Epidemiology and risk factors for *Sarcocystis neurona* infection in juvenile California sea lions (*Zalophus californianus*)

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**Background**

*S. neurona* is a protozoan parasite that can infect a wide range of terrestrial and aquatic mammals. Sarcocystosis often manifests as encephalopathy; however, in California sea lions (*Zalophus californianus*), *S. neurona* has been found to manifest as polyphasic rhabdomyolysis. Studies of sea otters suggest that marine mammals may be exposed to *S. neurona* through land-to-sea transmission of sporocysts shed by the definitive host, the Virginia Opossum (*Didelphis virginiana*).

**Rationale and Objectives**

Serosurvey study (1998-2009) found overall seroprevalence of 0.5% for juvenile CSLs

TMMMC observations: increased CSL strandings and sarcocystosis

This study aimed to investigate whether California sea lion (CSL) exposure to *Sarcocystis neurona* has increased during the past decade and to evaluate potential risk factors associated with *S. neurona* infection.

**Methods**

Archived serum samples from CSLs that stranded to The Marine Mammal Center (TMMMC) from 2012-2017 were stratified by age-sex class and tested for antibodies to *S. neurona* using indirect fluorescent antibody test (IFAT). 20 samples were randomly selected per age-sex class (pups: 0-1 years, yearlings: 1-2 years) per year (n=454).

Statistical analysis of risk factor association was performed using chi square and logistic regression. Environmental and demographic risk factors included total yearly rainfall, average yearly streamflow, average yearly sea surface temperature, age, sex, and stranding location.

**Results**

Serosurvey

Seroprevalence significantly (P<0.001) increased in 2012-2017 compared to the previous study period (1998-2009).

Environmental and Demographic Risk Factors

Seroprevalence during years of low rainfall (<33rd percentile total rainfall, mm per year) was significantly higher than years when rainfall was not categorized as low (>33rd percentile).

**Discussion**

**Key Findings**

- Seroexposure to *S. neurona* in juvenile CSLs increased significantly in 2012-2017 compared to the previous study period (1998-2009).
- Pups had significantly higher seropositivity than yearlings.
- Decreased rainfall was associated with increased seroprevalence.

**Future Directions**

- Expand study period (2010-2019, all age classes).
- Other environmental risk factors: harmful algal blooms, fires.
- Risk factor association with clinical disease/death due to *S. neurona*.

**Limitations**

- Time constraints: limited study period/population.
- CSLs are migratory (difficult to determine location of exposure).
- Serologic exposure does not equal disease.
- Rehabilitation population does not reflect wild populations.

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**Acknowledgements**


**Table 1: Environmental and demographic risk factor analysis**

<table>
<thead>
<tr>
<th>Risk variable</th>
<th>Reference</th>
<th>P Value</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (pup)</td>
<td>yearling</td>
<td>0.038</td>
<td>1.50 (1.004-2.360)</td>
</tr>
<tr>
<td>Sex (male)</td>
<td>male</td>
<td>0.407</td>
<td>1.19 (0.792-1.778)</td>
</tr>
<tr>
<td>Rainfall (low)</td>
<td>not low</td>
<td>0.003</td>
<td>1.90 (1.233 to 2.899)</td>
</tr>
<tr>
<td>Streamflow (low)</td>
<td>not low</td>
<td>0.072</td>
<td>1.47 (0.965 to 2.226)</td>
</tr>
<tr>
<td>SST (not high)</td>
<td>high</td>
<td>0.428</td>
<td>1.20 (0.760 to 1.907)</td>
</tr>
</tbody>
</table>

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