

CARDIORESPIRATORY PATTERNS IN RESTING ALASKAN SEALS

RYAN A. JONES¹, MADELINE MERANDA^{1,2}, NICOLE M. THOMETZ³, AND COLLEEN REICHMUTH^{1,2}

¹UNIVERSITY OF CALIFORNIA SANTA CRUZ, ²ALASKA SEALIFE CENTER, ³UNIVERSITY OF SAN FRANCISCO



OBJECTIVE

Most knowledge concerning the dive response in phocid seals comes from studies of a few representative species. To determine how well ice-dependent phocids fit expected patterns, we studied routine cardiorespiratory coupling in Alaskan seals with differing life histories and evolutionary adaptations for diving.

APPROACH

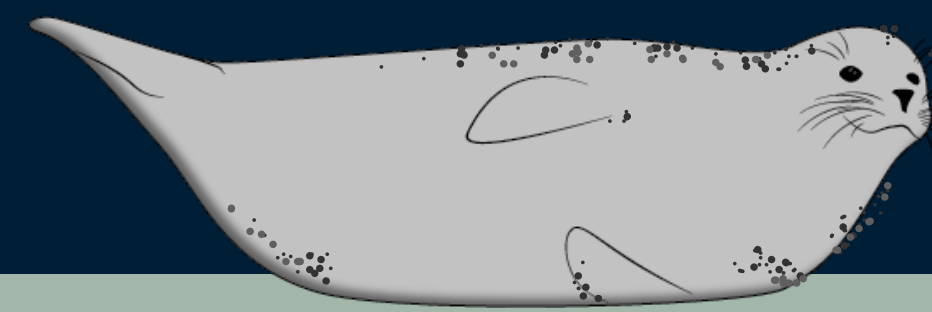
Electrocardiograms and respiratory behavior were recorded non-invasively from captive spotted, ringed, and bearded seals conditioned to rest calmly out of water. Instantaneous heart rate was determined from the interval between successive heart beats. Each breath was linked to the corresponding cardiac response.

FINDINGS

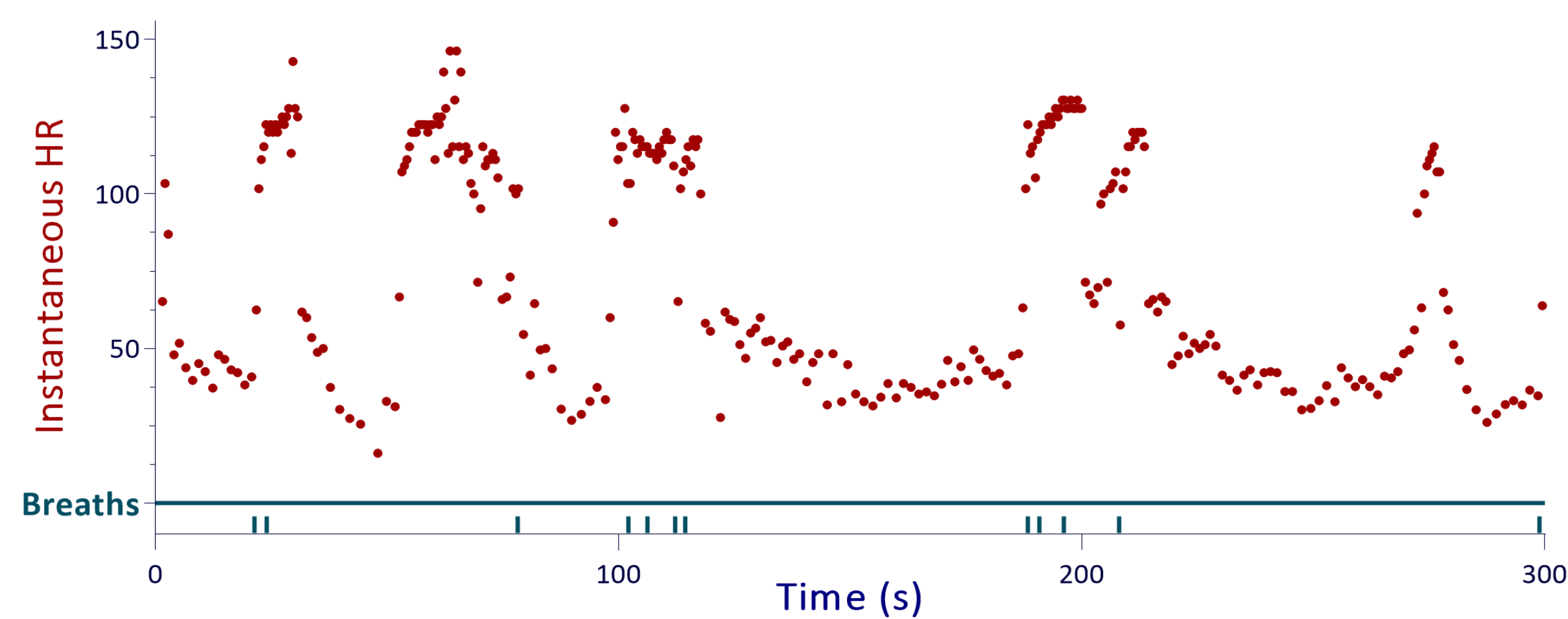
We observed a strongly bimodal pattern of heart rate that alternated between tachycardic (rapid heart rate) and bradycardic (slow heart rate) states in all seals. This pattern was linked to regular apneas that varied predictably in duration. While other true seals show similar adaptations for diving, these preliminary data suggest notable species differences.

