

Husbandry Manual for Californian Sea Lion



Zalophus californianus californianus

(Mammalia: Pinnipedia: Otariidae)

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1 Introduction

- Californian Sea Lions are perhaps the most familiar pinniped in the world. Highly gregarious and easily trained, these are the sea lions commonly seen in zoos, circuses and oceanariums. They are quite active, both behaviourally and vocally, and even large adult males are easy to tame and train. (Reeves et al, 2002)
- In the wild they have a similarly gregarious reputation. They are frequent visitors to boating marinas, sometimes hauling out by the dozens in yachts, bait barges, and buoys, and occasionally damaging or sinking them. (Reeves et al, 2002). Californian sea lions also learned to steal fish from commercial fishing nets at sea. This, however, often led to their deaths in nets. (Riedman, 1990).
- Not a lot was known about their biology until the 1960's. (Ridgway and Harrison, 1981)
- In captivity, Californian sea lions have been extensively studied with respect to their social attachment to people. When hand reared/fed, they showed stronger and more persistent efforts to interact with humans. (Riedman, 1990)
- Californian Sea Lions are classified as 'hazardous', suggesting that they have the ability to seriously maim or injure a person. (Taronga Zoo, 2005). There are risks to working with these animals, the main one is being bitten. To avoid this, there should be a safe area around the holding pools (about half a metre) that should not be crossed unless necessary (eg yellow line on floor). Also knowledge of temperaments of each individual should be known before approaching or trying to work a sea lion. Knowing the time of year is very important as they can sometimes be more aggressive during the breeding season. (pers.comm. Paul Hare, 2005)

2 Taxonomy

2.1 Nomenclature

Kingdom	Animalia
Phylum	Chordata
Sub Phylum	Vertebrata
Class	Mammalia
Sub Class	Eutherian
Order	Pinnipedia
Family	Otariidae
Subfamily	Otariinae
Genus	<u>Zalophus</u>
Species	<u>californianus</u>
Sub species	<u>californianus</u>

2.2 Subspecies

- There are three recognised subspecies. They are Z.c.californianus, Z.c.japonicus, and Z.c.wollebaeki. Each live in clearly separated ranges. (OurWorld). Rice (1998), believes that the geographical, amongst other, differences between these three justifies classification as separate species, Z.californianus, Z.japonicus and Z.wollebaeki.

2.3 Recent Synonyms

- No notable synonyms

2.4 Other Common Names

- ‘Lobos marinos’ is the common name listed by Walker, 1975.
- Often referred to as ‘Callies’. (pers.comm. Peta Clarke, Andrew Barnes, Paul Hare, Taronga Zoo 2005)
- Sometimes referred to as ‘amphibious carnivores’. This is due to their aquatic lifestyle, except for the birth and initial raising of young, when the females remain on land. (MacDonald, 2004)
- As per their classification, they are ‘eared seals’ (Otariidae). This means that they are not true seals (phocids). (MacDonald, 2004)

3 Natural History

- Californian sea lions are the only Otariid tested for aerial and aquatic hearing prior to 1987. In the water, they are able to hear a wide range of frequencies to over 70,000 hertz. As they lack a large external ear, their hearing sensitivity in air is reduced. Their overall hearing is less sensitive than humans, but their airborne absolute sensitivity is greater than phocids. (Riedman, 1990)
- In captivity, they sometimes emit clicking sounds when visibility is poor, suggesting an echolocation function for these sound emissions. Poulter and Del Carlo (1971) claimed that Californian sea lions used sophisticated sonar systems to navigate and find food. It is still debated, however, as to whether they do actually echolocate or not. (Riedman, 1990)
- Experiments have found that Californian sea lions don't see in colour. They instead see coloured objects in white, black, and grey shades. (Riedman, 1990)
- Studies have shown that they are poor thermoregulators and cannot regulate their body temperature on extremely warm days. To cool off they must enter the sea and immerse themselves. (Whitlow et al, 1971)
- It has been shown that El Nino events can affect the species. A decline in food resources for lactating mothers appeared to result in slower pup growth rates and higher pup mortality during the first 2 months of life. During the El Nino year, mothers also left their pups earlier to feed, and remained at sea feeding longer than during the year preceding El Nino. (Riedman, 1990)
- Studies have shown their ability to comprehend artificial language in the same way that dolphins have learnt to communicate with humans by means of symbols and sign language (Schusterman and Krieger, 1984, 1986). Their trainability has been utilised by the US Navy to help retrieve objects such as missiles on the ocean floor. The evolution of well-developed cognitive and learning abilities of pinnipeds would presumably enable their ability to inhabit a complex or difficult environment. (Riedman, 1990)

3.1 Morphometrics

3.1.1 Mass And Basic Body Measurements

- Length (average nose to tail): Male = 220cm-240cm
Female = 180cm
Pups = 75cm

(Our World; King, 1983)

- Weight (average): Male = 275 - 300kg
Female = 90-100kg
Pups = 5-6kg
(Our World; King, 1983)
- Average Life Span: 15-25 years (Chan, 1992)
- Top speed: Water = 17km per hour (Walker et al, 1975)
- Maximum dive depth = 247m (Feldkamp et al, 1983)

3.1.2 Sexual Dimorphism

- Young males and females look very similar with a blond or light brown pelage. When the male reaches 4 or 5 years of age, it's fur becomes a dark red or chocolate brown colour. This indicates that the sea lion is beginning to mature. The females often remain blond or only change slightly to dark brown. (NMML)
- Males get a sagittal crest on their head when they are mature. This can be used a feature to distinguish it from other sea lions species that are similar is colour and stature. (Chan, 1992)
- The females are much smaller than the males (as per manual 3.1.1)

3.1.3 Distinguishing Features

- Unlike phocids, sea lions have sparse under fur (MacDonald, 2004), and when wet they appear to be almost black. (Walker et al, 1975)
- A sagittal crest reaches up to 4cm high on mature males and is much more apparent in this species than in others (King 1983). This crest becomes quite blond.
- This species do not, however, have a mane that is well-developed like other sea lion species. (Reeves et al, 2002)
- They have relatively short hind flippers, and fore flippers that are haired on the dorsal surface, from the start of the limb to the first or sometimes second digit. (Antonelis et al, 1980). They are able to walk with their flippers and hitch with their body. (Walker et al, 1975)
- They only have 5 upper cheek teeth and the third upper incisor is large, with a circular cross-section. (Bonner, 1994)
- Their call resembles a barking or honking noise. These are sharp and quite loud. (Walker et al, 1975)

