

# The effects of external dilution on cardiovascular parameters in the longhorn sculpin, *Myoxocephalus octodecimspinosus*

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Using the double-cannulated longhorn sculpin preparation<sup>1</sup>, we have demonstrated that infusion of endothelin (mammalian ET-1) produces a very significant and concentration-dependent increase in gill vascular resistance<sup>2</sup>, but neither PGE<sub>2</sub> nor the NO-donor sodium nitroprusside have any effect on gill resistance<sup>3,4</sup>. This preparation also can be used to begin to investigate the cardiovascular effects of external dilution. Since the marine fish gill epithelium has a finite water permeability<sup>5</sup>, in theory, external dilution down to a hypotonic salinity would result in an osmotic influx of water, which should result in hemo-dilution and at least transient hypertension. This hypothesis has never been tested.

Longhorn sculpin were prepared as described previously<sup>1</sup> and measurements of cardiac output (CO) and ventral and dorsal aortic pressure ( $P_{VA}$ ,  $P_{DA}$ ), and calculations of gill resistance ( $(P_{VA} - P_{DA})/CO$ ) were made as described in an earlier study<sup>2</sup>. Once baseline parameters were measured, the external salinity was reduced by serial removal of small volumes of the experimental bath and replacement with distilled water. After each dilution, the cardiovascular parameters were allowed to reach consistent values (ca. 10 minutes) before the next dilution.

Serial dilution of the external medium had no large effect on any measured cardiovascular parameter and did not alter gill resistance ( $p > 0.5$ ; Table 1) in the longhorn sculpin. This suggests that either the branchial epithelium is impermeable water or, more likely, that the capacitance of the systemic vascular system is sufficient to buffer the osmotic uptake of water, so that blood pressure does not change when the fish is exposed to a dilute medium.

Table 1. Effect of serial dilution of the external medium on cardiovascular parameters in the longhorn sculpin. (mean±SE, N=4; 15 minutes after dilution). \* $p < 0.5$  relative to 1 min before specific dilution

Parameter	SW Control	50% Seawater	25% Seawater	12.5 % Seawater	6.25% Seawater
Ventral Aortic Pressure, cm H <sub>2</sub> O	40.8±3.8	39.1±4.8	32.3±7.8	30.3±8.5*	28.5±8.8
Dorsal Aortic Pressure, cm H <sub>2</sub> O	34.4±3.8	30.7±5.3	25.6±7.3	23.8±8.1*	22.3±8.6*
Cardiac Output, ml.min <sup>-1</sup> .kg <sup>-1</sup>	9.9±2.8	9.5±2.6	9.1±3.1	8.3±2.4	10.5±4.8
Heart Rate, BPM	32.8±1.6	33.7±3.6	31.7±4.0	26.9±3.9	29.1±3.5
Gill Resistance**	2.1±0.9	1.4±0.6	1.0±0.3	1.1±0.4	1.2±0.5

\*\*cm H<sub>2</sub>O.ml<sup>-1</sup>.kg<sup>-1</sup>.h<sup>-1</sup>

(Supported by NSF IBN-0089943 and the Maren Foundation to DHE, NSF DBI-0453391 to RLK)

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