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Solute Excretion in *Squalus acanthias* During Adaptation to Dilute Seawater

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When placed in 70% seawater, the spiny dogfish (*Squalus acanthias*) undergoes a diuresis, with increased glomerular filtration rate and increased excretion of sodium and urea (Forster et al, Comp. Biochem. Physiol., 42A: 3, 1972). Serum sodium and urea levels fall, bringing serum osmolality into equilibrium with that of the dilute seawater.

The present investigations were designed to further these observations, particularly with regard to their chronology and the pattern of solute excretion. Female *Squalus acanthias* weighing from 4-6 Kg were caught by trawl line and studied with twenty-four hours. Two 1 to 2-hour control clearance periods were obtained in a seawater pool. The fish were then transferred directly to a pool maintained at a 70% seawater dilution by hoses delivering seawater and freshwater. Efforts were made to avoid sudden water temperature alterations. Immediately on transfer, further clearance periods were obtained; studies were then repeated on the day following (day 2) and two days following (day 3) transfer to the dilute pool. A cloacal catheter for urine collection and caudal vessel catheter for blood specimens were left in situ throughout the study. Eight fish were originally studied, and studies were completed in six.

The results are shown in Table 1. There was a progressive increase in inulin clearance, urine volume, and the excretion of sodium and urea, reaching a maximum at days two and three. Plasma osmolality fell be approximately 15% of which one-third was due to the fall in plasma sodium and attendant anion, one-third to a fall in plasma urea, and one-third to a fall in another unmeasured solute, presumably trimethylamine oxide. On day 2 there was a profound reduction in urinary potassium excretion seen both when this excretion va expresses in absolute quanitites (UV_K) and as a fract of the filtered potassium. Potassium excretion tended increase towards control levels on the third day. Plas potassium levels were unchanged throughout the stu In a control group of four dogfish studied daily for th days in undiluted seawater, there were no signific changes in any of the measured parameters of so excretion.

While the mechanism of the adaptive changes t take place in plasma and urinary solute levels cannot determined from these studies alone, the transient a profound reduction in urinary potassium excret suggest that the secretion of a mineralocorticoid- substance may be reduced upon introduction to d seawater.

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Chloride Cells in *Anguilla* After Partial Adaptation to Fresh Water

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Eels were kept in seawater for four weeks and tran ferred to fresh water for three days. Epstein et al. (It Bulletin) found a high level of Na-K-ATPase and a h rate of Na efflux after the three weeks in seawater. Af 3 days in fresh water the ATP-ase level remained high b the rate of efflux declined. The four-week period in se wate was sufficient for full physiological adaptation.

As previously reported (Doye and Epstein – Cyto ologie *6*, 58-73, 1972), the chloride cells of the fully ada ted seawater eel have a fairly dense cytoplasm pervad by a fully developed maximally close-branched tubular r ticulum with mitochondria evenly distributed from t base almost to the apex of the cell. In eels fully adapt to fresh water the chloride cells tend to be swollen wit pale cytoplasm, minimally branched tubular reticulum a fewer mitochondria. Many cells appear degenerated. Se water adapted eels returned to fresh water for seven da

Table 1

	Day 1 100% Seawater	Day 1 70% Seawater	Day 2 70% Seawater	Day 3 70% Seawater
Urine volume (ml/kg/hr)	0.61±.13	82±.15	2.37±.25**	3.10± 34**
Inulin clearance (ml/kg/hr)	3.1±.65	2.8±0.4	5.5±0.8*	4.9±0.5
Posm (mOsm/kg)	936±5.0	902±4.2	827±4.3**	803±5.5**†
Purea (mM/l)	320±13	338±12	302±5.0	275±8.0*
P_{Na} (mM/l)	261±1.5	254±1.8	235±1.8**	233±2.5**
U_{osm} (mOsm/kg)	661±30	630±20	465±12**	478±18**
UV urea (mM/kg/hr)	30±10	79±16	376±57**	570±121**
U_{Na} (mM/kg/hr)	161±41	201±33	365±40*	453±65**
UV_K (mM/kg/hr)	36.2±6.2	21.8±6.1	6.1±0.9*	23.1±8.4
Excreted/Filtered Na	0.20±.02	0.30±.03*	0.30±.03*	0.41±.04**
Excreted/Filtered K	4.13±5.8	2.37±.70	0.43±.11**	1.39±.42**†

1. Each value represents the mean of two clearance periods for each animal studied.
2. Values are Mean ± SEM.
3. *Significant at $p<.02$ and **$p<.001$ (unpaired) from 100% seawater.
4. †Significant ($p<.02$) difference between days 2 and 3.