3.2 Distribution and Habitat

- Californian Sea Lions range from the West Coast of Mexico to British Columbia (Our World), and in the waters of Southern California.
- They are generally found in sheltered, quiet bays, as well as on rocky isolated islands and just off sea coasts. (Walker et al, 1975). They tend not to go further than 16km out to sea. (King 1983)
- They remain closer to the shoreline and cool off in the water more so in warmer habitats (eg Gulf of California) than they do in the temperate regions of southern California. (Riedman, 1990)
- Long distance seasonal migration with the males moving north after breeding. (Riedman, 1990)
- The subspecies are geographically different with Z.c.japonicus thought to have lived in the Sea of Japan, although now assumed extinct, and Z.c.wollebaeki found exclusively on the Galapagos Islands. (Our World)

3.3 Conservation Status

- It is a protected species (Our World), with population numbers being described as 'Stable' (Chan, 1992)
- In 1979, Mate thought there was a total population of around 50,000 and increasing. In 1982, Mate made a conservative population estimate of 75-100,000.
- In 1999, the population was thought to be between 204,000 and 214,000 worldwide. (MacDonald, 2004) This shows that the population is not in any immediate danger of becoming a threatened or endangered species.

3.4 Diet in the Wild

- Thought to be an opportunistic feeder in the wild. (Our World)
- Known prey species include pacific lamprey, pacific herring, northern anchovy, salmon, plainfin midshipman, pacific hake, pacific tomcod, jacksmelt, white croaker, jack mackerel, rock fish, rex sole, slender sole, english sole, and squid. (Antonelis, et al, 1980)
- Although opportunistic, their diet is thought to be 63% fish, 7% squid, and 30% other invertebrates. (MacDonald, 2004)
- Californian sea lions have been observed undertaking mariposia. This commonly

occurs in various sex and age classes during their non-breeding season. (Gentry, 1981)

3.5 Longevity

3.5.1 In the Wild

- Estimated between 15-30 years. (Chan, 1992)

3.5.2 In Captivity

- Estimated to be up to 23 years of age. (Walker et al, 1975)

3.5.3 Techniques Used to Determine Age in Adults

- Crest height in males. (King, 1983)
- Pelage and mane colour of males. (NMML)

4 Housing Requirements

NB: Unless otherwise stated, all of section 4 referenced from Q.W.P.A. 1999.

4.1 Exhibit/Enclosure Design

- The 'Code of Practice for the Recommended Minimum Standards for Exhibiting Fauna in Queensland' for Marine Mammals (1999) is intended to ensure the humane handling, treatment, care and maintenance of marine mammals, to enhance health and longevity, and to enhance public interest and awareness.
- All pool and area measurements are 'minimum' sizes required.
- The requirements and capabilities of individual animals demand a degree of flexibility in meeting the recommendations given in the code of practice.

- The guidelines at this point are provisional and may be modified with further information.

4.2 Holding Area Design

- Animals should not be held in a holding pool for more than 10% of a 24 hour period, unless otherwise advised by a vet or senior keeper.
- Must have a dry haul out area.

4.3 Spatial Requirements

4.3.1 Primary Pool

- MPV with one animal is 110m³. For each additional animal add 35m³.
- Minimum spatial requirements are for two animals: NA (Number of Animals).
- If housing different species together, all measurements relate to the largest held species.
- MHD = AAL (Average Adult Length) x 3 NA.
For Californian Sea Lions, ALL = 2.2m
- MD = AAL x 1.25 over the area of the MHD

4.3.2 Dry Haul Out (DHO) Primary Pool

- Minimum spatial requirements are for two animals: NA
- If housing different species together, all measurements must relate to the largest species held.
- Californian Sea Lions AAL = 2.2m
- Total DHO = Primary Enclosure. For each additional animal held in the primary enclosure add 3.5m².

4.3.3 Holding Pool

- MPV is 20m³.
- Minimum spatial requirements for primary pools are for one animal: NA (Number of Animals).
- MHD = AAL x 1 NA.

- Californian Sea Lions AAL = 2.2m
- MD = AAL x 0.5 over the area of the MHD.

4.3.4 Dry Haul Out (DHO) Holding Pool

- Minimum spatial requirements for primary DHO pool areas are for one animal. AAL for Californian Sea Lions is 2.2m.
- Total square meters for DHO Holding pool = (1xAAL) + (0.75 AAL).

4.4 Position of Enclosures

- The enclosure does not need to face a certain direction. As long as a sea lion has the essential furniture in its enclosure and protection from the elements, direction has no real affect. (pers.comm. Matt Jacobs, 2005)

4.5 Weather Protection

- Shadecloth over one section of the enclosure to protect the sea lions from extreme sun and heat, or rain. (pers.comm. Jo Walker, 2005)

4.6 Temperature Requirements

- Animals should initially be maintained in conditions that approximate those from which they were removed (Summer - low to high 20's °C, Winter - low to high 10's °C). They should then be gradually acclimatised to their surrounding conditions.
- Air and water temperatures should be recorded daily.
- Sea Lions should not be held in outdoor facilities unless the air and water temperature ranges do not affect their health or comfort adversely.
- If held indoors, the facilities must be air and water temperature regulated.

4.7 Substrate

- No pool should contain water that may be detrimental to the health of the animals. The water should be maintained by filtration, chemical treatments, or other means that comply with water quality standards (Appendix).

