HEALTH ASSESSMENT OF PINNIPEDS AT THE CALIFORNIA CHANNEL ISLANDS

Pamela K. Yochem[1], Brent S. Stewart[1], and David A. Jessup[2]

[1]Hubbs-Sea World Research Institute, 2595 Ingraham Street, San Diego, CA 92109
(619) 226-3870, FAX (619) 226-3944, E-mail of corresponding author: pyochem@hswri.org
[2]Marine Wildlife Veterinary Care and Research Center
1251 Shaffer Road, Santa Cruz, CA 95060, (408) 469-1726

ABSTRACT

Baseline data on demography and physical condition are essential for understanding the impacts of natural (e.g., environmental perturbations) or anthropogenic (e.g., toxic spills) events on wildlife populations (Loughlin 1994; Jessup and Leighton 1996; Estes et al. 1998). Because of the relatively large and diverse populations of pinnipeds at the Channel Islands and their potential susceptibility to such events, we have been studying the variability among individuals of physiological and pathological conditions for comparison with individuals examined during and following unusual events. Further, we have hypothesized that the investigation of such explanatory variables may explain differences documented in the foraging and reproductive success and survival of harbor seals, northern elephant seals, California sea lions, and northern fur seals at San Miguel and San Nicolas islands. We documented clinical abnormalities (e.g., dehydration, ocular lesions, signs of respiratory disease) during routine veterinary medical exams, compiled baseline hematological and serum biochemical data for harbor seals (n=120) and northern elephant seals (n=100), and tested for exposure to several known or suspected pinniped pathogens. A subset of apparently healthy harbor seals (n=20) was sampled more intensively; additional tests included immune function assays and measurement of polycyclic aromatic hydrocarbon levels in plasma. Development of a similar biomedical database for California sea lions and northern fur seals is underway.

Keywords: San Nicolas Island, San Miguel Island, pinnipeds, harbor seals, northern elephant seals, sea lions, fur seals, health, disease, petroleum hydrocarbons.

INTRODUCTION

The population biology and ecology of the seals, sea lions, and fur seals at the Southern California Channel Islands have been studied for several decades, particularly at the two major rookeries (San Miguel Island and San Nicolas Island), and changes in their abundance and distribution have been attributed to a variety of influences (e.g., DeLong et al. 1991; Stewart 1992, 1997; Stewart and Yochem 1991, 1994; Stewart et al. 1993).

Identification of an unusual mortality event such as an epizootic requires a basic understanding of the physiological and pathological conditions that are within normal limits for a particular population (Geraci 1998). However, although infectious diseases (e.g., morbillivirus epizootics; Heide-Jorgensen et al. 1992; Duignan et al. 1995) have had dramatic impacts on pinniped populations in some parts of the world, only a few reports on health and disease (e.g., Smith 1987; Lyons et al. 1997) are available for animals at the California Islands.

Resource managers have long considered the wildlife in the Santa Barbara Channel and offshore islands to be particularly vulnerable to oil spills due to the presence of heavy vessel traffic, oil and gas platforms, pipelines, tankers, and terminal facilities in the area (e.g., Cox 1994). Several of the most significant spills reported in California since the Office of Oil Spill Prevention and Response was established by the California legislature (Lempert-Keene-Seastrand Oil Spill Act of 1990) have occurred in Santa Barbara and Ventura counties (Office of Oil Spill Prevention and Response 1998). However, the presence of natural seeps in this area and the difficulties encountered following the *Exxon Valdez* spill in Alaska have demonstrated the need for baseline data on petroleum hydrocarbon levels and population health in order to properly evaluate the effects of an unusual event such as an oil spill (Geraci and St. Aubin 1990; Loughlin 1994; Rice et al. 1996). The California Department of Fish and Game, through its Office of Oil Spill Prevention and Response, has a legislative mandate to evaluate the potential impact of oil spills on California wildlife. In support of this mandate, we are collecting baseline biomedical data on health, disease, and petroleum exposure in California pinnipeds, primarily at San Nicolas and San Miguel islands. These data are essential for post-spill injury assessments, for effective treatment and monitoring of oiled animals, and for evaluation of other unusual mortality events such as epizootics. The information will also provide resource managers with an index of population health to complement demographic data collection.

