

Cal/Ecotox Exposure Factors for Sea Otter (*Enhydra lutris*)*

Page 1

Endpoint Type	Endpoint Value	Error	Range	Units	Sex	Life Stage	Location	Note	Reference
Age at Fledging, Metamorphosis, Weaning	<80 or >120			d	NR	Juvenile	CA	a	1
Age at Sexual Maturity	6.5		6-7	yr	M		CA	b	2
Age at Sexual Maturity	4			yr	F	Juvenile	AK	c	3
Body Weight - Mean	24.3	1.5 SE		kg	B	Adult	Lab	d	4
Body Weight - Mean	18.6			kg	F	Adult	Lab	e	4
Body Weight - Mean	21.1	6.49 SD	14.5-31.7	kg	F	Adult	AK	f	3
Body Weight - Mean			22-25	kg	F	Adult	Monterey; CA	g	5
Body Weight - Mean	29.5	0.3 SE		kg	M	Adult	CA	h	2
Body Weight - Mean	28.3	7.98 SD	21.8-38.6	kg	M	Adult	AK	i	3
Body Weight - Mean			8-25	kg	F	Both Adult and Juv.	Monterey; CA	j	6
Body Weight - Mean			13-34	kg	M	Both Adult and Juv.	Monterey; CA	k	6
Body Weight - Mean	1.96		1.02-2.83	kg	F	Juvenile	AK	l	3
Body Weight - Mean			8.2-24.1	kg	M	Juvenile	CA	m	2
Body Weight - Mean	1.75		1.2-2.5	kg	M	Juvenile	AK	n	3
Clutch or Litter Size	1			pup	F	Adult	AK	o	3
Clutches or Litters per year			14-15	%	B	Adult	AK	p	3
Clutches or Litters per year	Pr (giving birth in a year) = 1 - (1-p1)^120(1-p2)^65		0.890 - 0.898		F	Adult	AK	q	7
Clutches or Litters per year	0.9			pups/year	F	Adult	CA	r	1
Dietary Composition	unidentified crab (11.5%), pugettia (8.9%), cancer species (11.0%), unidentified abalone (0.7%), red abalone (1.0%), black abalone (0%), clam (2.9%), turbon snail (12.0%), kelp and holdfasts (0.2%), unidentified (37.7%), mussel (2.6%), annelid (1.0%), limpet (0.2%), scallop (0%), octopus (6.2%), red urchin (0%), cucumaria (0.2%), purple uechin (1.0%), pisaster species (1.7%), barnacle (1.2%)			%	B	Adult	CA	s	8
Dietary Composition	clams (34-61%), mussels (7-20%), crabs (2-11%), other invertebrates (4-5%), unknown prey (12-33%)				NR	Adult	AK	t	9
Dietary Composition	unidentified crab (15.0%), pugettia (4.5%), cancer species (6.8%), unidentified abalone (0%), red abalone (0%), black abalone (0%), clam (0.8%), turbon snail (19.6%), kelp and holdfasts (0%), unidentified (42.9%), mussel (0.8%), annelid (0%), limpet (0%), scallop (0%), octopus (0.8%), red urchin (6.0%), cucumaria (0%), purple urchin (2.3%), pisaster species (0.8%), barnacle (0%)			%	B	Juvenile	CA	u	8

Exposure Factors for Sea Otter (*Enhydra lutris*)