4.8 Nestboxes and/or Bedding Material

- Wooden beds that are the large enough for a sea lion to comfortably lay down on. (Sydney Aquarium, Taronga Zoo, 2005)

4.9 Enclosure Furnishings

- Wooden beds. (Appendix C1). (Taronga Zoo, Sydney Aquarium, 2005)
- Shade cloth. (Taronga Zoo, 2005)
- Plants and sand. (Taronga Zoo, 2005)

5 General Husbandry

5.1 *Hygiene and Cleaning*

- Daily: All pools should be dropped, hosed, and chlorinated if required; scrubbing of food preparation sinks, buckets, pouches, fridges, holding pen fences, and benches with disinfectant; hosing and scrubbing of floors with disinfectant; rinsing of any enrichment toys with water. (Taronga Zoo, 2005)
- Once a week: Chlorination of buckets and plastic fish tubs for any loose fish containment. (Taronga Zoo, 2005)
- Used chemicals: Diluted HCl, Disinfectant. (Taronga Zoo, 2005). The dilution should be referred to on the MSDS sheets or on the bottle as different chemicals have different dilutions.
- MSDS sheets should always be read before using any chemicals. (pers.comm. Graeme Phipps and Andrew Titmuss, 2005)
- NB: When using HCl, PPE *must* be worn, including gumboots, gloves and a face mask or goggles.
- A maintenance table should be made up for the year for recurring activities or information that is required for certain times of the year. (Appendix F)

5.2 *Record Keeping*

- Information that must be recorded on an individual is birth date, parentage, identification, offspring, medical history, enclosure housed and movements, and husbandry notes. (Q.W.P.A., 1999)
- Each sea lion should have a personal diary where all daily individual information and husbandry notes are kept. Things to note are DFI, weight, behavioural grading for the day (i.e. behaved well, behaved strangely), any illness or treatment received, any medications taken, and any animal transfer. (pers.comm. Ady D'Ettorre and Peta Clarke, 2005; Q.W.P.A., 1999)
- It is to be recorded if a sea lion doesn't eat all of its food. Any remaining food should be weighed and recorded as an ED or an SID. (pers.comm. Peta Clarke, 2005)
- Arks records (Appendix D) are to be kept daily. This is a daily report of any medical treatment, pregnancy or birth, or any information deemed important. Arks records should be filled out according to protocol in the front of the Arks diary. (pers.comm. Graeme Phipps, 2005)

5.3 Methods of Identification

- All pens are to have species boards on the gates. (Appendix C4). (Taronga Zoo, 2005)
- Verbal identification by names (Taronga Zoo, Sydney Aquarium, 2005)
- Any individual colorations, scars, or markings (Taronga Zoo, Sydney Aquarium, 2005)
- Size is not a good method for identifying individuals as it can be seasonally variable. (Taronga Zoo, 2005)

5.4 Routine Data Collection

- Sea Lion weights should be collected on the same day every week. (Taronga Zoo and Sydney Aquarium, 2005)
- Water samples of the pools should be collected and their pH's and temperatures are to be recorded every day. (Taronga Zoo and Sydney Aquarium, 2005)
- DFI's and any changes are recorded every day. (pers.comm. Ady D'Ettorre, 2005)
- Any training that has taken place for the day and behaviour is recorded every day. (pers.comm. Ady D'Ettorre, 2005)

6 Feeding Requirements

6.1 Captive Diet

- The diet at Taronga Zoo (2005) consists of Mullet, Pilchards, Slimy Mackerel, Herring, Yellow Tail, Red Spot Whiting, and Squid. The DFI increases and decreases seasonally. (Appendix C3). (pers.comm. Paul Hare, 2005)
- The diet at the Pet Porpoise Pool (2005) consists of Red Spot Whiting, Sand Whiting, Mullet, Squid, Cuttlefish, Blue Mackerel, Red Eyes, Silver Eels, and Silver Biddies. Seasonal fish include Grinners, Slimy Grinners, and Yellowtail in winter, and Trumpeters in summer. (pers.comm. Aaron Tolley, 2005)
- The diet at SeaWorld (2005) consists of Mullet (Bull, Tiger and Pinkeye), Mackerel (Slimy and Spanish), Tommy Ruff, Whiting, Sanmar, Silver Biddies, Squid, Yellowtail, Pilchards (Indo Pacific and Blue), Taylor, Grinners and Razor Guts.
- There is no set ratio of food items. Food can be divided into Fats (eg Mullet and Pilchards), Mids (Mackerel and Herring) and Thins (Whiting and Squid). Should an animal be putting too much weight on, their fats can be dropped and thins can be raised, and vice versa. The DFI is different for each animal. (pers.comm. Paul Hare, 2005)
- Fish should be put in the bucket from largest in the bottom to smallest on the top, as a general rule. This stops any fish being squashed and losing any nutrients. (pers.comm. Ady D'Ettorre, 2005)
- Any fish that are not whole, not the right colour, smell bad, or just look unhealthy should never be fed. If unsure, throw it away. They may be diseased or contaminated. Fish that are not whole lose their nutrients quickly. Fish that is fed to sea lions should be able to be fed to humans. (pers.comm. Ady D'Ettorre, 2005)
- The diet of any pinniped should be written up on a DFI board (Appendix C2) and followed accordingly. Any changes to the diet should be changed on the board and recorded in daily records. (Taronga Zoo, Sydney Aquarium, 2005)
- Food should be offered at least twice a day, preferably more. (Q.W.P.A., 1999)
- DFI generally rises in winter and falls in summer. This is because in winter, sea lions need to build up their fat stores. The amount in which it rises and falls is different in each individual. (pers.comm. Paul Hare, 2005)

6.2 Supplements

- Can receive daily *pinniped* 'sea tabs'. These are vitamin supplements and are to be given as per instructions on bottle. Their concentration can be found in the appendix (E). Usually, pinnipeds receive 1 tablet per 2kg of DFI. Eg if DFI is 6kg, then

individual receives 3 tablets that day. The tablet/s are placed in the gills of fish or in the bell/s of squid. The vitamin fish/squid is wrapped in paper so it can be easily identified. (pers.comm. Ady D'Ettore, 2005)

6.3 Presentation of Food

- All food is weighed and kept in metal buckets in fridges. Each bucket has a tag or name on it so that each pinniped has its own food. (Taronga Zoo and Sydney Aquarium, 2005)
- Food can be presented in the following ways (Taronga Zoo):
 - Free feed. This is when the seal is not required to work for their food
 - Sessional. This is when an animal is working for food, whether it be during a training session or during a show.
 - Enrichment. This is when food is put into a toy, making the seal work for the food for fun. (Refer to 9.7 for more information).
- Food can be received from a keeper, trainer, or a person from the public (under keeper supervision). Sessional feeds should only be undertaken by the primary or secondary trainers. (Taronga Zoo)
- Generally only one person should carry out any one feed for the animal to reduce confusion. (Taronga Zoo).