MATERIALS AND METHODS

Harbor seals (*Phoca vitulina richardsi*), sea lions (*Zalophus californianus*), and fur seals (*Callorhinus ursinus*) were captured in hoop nets and physically restrained or lightly sedated for physical examination and biomedical sample collection. Northern elephant seals (*Mirounga angustirostris*) were chemically immobilized or sedated prior to handling and sample collection. Only apparently healthy individuals were selected for capture; any clinical abnormalities noted when the animals were in hand (e.g., dehydration, ocular lesions, bite wounds) were recorded and a blood sample was collected. Length, girth, and sometimes weight were recorded, and animals were tagged and released. Up to 45 quantitative and two qualitative hematological and serum biochemical tests were conducted on whole blood and serum by the Sea World San Diego Animal Care Laboratory within 48 hours of collection. Additional assays conducted on a subset of animals included serological tests for exposure to a variety of bacterial and viral pathogens (e.g., morbillivirus, *Brucella* sp., *Chlamydia* sp., *Leptospira* sp.), immune function tests (Laboratory for Marine Mammal Immunology, University of California Davis), and assays for polycyclic aromatic hydrocarbons (Trace Organics Facility, University of California, Santa Cruz).

RESULTS AND DISCUSSION

Most hematological and serum biochemical values for Channel Islands harbor seals (n=120) and northern elephant seals (n=100) were within previously published (cf. Bossart and Dierauf 1990) ranges for phocid seals (Yochem et al. 1997). However, adult male elephant seals sampled during the breeding season differed significantly (ANOVA, $p < 0.05$) from adult females for a suite of parameters associated with inflammation, infection, and other stressors (Table 1; Yochem et al. 1998). Males had significantly higher white blood cell and neutrophil counts than females, lower numbers of lymphocytes, and lower serum albumin and iron; these results suggest that males were suffering from subclinical inflammatory or infectious conditions, probably associated with intrasexual competition. Creatine kinase levels were also significantly higher in adult males, evidently a further reflection of the stress associated with aggression among breeding males. These differences may help to explain the relatively poorer post-breeding season dive performance of adult males compared with adult females (e.g., Stewart and DeLong 1994, 1996). Data from Channel Islands harbor seals are being examined for variation with age class, sex, season, and geographic region in collaboration with researchers studying seal populations in northern California, Washington, and Alaska.

Table 1. Comparative hematology and serum biochemistry of adult male and female northern elephant seals during the breeding season.

	MEAN VALUES (S.D.)		
Parameter	Adult Males	Adult Females	P
White Blood Cell Count	14,017 (2,479)	10,590 (3,538)	0.002
Neutrophil Count (%)	75 (8)	65 (9)	0.002
Lymphocyte Count (%)	12 (5)	17 (6)	0.002
Serum Albumin (g/dL)	2.9 (0.6)	3.3 (0.2)	0.014
Serum Iron (mcg/dL)	112 (68)	161 (40)	0.025
Serum Creatine Kinase (U/L)	2, 154 (2, 405)	589 (334)	0.049

Serological tests for pathogen exposure were negative in 18 of 20 harbor seals on whom additional tests were performed; one adult female tested positive for *Chlamydia* sp. and one adult male was suspect-positive for *Brucella* sp. The significance of these results in clinically healthy individuals is unknown, but it is important to keep in mind that these tests merely reflect possible exposure to a pathogen rather than presence of active disease. Immunological tests were within normal limits for 19 of 20 seals. Detectable levels of polycylic aromatic hydrocarbons (PAH; naphthalene, 2-methylnaphthalene, or 1-methylnapthalene) were found in 11 of 20 seals. The biological significance of these findings is difficult to assess, given the small size of the sample; nonetheless, they represent the only available information on PAH levels in free-ranging California pinnipeds and therefore will provide useful baseline data in the event of an oil spill.

Future biomedical sampling efforts will focus on California sea lions and northern fur seals; sample sizes for most age classes are too small at present to provide meaningful reference ranges. Additional samples collected from harbor seals and elephant seals will allow evaluation of interannual differences in various parameters, particularly those likely to be affected during times of intense environmental perturbations such as the 1996-97 El Niño Southern Oscillation event.

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