SPOTTED SEAL

Phoca largha



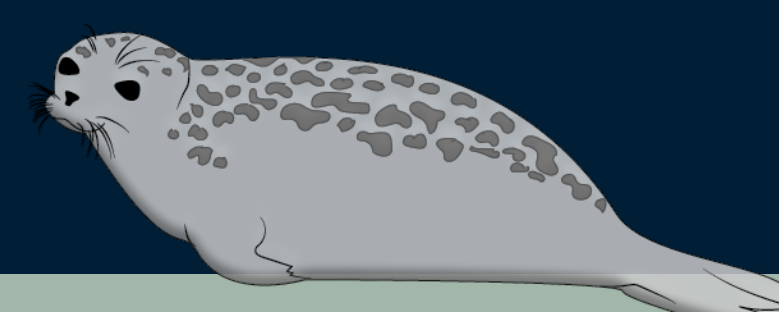
Spotted seals typically forage in the water column at depths < 100 m, with a usual duration from 3 – 4 min. These seals show evolutionarily derived features and are closely related to harbor seals.



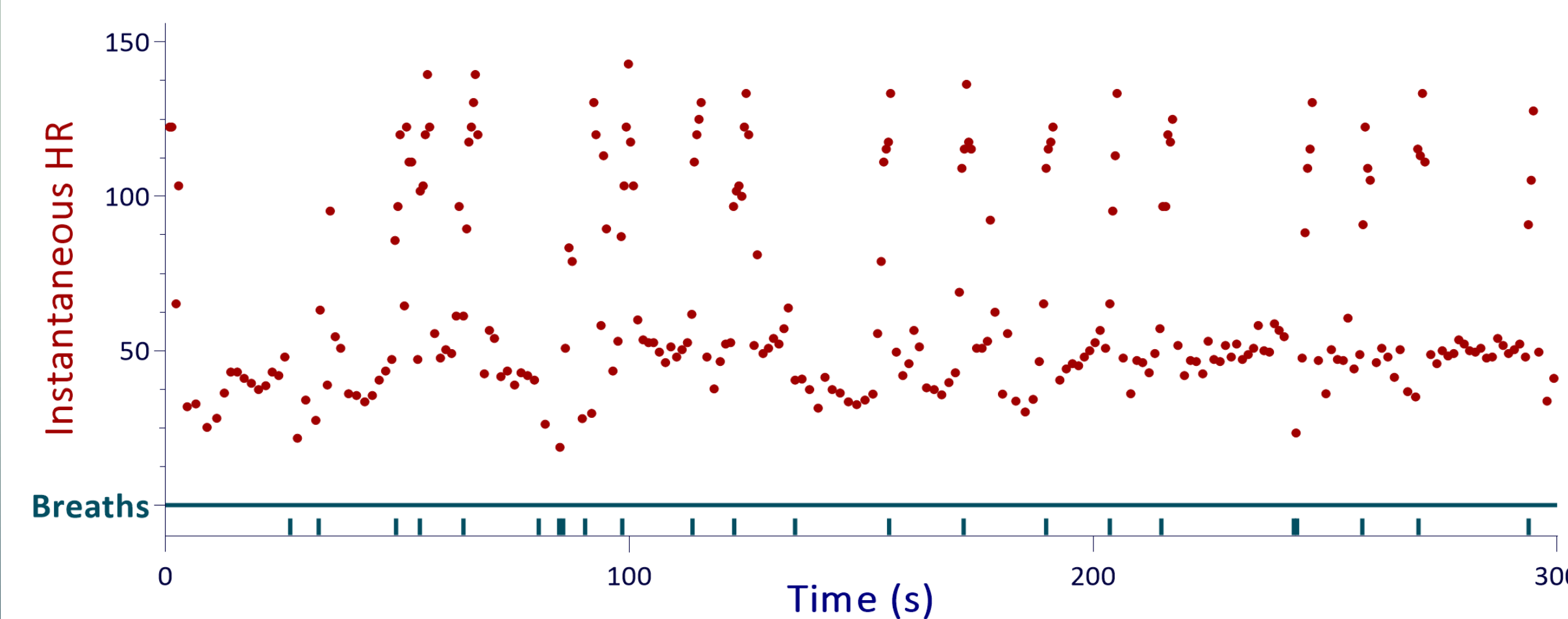
- ECG icon — Intermittent breathing pattern
- ECG icon — Clustered respirations: ~ 3 per minute