7 Handling and Transport

- Courses have been developed by NPWS for handling and transport of seal and sea lions. (NPWS, 1997)

7.1 Timing of Capture and Handling

- House animals in area without water access to facilitate restraint. (Holland, 1999)
- Capture is preferable before the public arrive at the park if the animal is on display, but not imperative. It is also preferable in the morning when it is cooler and the animal is more likely to respond better. (Taronga Zoo, 2005)

7.2 Catching Bags

- Bags are not used - cages are instead.
- Suspension cages - otherwise known as 'boxes'. (Taronga Zoo and Sydney Aquarium 2005)
- Pet packs, usually only used for young sea lions. (Taronga Zoo, 2005)
- Herding boards - wooden boards with dimensions of 120 x 80 cm and handles. (NPWS, 1997)
- Other options include hoop nets, stretcher nets, cargo sling nets and sausage-shaped nets. (NPWS, 1997)
- All cages should be sturdy, and well ventilated. (Q.W.P.A., 1999)

7.3 Capture and Restraint Techniques

- Sea Lions are often 'box trained'. When a sea lion is needed to enter a box, this should only be undertaken by senior or primary trainers of the individual. It can sometimes be stressful for the sea lion, so being put in by a trainer with which the sea lion has a strong rapport with is extremely important. (Taronga Zoo, 2005).
- Herding is another capture technique but is often used as a last resort. It involves using herding boards (wooden boards with handles) to move the sea lion into a box or enclosure by blocking all other pathways so it has no where to go other than forward. This can be quite stressful for the sea lion and should never be undertaken by a primary trainer. (NPWS, 1997; Taronga Zoo, 2005)

- In many instances, they will receive sedation (usually via food). (Holland, 1999)
- Head bags are often placed on animals head to calm them and prevent bites for keepers. (Holland, 1999)

7.4 Weighing and Examination

- Weighed by using scales under a 'bed'. They should be tared before the seal is asked to sit on the bed. If weighed in the box, scales should also be tared. (Taronga Zoo, 2005)
- Sea lions are usually trained to lie down, roll over, open their mouths, show their flippers and allow touch by humans, all on command. These behaviours are useful for examinations as they are not stressful for the animal, and relatively safe for the keepers to undertake. (Taronga Zoo, 2005)
- The sea lion should be monitored regularly during a move to ensure that the animal is not stressed, hurt, or dehydrated. (NPWS, 1997)

7.5 Release

- Sea Lions have no particular time of the day for best release. It is preferred that they be released in their own enclosure or holding pool and have time by themselves in it first. It also allows others around it to get used to having it back and to sort out the hierarchy again. (Taronga Zoo, 2005)
- They should have a free path of escape from any box or cage it is in and an unobstructed path to a water body, if they are healthy enough. (Taronga Zoo, 2005)
- The release of an animal into water or not is dependant on what happened prior to its release. Eg: don't let it in a pool if it has been sedated or anaesthetised. (Taronga Zoo, 2005)

7.6 Transport Requirements

7.6.1 Box Design

- All containers must be well ventilated and strongly built. They must be large enough to ensure that the animal has sufficient space to stretch in all normal postures. (Q.W.P.A., 1999)
- Containers must be sturdy enough to prevent the animal from breaking free. (NPWS, 1997)
- Containers must have solid bottoms and be designed to provide easy access to the animals by attendants. (Q.W.P.A., 1999)

7.6.2 *Furnishings*

- A container should be empty, other than a solid bottom in the cage. (Taronga Zoo, 2005)

7.6.3 *Water and Food*

- For long travel times, water should be available so the animals can be hosed if signs of stress become apparent. (Holland, 1999)
- Their normal food is appropriate. (Taronga Zoo, 2005)

7.6.4 *Animals per Box*

- There should only ever be 1 animal per box. (pers.comm. Ady D'Ettorre, 2005)

7.6.5 *Timing of Transportation*

- There is no real time that transportation should/not be undertaken. It is generally done as required. It is preferential in the morning as it is cooler and the animal is more likely to work/respond to the keeper or trainer. (pers.comm. Ady D'Ettorre and Matt Jacobs, 2005)

7.6.6 *Release from Box*

- The box should be opened in the enclosure or the area the animal has been transported to (pers.comm. Ady D'Ettorre, 2005). It should be opened safely by a keeper and should allow the animal a free path without any obstruction. The animal should be left to get out of the box in it's own time, which is often quite quickly. (Taronga Zoo, 2005).

8 Health Requirements

8.1 Daily Health Checks

- During daily routines, the following should be checked:
 - fish is fresh and good to eat. It must be ok for human consumption. It should smell fresh, its eyes should be clear, and the fish should be complete. If unsure of fish health, throw it away. (Taronga Zoo and Sydney Aquarium, 2005)
 - there are no structural problems with holding pens and exhibits. (Taronga Zoo, 2005)
 - all equipment and chemicals are safely away. (Taronga Zoo, 2005)
- When undertaking distance examinations, you should look for any:
 - sluggish or lethargic movement.
 - obvious cuts, bruises, limps or anguish in movement (including swimming).
 - general demeanour of animal. (Taronga Zoo and Sydney Aquarium, 2005)

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint

- Tablets can be ingested if put in food, or an injection may be administered. (Taronga Zoo, 2005)
- Anaesthesia often administered by veterinarians. (Dierauf, 1990)
- Chemical restraint is often used as a last resort. (Taronga Zoo, 2005)
- NB: For any chemical restraint, a vet should be referred to before any methods are used and a vet should, if possible, be on site. (Taronga Zoo, 2005)

8.2.2 Physical Examination

- This species has many signals that can show ill health, such as behavioural changes, appetite loss, and general change in demeanour. Refer to sections 8.1 and 9.

8.3 Routine Treatments

- Worming: Ivomec liquid administered once a month after it has been weighed. It is injected into the fish. (Holland, 1999; Taronga Zoo, 2005). The dose rate is 1ml per 80kg of weight of seal.