Page 2

Endpoint Type	Endpoint Value	Error	Range	Units	Sex	Life Stage	Location	Note	Reference
Dietary Composition	abalone (43%), crabs (16%), urchins (13%), other (28%)				B	NR	CA	v	10
Dietary Composition	sea urchins (47.8-70.2%), mussels (0.4-3.1%), sea stars (0.5-0.8%), crabs (1.4-5.2%), clams (0.4-1.8%), octopus (0.0-0.9%), anemone (0.0-0.2%), algal holdfasts (0.0-2.6%), fish (0.0-12.3%), fish eggs (0.0-0.9%), chitons (0.2-0.8%), coralline algae (0.0-0.2%), unknown (14.6-26.7%), unsuccessful (3.4-7.1%)				NR	NR	AK; OR	w	11
Dietary Composition	pismo clams (559), unidentified bivalves (1), rock crabs (1), market crabs (1), unidentified crabs (1), unidentified food items (15)				NR	NR	San Luis Obispo; CA	x	12
Dietary Composition	vertebrates (fish; 50%), mollusks (37%), echinoderms (11%), annelid worms (1%), tunicates (<1%), crabs/shrimp (<1%)				NR	NR	AK	y	3
Duration of Incubation or Gestation	198		119-264	d	F	Adult	Monterey; CA	z	13
Duration of Incubation or Gestation			12-13	mo	F	Adult	AK	aa	3
Duration of Incubation or Gestation			4-6	mo	F	Adult	Monterey; CA	ab	5
Fledging or Weaning Rate	1.0				F	Adult	Monterey; CA	ac	13
Fledging or Weaning Rate	0.75				F	Adult	Monterey; CA	ad	13
Fledging or Weaning Rate	0.4				F	Adult	Monterey; CA	ae	13
Food Ingestion Rate	168			Kcal/kg-d	B	Adult	Lab	af	4
Food Ingestion Rate	234	19 SE		Kcal/kg-d	B	Adult	Lab	ag	4
Food Ingestion Rate	21.6	1.3 SE		% of body mass/d	B	Adult	Lab	ah	4
Food Ingestion Rate	4.04		0.9-7.2	kg/d	F	Adult	Lab	ai	3
Home Range	3.7	3.1 SD		km^2	B	Adult	CA	aj	14
Home Range	5.6	1.9 SD		km^2	B	Adult	CA	ak	14
Home Range	4.7	2.9 SD		km^2	F	Adult	CA	al	14
Home Range	6.8	2.3 SD		km^2	F	Adult	CA	am	14
Home Range	80	19.04 SE	28.2-198.2	ha	F	Adult	Monterey; CA	an	6
Home Range			10 - 1166	ha	F	Adult	CA	ao	15
Home Range	78.0	7.2 SE	55-95	ha	M	Adult	CA	ap	2
Home Range	40.3	4.0 SE	23-65	ha	M	Adult	CA	aq	2
Home Range	0.8	0.8 SD		km^2	M	Adult	CA	ar	14
Home Range	4.6	0.8 SD		km^2	M	Adult	CA	as	14
Home Range	44	13.36 SE	29.3-137.6	ha	M	Adult	Monterey; CA	at	6
Home Range	35	8.75 SE	18.3-57.8	ha	M	Adult	Monterey; CA	au	6
Home Range			7 - 223	ha	M	Adult	CA	av	15
Home Range			32 - 214	ha	F	Juvenile	CA	aw	15
Home Range			221 - 759	ha	M	Juvenile	CA	ax	15
Longevity	11			yr	F	Adult	CA	ay	1

Exposure Factors for Sea Otter (*Enhydra lutris*)

Page 3

Endpoint Type	Endpoint Value	Error	Range	Units	Sex	Life Stage	Location	Note	Reference
Metabolic Rate	see Figure 1				NR	NR	Lab	az	16
Metabolic Rate	0.99			cc O2/g x hr	NR	NR	Lab	ba	17
Metabolic Rate	1.21			cc O2/g x hr	NR	NR	Lab	bb	17
Metabolic Rate	0.85			cc O2/g x hr	NR	NR	Lab	bc	17
Metabolic Rate	0.72	0.06		cc O2/g x hr	NR	NR	Lab	bd	17
Population Density	15			per 1000 ha	M	Adult	CA	be	2
Population Density	54		43-68	Animals per study area	B	Both Adult and Juv.	Monterey; CA	bf	6
Population Density			3.57 - 19.07	#/km2	B	Both Adult and Juv.	CA	bg	18
Population Density	50			animals per study area	B	NR	CA	bh	10
Population Density	150			animals per study area	B	NR	CA	bi	10
Surface Area	see Figure 3				NR	NR	Lab	bj	16
Survival/ Mortality	review							bk	19
Survival/ Mortality			8-11	%	B	Both Adult and Juv.	AK	bl	3
Survival/ Mortality	0.58				NR	Juvenile	CA	bm	1
Time of Hatching or Parturition	December to February				F	Adult	Monterey; CA	bn	20
Time of Mating/ Laying	review				B	Adult		bo	21
Time of Migration or Dispersal			3.5-8.5	mo	NR	Juvenile	Monterey; CA	bp	5
Water Ingestion Rate	62	27 SE		mL / kg-d	B	Adult	Lab	bq	4
Water Ingestion Rate	269	25 SE		mL/kg-d	B	Adult	Lab	br	4

Notes

- a estimate time period that pups spent with mothers; N=24 animals
- b N=22; Central coast
- c N=NR; Amchitka Island
- d combined male and female weights; N=5
- e N=5
- f N=254; Amchitka Island
- g range of body weights; N=2 otters; Mar, Aug; near Monterey
- h resident and non-resident males were not significantly different; N=22; Central coast
- i N=79; Amchitka Island
- j Weight for females; N=9; Monterey, CA
- k Weight for males; N=15; Monterey, CA
- l N=6; Age=newborn; Amchitka Island
- m Individual data available in Table 2; N=33; Central coast
- n N=4; Age=newborn; Amchitka Island
- o litter size as indicated by reproductive tract examination; N=278 reproductive tracts; Amchitka Island
- p annual reproductive rate, based on field count, sex ratio, reproductive tract data; N=NR; Amchitka Island
- q p1 = daily probability of becoming pregnant during the high probability period
p2 = daily probability of becoming pregnant during the remaining part of the year.
p1 and p2 = 0.02 and 0.00067, respectively, based on observations from Prince William Sound, AK.; N=1,482; Age=2-16 years; Spring and fall; Aleutian islands, AK; The 0.890 value appeared to be the best point estimate

Exposure Factors for Sea Otter (*Enhydra lutris*)