- ECG icon — Longer apnea duration > 45 s
- ECG icon — Bradycardia : Tachycardia = 40 : 120 beats per minute

RINGED SEAL

Pusa hispida



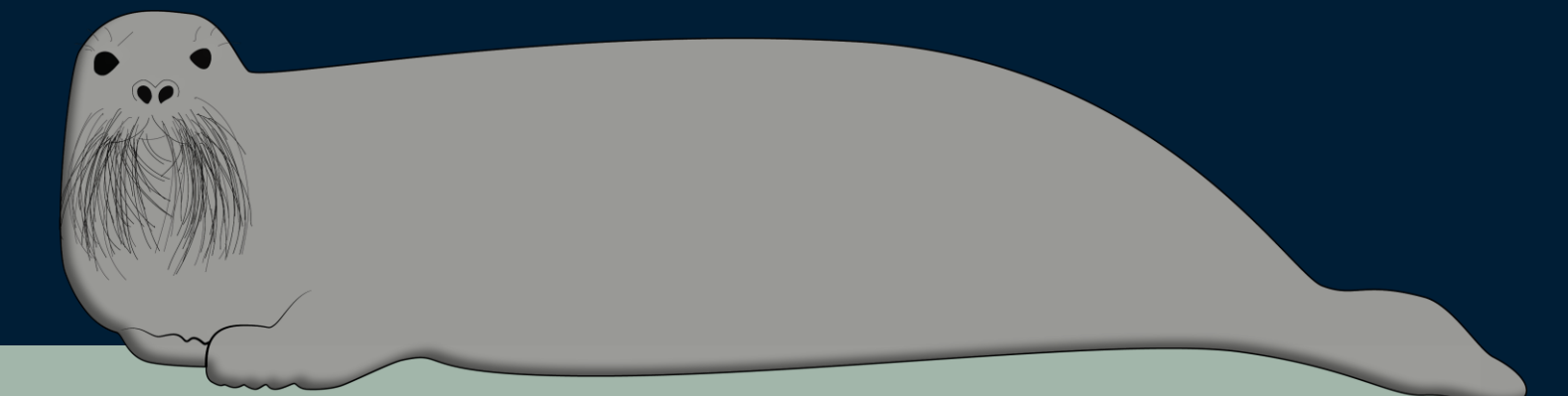
Ringed seals forage pelagically with dives typically < 100 m for 2 - 5 min. They are small phocids that rely on stable sea ice. More recently derived and closely related to other small, northern phocids.