- Faecal examination: Every 6 months to check for parasites. (Holland, 1999; pers.comm. Ady D'Ettoire, 2005)

8.4 *Known Health Problems*

- Respiratory Infections. Symptoms: reduced activity, increased respiratory rate, possible moist or rasping sounds of exhaled breath, possible putrefying odour of exhaled breath, flaring of nostrils with inspiration, flaring of chest during increased efforts at inspiration, coughing, breathing through mouth, general reluctance to perform strenuous behaviour. (Dierauf, 1990)
- Gastric/Duodenal Inflammation. Symptoms: history of chronic variability in food intake, reduction in attitude and activity, assumption of tucked up body posture while in the water and on land, reluctance to enter the water, mucus discharge from mouth and/or in faeces, and general aggravation exhibited at attempts to make physical contact with animals where such contact is normally accepted. (Dierauf, 1990)
- Bowel Tympany. Symptoms: similar to gastric/duodenal inflammation but acute onset, presence of gas bubbles emitted from both the mouth and anus, generally more exaggerated clinical symptoms compared to gastric/duodenal inflammation. Marine mammals have a low tolerance to the presence of gas within their gastrointestinal tracts due to the relative restricted volume of the peritoneal cavity and the extended length of the intestinal tract. Therefore even small accumulations of gas in the bowel are very uncomfortable and result in extremes of clinical behavioural symptoms. (Dierauf, 1990)
- Trauma/Body Infections: Symptoms: where not obvious, such diseases are made apparent by careful examination of the normal body conformation. A good understanding of such conformation is thus necessary, as well as an ability to observe and evaluate body functions so that alteration in normal functions which may signify disease may be quickly recognised. (Dierauf, 1990)
- Marine mammals tend to exhibit symptoms of disease late in the disease process. Once symptoms are evident, the disease has often progressed. It is therefore imperative for keepers to be diligent in distant and close examinations and report anything unusual immediately. (Dierauf, 1990).
- Prevention of these diseases can include making sure that food is up to standard and good enough for human consumption; separating aggressive animals so that they cannot bite, even through common holding pool bars; interacting with individuals each day to look for food or behavioural changes, and making sure that all areas are cleaned and disinfected to reduce the passing on of infections.
- The ailments listed above are just a few of the common diseases that exist. If any sign of ill health is present, a vet should be called to make a diagnosis on the animal.

8.5 *Quarantine Requirements*

- Quarantine pools must have pumping filtrations systems separate to the primary pool. (Q.W.P.A., 1999)

- New Sea Lions must be quarantined until they can be deemed to be in good health. (Q.W.P.A., 1999)
- A quarantine program should include the following procedures: physical examination of all animals on arrival; vet care, treatment, and immunisations; treatment for physical and social trauma; adaptation to diet; and close observations of animals within the quarantine area. (Q.W.P.A., 1999)

9 Behaviour

9.1 Activity

- Usually early morning swimmers, with most of their day spent swimming. (Holland, 1999)
- Very inquisitive and like to play with loose stones (Holland, 1999) and other toys. (Refer to behavioural enrichment, section 9.7)
- Sometimes play with fish without eating them, often tossing them in the air (Riedman, 1990) and flicking them around.

9.2 Social Behaviour

- Common social behaviour for males, females and pups are locomotion, vocalization, play, female-pup relations. (Walker et al, 1975)
- Captive Californian sea lions bark more in some seasons than others, despite the absence of females. During the non-breeding season, barking is often associated with less intense size-related dominance hierarchy, and subordinate males bark more frequently. (Riedman, 1990)
- Animals often lay side by side when not in breeding season. The males are very tolerant of the pups and juveniles around them. Females often lay next to males to deter young males from annoying them. (Holland, 1999)

9.3 Reproductive Behaviour

- Males are territorial around their rookeries. (Bonner, 1994). Their territorial tenure depends on a number of related variables including his age and size, ability to compete with other males, ability to fast, the location of his territory, the distribution of females, the population density, climate, and the accessibility of water for thermoregulation. They are extremely territorial in water as well as on land. (Riedman, 1990).
- Animals thermoregulatory needs as well as the topography of their rookery are important in structuring the male's breeding behaviour and in determining his mating success. (Riedman, 1990)
- Males have a harem of females. (Walker, et al, 1975)
- Copulation is generally on land, and occasionally in water. In warmer climates, it also takes place in shallow water tide pool areas. (Riedman, 1990)
- Females initiate and end copulation at their discretion. (Bonner, 1994)

- They are commonly more vocal during breeding season. (Riedman, 1990)

9.4 Bathing

- Molt annually. Males from November to February and females and juveniles from August to October (USA). (Thorson, 2004).

9.5 Behavioural Problems

- Rubbing their body on the pool walls. This causes patches of raw skin. (Holland, 1999)
- Because of their inquisitive nature, they tend to swallow foreign objects that may have been dropped in the pool by the public. Otariids have small pyloric openings, so things cannot pass into the small intestine, causing obstructions. (Holland, 1999)
- The Sea Lions at Taronga Zoo have a very skittish personality and although are inquisitive, they are very hesitant around new objects and are frightened easily. This type of behaviour can be overcome with conditioning by the trainer. (pers.comm. Peta Clarke, 2005)

9.6 Signs of Stress

- Signs of stress include nervousness, one eye closed behaviour, poor response to keeper, aggressiveness to keepers, poor motivation to eat. (Holland, 1999)

9.7 Behavioural Enrichment

- Artificial 'ice edges and ice holes' - activates the use of fore flippers. (Copenhagen Zoo, 1990)
- Deep pool with plenty of water - stimulates natural swimming behaviour. (Copenhagen Zoo, 1990)
- Dry resting places/beds - allows grooming, care of young, dry area in the enclosure. (Copenhagen Zoo, 1990) (Appendix C1)
- Fish-sicle - whole fish in blocks of ice. Put in pool or on land and let them play with it. (Metro Washington Zoo, 1993). Biting the ice can also benefit their teeth. Ice blocks without fish can also be made, as can ice blocks with toys in them rather than fish. (Taronga Zoo, 2005)
- Food ball or drum - plastic large ball/container with holes drilled in it. Put fish inside so sea lion has to work out how to get it out. (Taronga Zoo, 2005) (Appendix C5)
- Irregular shape of pool - counteracts stereotyped behaviour. (Copenhagen Zoo, 1990)
- Milk crate feed puzzle - 2 plastic milk crates secured together at the open ends. Put fish inside the crates and put in pool. Sea lion must find a way to get the fish out. (Metro Washington Zoo, 1993)
- Neutral buoyancy items - fill toys such as inner tubes, basketballs, and drums with water until neutrally buoyant. They can be pushed around the pool with little effort. (Metro Washington Zoo, 1993)
- Response to barking - promotes males territoriality (needs more research though). (Copenhagen Zoo, 1990)
- Rolling pipe toy - PVC pipe $\frac{3}{4}$ full of pea gravel, with ends glued. Can be rolled on floor of pool. Gravel also makes a noise when rolled for extra enrichment. (Metro Washington Zoo, 1993)
- Rubbing Post - Concrete parking bumper has bolted natural bristled broom head on it. Put into pool. Utilise bristles for tactile stimulation. Different textured bristles can be used for further enrichment. (Metro Washington Zoo, 1993)
- Sea Squid - place fish inside and sea lion must work out how to get fish out. (Taronga Zoo, 2005) (Appendix C6)
- Semi circle boat - put boat in water concave up so that it floats. Put fish in middle of boat and allow sea lion to work out how to get the fish. (Taronga Zoo, 2005) (Appendix C7)