Page 4

r annual reproductive rate based on number of pups born during monitoring period; N=13 animals; Condition=breeding

s dietary composition for adults; N=608; Piedras Blancas

t relative occurrences of prey items in diet, based on observation (range crosses three locations); N=752-833 foraging dives/site; April-July; Prince William Sound

u dietary composition for juveniles; N=156; Piedras Blancas

v The composition is based on occurrence of observed items.; N=15-170; Diablo Canyon nuclear power plant; Point San Luis to Point Buchon

w percentage (ranges) of total dives that resulted in capture of different prey items at three locations; N=425-584 dives/location; summer, winter; Amchitka and Attu (Aleutian Islands), and Blanco Reef, OR

x number of prey retrieved, based on observations from shore; N=578 observed retrievals; Pismo Beach

y mean percent of total stomach content volume contributed by dietary items; N=309 stomachs; Jan, Feb, Oct, Mar, Apr; Amchitka Island

z N=53; Age=> 3 years; Monterey Bay

aa estimated gestation including delayed implantation period; N=275 reproductive tracts; Amchitka Island; Includes unimplanted gestation (7-8 mo) and implanted gestation (4.5-5.5 mo)

ab range of estimated gestation period, based on observations; N=2 otters; near Monterey

ac pre-weaning survival rate (mothers aged 11-14 years); N=4; Age=11-14 years; Monterey Bay

ad pre-weaning survival rate (mothers aged 7-10 years); N=12; Age=7-10 years; Monterey Bay

ae pre-weaning survival rate (mothers aged 3-6 years); N=5; Age=3-6 years; Monterey Bay

af Net metabolizable energy; N=5

ag Daily total energy consumption; N=5

ah N=5

ai N=1; all mo; Equivalent to 23% of bw per day.

aj N=11; Condition=Residents; October-December, 1979; Santa Cruz to San Luis Obispo

ak N=9; Condition=Residents; October-December, 1978; Santa Cruz to San Luis Obispo

al N=8; Condition=Residents; October-December, 1979; Santa Cruz to San Luis Obispo

am N=4; Condition=Residents; October-December, 1978; Santa Cruz to San Luis Obispo

an N=8; July - March; Monterey

ao daily home range, estimated from hourly triangulations during 24-hr watches using the minimum convex polygon method; N=16 animals; yr-round; Monterey to San Luis Obispo

ap N=5; winter/spring; Central coast

aq N=10; summer/fall; Central coast

ar N=3; Condition=Residents; October-December, 1979; Santa Cruz to San Luis Obispo

as N=5; Condition=Residents; October-December 1978; Santa Cruz to San Luis Obispo

at Home range for non-territorial males; N=7; July - March; Monterey

au Home range for territorial males; N=4; July - March; Monterey

av daily home range, estimated from hourly triangulations during 24-hr watches using the minimum convex polygon method; N=9 animals; yr-round; Monterey to San Luis Obispo

aw daily home range, estimated from hourly triangulations during 24-hr watches using the minimum convex polygon method; N=10 animals; yr-round; Monterey to San Luis Obispo

ax daily home range, estimated from hourly triangulations during 24-hr watches using the minimum convex polygon method; N=5 animals; yr-round; Monterey to San Luis Obispo

ay oldest animal captured in study; N=1 animal

az oxygen consumption measured at 15-20 C; N=2; Condition=fed

ba average metabolic rate in air; N=10; Condition=fasted; See figure for metabolic rate measurements over a range of ambient temperatures.

bb average metabolic rate in water; N=13; Condition=fasted; See figure for metabolic rate measurements over a range of ambient temperatures.

bc average basal metabolic rate in water; N=13; Condition=fasted; See figure for metabolic rate measurements over a range of ambient temperatures.

bd average basal metabolism in air; N=10; Condition=fasted; See figure for metabolic rate measurements over a range of ambient temperatures.

be maximum density at this time of year; N=7; summer/fall; Central coast

bf population density, 1975 - 1977; N=54; Monterey, CA; See citation for map of study area with approximate size.

bg range of densities for entire study area for 2 yrs; N=NR; June - Oct.; Elkhorn Slough

bh resident population density (see citation for map of study area); N=15-170; Diablo Canyon nuclear power plant; Point San Luis to Point Buchon; Land surveys were done weekly 1973-1978. The population was observed to be predominantly male

bi population density for resident and non-resident animals (see citation for map of study area); N=15-170; Diablo Canyon nuclear power plant; Point San Luis to Point Buchon

bj estimated surface area; N=2; Condition=fed

bk N=NR; all otter species included

bl annual mortality over two years estimated from carcass searches on beaches; N=1 population (1076 otters); Amchitka Island

bm pup survival rate to weaning; N=19 animals

bn peak period of birth; N=NR; Point Lobos State Reserve to Lucia

- bo N=NR
bp observed ages at which pups were no longer observed with mothers; N=5 pups; near Monterey
bq Sea water ingestion rate; N=5
br N=5; Nitrogen influx was also measured. Electrolytes were measured using milliequivalents of Mg, Na, Cl, and K. Implications for elimination rates and kidney physiology are discussed.

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