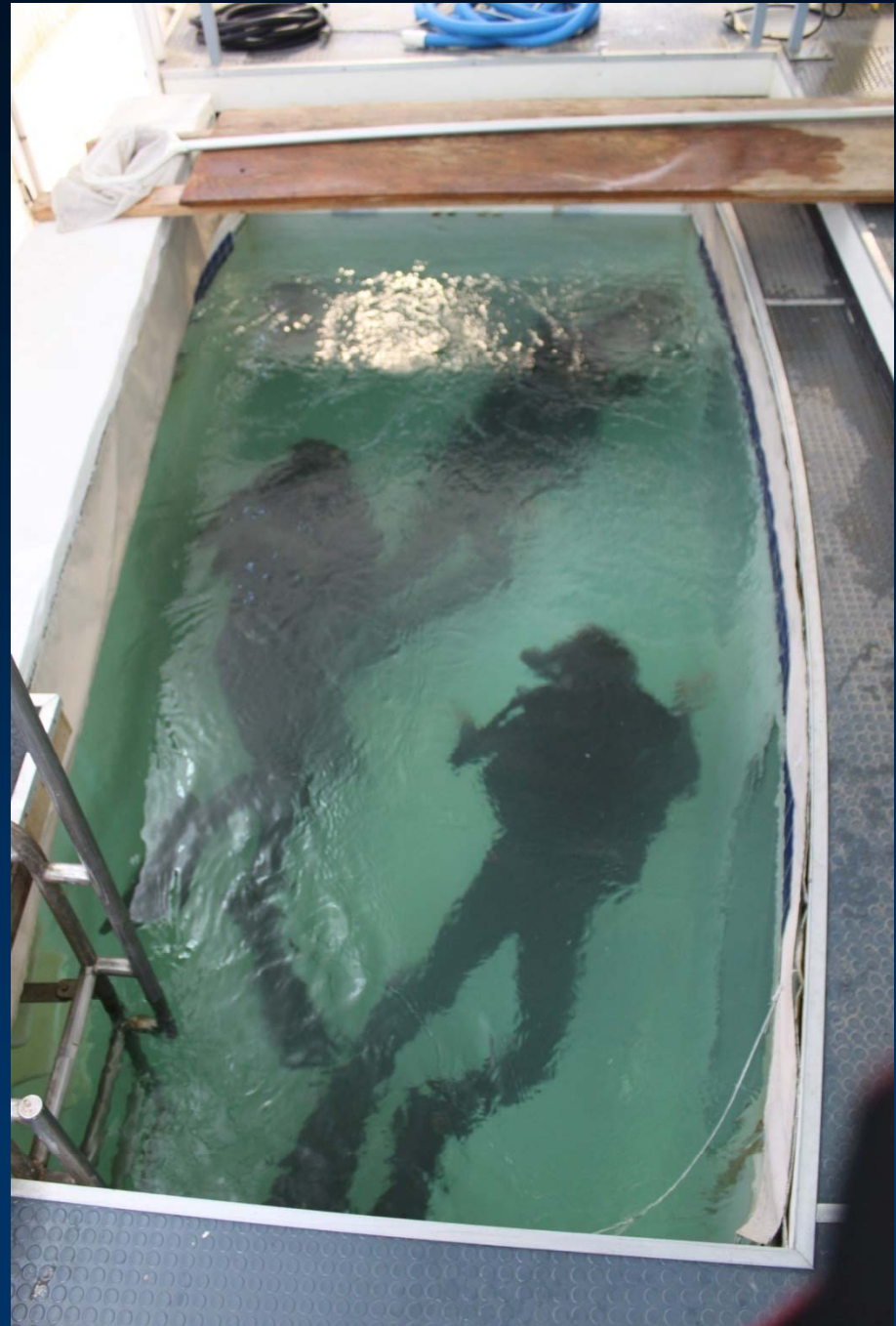
- We did not find significant differences for the cognitive tests

Conclusion

- Although there was a decrease in core temperature and psychomotor function, we can conclude that the 3-4 mm surfing suit (series Psycho, O'Neill ®) provides adequate thermal protection during active diving at the three temperatures tested.

Thank You

Diving in The Experimental Flume





**Core Body Temperature
Monitoring System**



**Core Body Temp. Sensor
HT150002**