9.8 Introductions and Removals

- New animal must be given time to feel comfortable in the exhibit and with the keepers before introduction with other animals. A slow introduction is desirable. (Holland, 1999)
- They should be introduced in an exhibit that has an escape route for either animal, as aggression is anticipated and unavoidable. They need to develop a hierarchy. Once established, any aggression should decrease. (Holland, 1999)
- They should have initial contact first visually through barriers, then when the time is right and the animals are somewhat comfortable with each other, they can be introduced. (Holland, 1999)

9.9 Intraspecific Compatibility

- They can be kept with other individuals of the same species, of the same sex. This is especially important in breeding season if reproduction is not wanted. (Taronga Zoo, 2005)

9.10 Interspecific Compatibility

- They can be kept with other species of eared seals, provided that they are relatively the same size. It is preferable that they are all the same sex. (Taronga Zoo, 2005)
- They can be kept with sturdy birds (eg Humboldt's Penguin/ Mallards/ Cormorants). (Copenhagen Zoo, 1990).

9.11 Suitability to Captivity

- They are very adaptable to a captive lifestyle. They are very trainable animals and are often kept by circus' and zoos. (Bonner, 1994; Reeves et al, 2002)

10 Breeding

10.1 Mating System

- Most seal lions are present around their rookeries throughout the year. Males begin to establish territories about the same time that the pregnant females arrive to pup. (Bonner, 1994)
- Males are promiscuous and polygynous. (Atkinson, 1997)
- Each bull has 5-20 females in a harem in the wild. (Walker et al, 1975). In captivity, sea lions can be put into breeding pairs. (San Diego Zoo, USA)
- Sea Lions tend to breed on beaches (MacDonald, 2004) or on the waters edge. It has been hypothesised that males breed on the waters edge to reduce their risk of hypothermia during copulation. (Atkinson, 1997)
- Males are referred to as 'bulls', females as 'cows' and juveniles as 'pups'. (Chan, 1992)

10.2 Ease of Breeding

- Gestation: approx. 365 days (Big Zoo), 50 weeks. (Our World)
- Embryonic diapause for up to 120 days after fertilisation. (Atkinson, 1997)
- Lactation: 4-12 months (Atkinson, 1997; Our World)

10.3 Reproductive Condition

10.3.1 Females

- Females exhibit certain behaviours when leading up to their oestrus period. They are aggressive open-mouth threats; growling and drumming; vocalisations; nosing and biting interactions. (Atkinson, 1997)
- Females actively solicits and terminates copulation. (Bonner, 1994)
- Philopatric - return to beaches where born. (MacDonald, 2004)

10.3.2 Males

- Males exhibit certain behaviours when they are ‘in season’. Such behaviours are approaching, nudging and chasing females; vocalisations; and agonistic threats to neighbouring males. (Atkinson, 1997)
- Have secondary sexual dimorphism/characteristics present. (Riedman, 1990)
- Males also will have an increase in the size of their testes. (Atkinson, 1997)
- Breeding males do not appear to fast for long periods and few bulls hold one territory for more than two weeks. Bulls continuously displace one another throughout the breeding season. (Riedman, 1990).

10.4 Techniques Used to Control Breeding

- Separation of the males and females in captivity is a most effective method of controlling breeding. (Taronga Zoo and Sydney Aquarium, 2005)
- Females can have embryonic diapause. (Atkinson, 1997)
- The extent of the effect of abortion and premature pupping in sea lions is not known. It may be a mechanism for population regulation. Studies have indicated that abortion is due to a viral infection. (Walker et al, 1975)

10.5 Occurrence of Hybrids

- In captivity, hybrids are known to exist. In the wild, this is not the case. (pers.comm. Ady D’Ettorre, 2005)
- Offspring of couplings with *Arctocephalus* species (Fur Seal) have been reported. (Mitchell, 1968)

10.6 Timing of Breeding

- Breeding is undertaken in the warmer months of the year (usually between May and July in USA), as temperatures of around 30°C are favourable for the pups being born. (MacDonald, 2004)
- The males breed with the females about 3 weeks after she has given birth to her pup

from the breeding season before. (MacDonald, 2004)

10.7 Age at First Breeding and Last Breeding

- The age of females at first breeding is the cause of some contention. Walker et al, 1975, says that females can begin breeding at 3 years of age, but Atkinson, 1997, says they can't begin breeding until about 5-9 years of age.
- Males are able to breed at 5 years of age. (Walker et al, 1975; Atkinson, 1997)
- The ages of the last breeding of females and males are unknown.

10.8 Ability to Breed Every Year

- They are only able to reproduce once a year. (Walker et al, 1975)

10.9 Ability to Breed More than Once Per Year

- They are unable to breed more than once per year as they have a gestation time of almost 1 year. (King, 1983)

10.10 Nesting, Hollow or Other Requirements

- Sea lions need a dry haul out area for copulation to take place. (McDonald, 2004)

10.11 Breeding Diet

- Females fast for 5-12 days after the birth of a pup. They live off their fat stores. (MacDonald, 2004)
- After this fasting period, the females go in search of food, leaving the pup on the shore for short periods of time. (Atkinson, 1997)

10.12 Oestrous Cycle and Gestation Period

- Females come into oestrous and mate two weeks after the birth of their pups. (Bonner, 1994). They are mono-oestrous. (Atkinson, 1997)
- Female oestrous cycles are synchronised by parturition. They are spontaneous ovulators and will ovulate in the absence of male sea lions. (Atkinson, 1997)
- Females enter embryonic diapause for up to 120 days. (Atkinson, 1997)
- Gestation period of 50 weeks, approximately 365 days. (King 1983; Our World)

10.13 Litter Size

- Like many mammals, sea lions tend to only have one pup per breeding season. (Chan, 1992).
- Twins are rare due to mothers being unable to produce enough milk for two. Examinations of reproductive tracts, have revealed their existence. A set of twins have been born in captivity, but one died soon after birth. (Uchiyama, 1965).
- Sex ratios of pups are 1:1 (i.e. 50% chance of male or female). (Walker, 1975)

10.14 Age at Weaning

- Pups begin to enter the sea at one to two weeks of age. They moult into the adult coat at about five months and shortly after, begin to feed for themselves. (Bonner, 1994)

10.15 Age of Removal from Parents

- They are completely weaned by 1 year of age. (Chan, 1992)

10.16 Growth and Development

- Pups grow rapidly within the first 18 months. It slows down after weaning until about 3 years of age (Holland, 1999), and then is very gradual and seasonal.
- Research found that commonly male pups weighed more at birth, grew faster, or ingested more milk than females pups. (Riedman, 1990). However, Francis and Heath (1985) found that maternal care continues longer for female than male offspring.
- Maximum weights and lengths are in section 3.1.1.