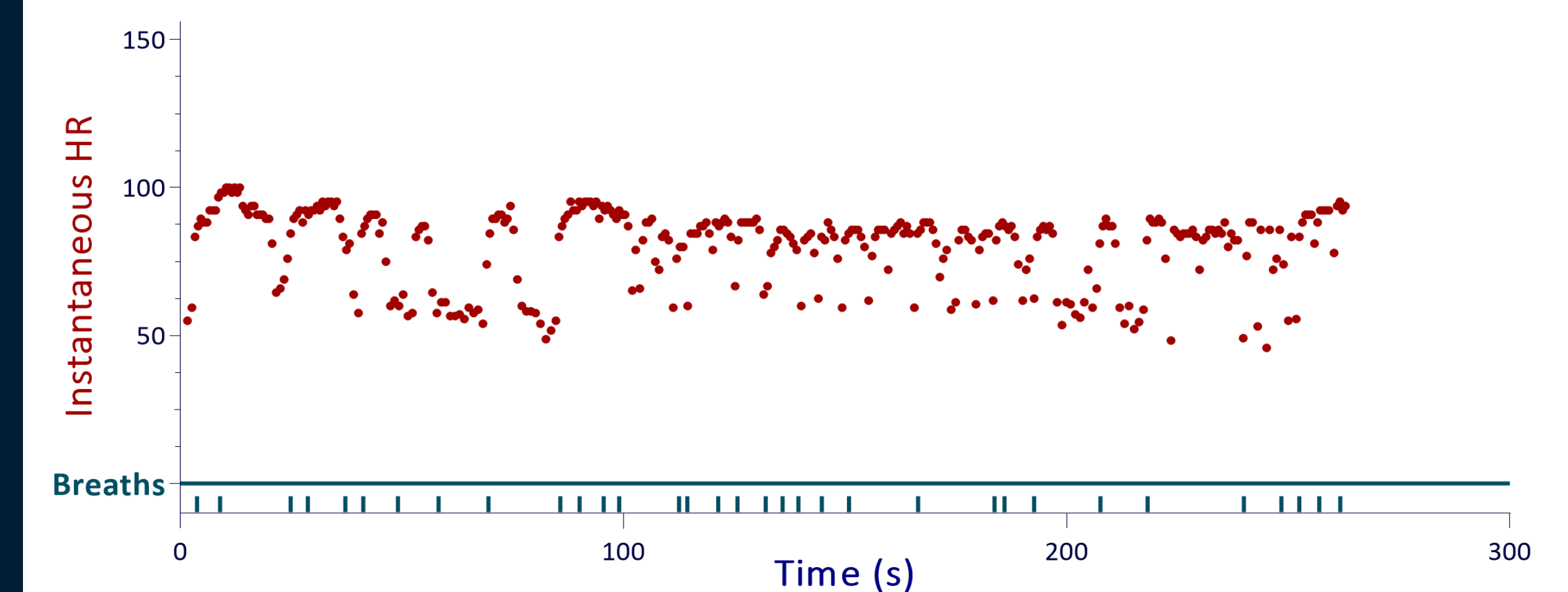
- ECG icon — Less intermittent breathing pattern
- ECG icon — Regular respirations: ~5 breaths per minute
- ECG icon — Moderate apnea duration < 25 s
- ECG icon — Bradycardia : Tachycardia = 50 : 120 beats per minute

BEARDED SEAL

Erignathus barbatus



Bearded seals are an evolutionary outgroup isolated from other seals for about 14 million years. They are shallow divers (< 35 m) that forage benthically near pack ice. Dive durations are usually < 4 min.



- ECG icon — More continuous breathing pattern
- ECG icon — Average Respiratory Rate: ~ 8 breaths per minute
- ECG icon — Brief apnea duration < 10 s
- ECG icon — Bradycardia : Tachycardia = 60 : 100 beats per minute