11 Artificial Rearing of Mammals

11.1 Housing

- A pup should be housed in a holding pool, preferably with its mother. (Taronga Zoo, 2005)
- The pup should have access to an area that allows them to remove themselves from view. If not provided, the pup may show signs of stress. (Holland, 1999)

11.2 Temperature Requirements

- The temperature should replicate their natural habitat. Refer to section 4.6.

11.3 Diet and Feeding Routine

- Sea lions are lactose intolerant so formula needs to be based on the nutrients in the mothers milk (i.e. low in lactose and high in fat). (Holland, 1999)
- Artificial milk formula (Appendix E) should be made up and administered by bottle. A pup should be fed 2 litres per day. This amount is increased so that by 2 months the pup is fed 3 times this amount while being weaned onto whole fish. (Dierauf, 1990)

11.4 Specific Requirements

- A female who has just pupped needs to be monitored closely to make sure she is eating and healthy. Her appetite should increase due to her lactating. (Holland, 1999)

11.5 Data Recording

- Records should be kept on:
 - The time of day anything happens, including the time of the pup's birth.
 - Any liquid intake and how much was taken/left.
 - Any food intake. Initially this is the number and species of fish taken/left, and as the pup grows, this will become the weight of fish taken/left.
 - Urinating and defecating.
 - Response to the bottle/fish (i.e. keen, not keen, force fed).
 - Level of restraint to bottle and fish feeding (i.e. easy to feed, had to be restrained and force fed).
 - What it is they are eating (i.e. formula or fish).

(pers.comm. Ady D'Ettorre, 2005)

11.6 Identification Methods

- The only method used at Taronga Zoo is visual identification. (pers.comm. Ady D'Ettorre, 2005)

11.7 Hygiene

- All bottles used for formula feeds must be sterilised at the end of each day to prevent any contamination, or cross contamination if there is more than one pup on site. (pers.comm. Ady D'Ettorre, 2005)
- If in a holding pool, it must have a complete water change every day, like all of the other pools. (pers.comm. Ady D'Ettorre, 2005)
- Footbaths for Sea Lion pups are common to prevent any infections that may occur. (pers.comm. Ady D'Ettorre, 2005)

11.8 Behavioural Considerations

- Make sure the pup is feeding properly. They can often suckle without actually getting any milk (Holland, 1999). Their weights should be monitored and if they are not eating, this should be reflected in their growth.
- There are often behavioural problems in young reared pups such as flipper sucking and eating disorders (pers.comm. Corryn Lewis, 2005)
- A minimum number of keepers, but more than one, should have access to the pup. This prevents fixation on one person, and allows rapport building with others. (Holland, 1999)

11.9 Use of Foster Species

- Foster parents or species are not used with Sea Lions, nor any pinniped species. This is largely due to two factors:
 - Timing. It is unlikely that you will have 2 lactating sea lions or seals at the same time.
 - No adoptive nature. Females bond with their pups strongly through smell and only ever care for their own. Putting a pup with a sea lion that is not its mother can lead to a great amount of aggression from both parties.
(pers.comm. Ady D'Ettorre, 2005)

11.10 Weaning

- Sometimes initiated earlier in captivity than in the wild. (refer to section 10.14 and 10.15) (Holland, 1999)
- Offer pup small bits of fish whilst the mother is being fed. It would maintain on this diet until 18 months. The pup can begin to be weaned when it is showing an active interest in fish whilst it is still being suckled by its mother. (Holland, 1999)

11.11 Rehabilitation and Release Procedures

- All animals are to be seen to by a vet in regards to its rehabilitation and release. (Smith, 1997)
- When sea lions need rehab they are usually dehydrated so fluids should be administered by tubing them or by giving injections as soon as possible. (pers.comm. Corryn Lewis, 2005)
- Rehabilitated sea lions should be returned to their habitat or enclosure as soon as they are considered capable of surviving. If released into the wild, they must be marked in some way before release, so that they can be identified if they are resighted. (Smith, 1997)
- Release times may need to be synchronised with the migration patterns of the species. (Smith, 1997)
- Authorised Rehabilitation Facilities in Australia are: Taronga Zoo, Sydney; Pet Porpoise Pool, Coffs Harbour; and Sea World, Surfers Paradise.(Smith, 1997)

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http://thebigzoo.com/animals/california_sea_lion.asp

Personal Communications

Peta Clarke (Keeper - Taronga Zoo, Sydney 2005)

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Aaron Tolley (Keeper - Pet Porpoise Pool, Coffs Harbour, 2005)

Ben Squires (Keeper - SeaWorld, Gold Coast, 2005)

Corryn Lewis (Keeper - Auckland Zoo, New Zealand, 2005)

Graeme Phipps (Teacher - TAFE Richmond, 2005)

Andrew Titmuss (Teacher - TAFE Richmond, 2005)

Other Sources

San Diego Zoo. (20/08/05) Interview on television with a keeper of Californian Sea Lions from San Diego Zoo. World Around Us, Channel 7.

Sydney Aquarium. (2004 - 2005) This is information from my practical experience in the Curatorial section at the Sydney Aquarium, Sydney, Australia. All comments are based on information from the Supervisors and Staff in this section.

Taronga Zoo. (2005) This is information from my practical experience in the Marine

Mammal Section at Taronga Zoo, Mosman, Australia. All comments are based on information from the Supervisors and Staff in this section.

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15 Glossary

Box Trained: This means that the sea lion has been trained to enter boxes that it can be transported in.

DFI: Daily Food Intake. The total amount of food that is set aside for each individual animal to eat each day. It is usually set in kilograms.

ED: Enforced Decrease. This is the amount of food left after a sea lion has been ended for the day by a trainer. (Taronga Zoo, 2005)

Harem: When a dominant male has a group of females that all live together in a large group.

Hitch: The movement of the body when walking. The body moves side to side, like it is hitching a ride from the front flippers. (Walker et al, 1975)

HCl: Hypochlorite abbreviation.

Mariposia: Drinking of sea water. (Riedman, 1990)

MD: Minimum Depth. (Q.W.P.A. 1999)

MHD: Minimum Horizontal Dimension. The diameter of the largest circle that can be drawn within an enclosure pool to encompass the minimum water depth for the pool. (Q.W.P.A. 1999)

Mono-oestrous: Ovulation and mating occur once around the same time each year (Atkinson, 1997).

MPV: Minimum Pool Volume. (Q.W.P.A. 1999)

Otariidae: Eared seal.

Pelage: Coat or fur layer.

Phocid: True seal. (Perrin et al, 2002)

Pinniped: Winged-foot.

PPE: Personal Protective Equipment. Any equipment that should be used for safety reasons.

Pyloric: the third stomach of the pinniped. (Perrin et al, 2002)

SID: Self Induced Decrease. This is the amount of food left when a sea lion doesn't want any more of it's food and is not ended by a trainer. (Taronga Zoo, 2005)

Zalophus californianus: *Greek* = 'za' - an intensive prefix; 'lophus' - a high crest.
(Gotch, 1979)

A. Water Quality Standards (O.W.P.A., 1999)

Bacteria: Total coliform bacterial count in water should not exceed 500 most probable count per 100ml of water.

pH: Water must be maintained between 7.2 - 8.4.

Salinity: Water should be maintained between 20 - 36g/litre.

Temperature: Water should not exceed the temperatures experienced in the natural geographic range of the species.

Suspended Solids: Water should not exceed 1% by volume.

Chlorine: The daily average combined bromine level should not exceed 0.8mg/litre. The average free chlorine level should not exceed 100% of the combined chlorine level.

B. Species List

English Sole: Parophrys vetulus

Herring: Arripis georgianus

Jacksmelt: Atherinopsis californians

Jack Mackerel: Trachurus symmetricus

Mullet: Mugil cephalus

Northern Anchovy: Engraulis mordax

Pacific Hake: Merluccius productus

Pacific Herring: Clupea harengus pallasii

Pacific Lamprey: Entosphenus tridentate

Pacific Tomcod: Microgadus proximus

Pilchard: Sardinops neopilchardus

Plainfin Midshipman: Porichthys notates

Red Spot Whiting: Sillago flindersi

Rex Sole: Glyptocephalus zachirus

Rockfish: Sebastes sp.

Salmon: Oncorhynchus sp.

Slender Sole: Lyopsetta exilis

Slimy Mackerel: Scomber australasicus

Squid: Loligo opalescens

White Croaker: Genyonemus lineatus

Yellow Tail: Trachurus novaezelandiae

C. Images

Source: All images taken by Melissa Grainger, Taronga Zoo, August 2005.



C1. Wooden bed. Can be different sizes, as long as the seal can comfortably sit on the bed without it's flippers sitting off the edge.

	ADULT / BIBBY	PILCHARD	PACKER / L.S. WENDERS	HERKING	WINTERS/ SOL. WINTERS	SAND	TOTAL
		FATS	MIDS	THINS			
ORSON	2.5	1.5	0.0	3.5	0.5	10.0	
EIRA	2.5	0.5	1.0	1.0	2.5	0.5	6.0
LENE	1.0	0.25	2.0	2.75	1.75	0.5	8.25
DROOKE	2.0	0.25	3.0	4.0	5.0	14.0	
ANNE	2.0	1.5	0.5	7.0	1.5	5.0	
WESL	1.5	1.5	0.5	0.5	1.5	3.0	5.0
KATRINA	1.5	0.5	10.0	0.5	2.5	1.5	5.5
	0.5		1.0		4.0		

C2. DFI Board. This board states all the current DFI's for each individual, and the amount of fats, mids and thins they should receive (kgs).



C3. Fish species that are fed out to sea lions at Taronga Zoo. From the top, they are a Mullet, Slimy Mackerel, Herring, Yellow Tail, Red Spot Whiting, and Pilchard.



C4. *Species Board.* This should be on all exhibit doors and holding pool gates. They should state the species held and any comments that may be important.



C5. *Enrichment container.* Standing at 60cm high, this can be used for behavioural enrichment by putting some fish in it and putting it in the exhibit (generally in the pool)

with the Sea Lion. The aim is to stimulate their mind to work out how to get the fish out.



C6. Sea Squid. Standing at 1m high, it can be used for behavioural enrichment. It can have fish put inside it and put into the sea lion pool with the animal. The aim for the sea lion is to work out how to get the fish out.



C7. Floating boat. This can have fish placed in it or can be left empty. It is a toy that sea lions can play with for behavioural enrichment. It has a diameter of 2 metres.

D. Arks record sheet

Find attached to back of manual

E. Formulae

Artificial Milk Formula (Dierauf, 1990)

p525

Ingredients	Amount
Blended fish	700 g
Salmon (marine) oil	50 ml
Reconstituted synthetic infant formula	500 ml
Calcium caseinate	60 g
Cod Liver oil	60 ml
Salt	4 g
Vitamin mix (including 100 mg thiamine and 100 iμ vitamin E)	

Seatabs (Taronga Zoo)

Ingredients	Amount
Vitamin A	8000 iμ
Vitamin E	120 mg
Thiamin	100 mg
Riboflavin	8 mg
Pyridoxine	8 mg
Pantothenic	8 mg
Folic Acid	320 μg
Biotin	250 μg

F. Maintenance Activites Table

Find attached to back of manual

G. Stock

(Taronga Zoo, 2005)

Sea tabs - Vetafarm
3 Bye Street
Wagga Wagga 2650

Substitute
Sea tabs - BVR Seatabs 1000's
PO Box 755
Mittagong NSW 2575

Arks Record Sheet

CODE	SEX	SPECIES	ID	ARKS	ENCL.	NOTES

Code: Refer to codes below

Sex: Male or Female

Species: Animal species

ID: Animal Name

Arks: Each animal has an Arks number and this is to be entered here

Encl.: Where the animal is held

Notes: Record and explanation if required

CODES

ACQ: *Acquisition.* Any importation from outside the collection, public donation, or capture from ground or wild.

B: *Birth.* Day animal is born.

D/30: *Death within 30 days.* Death/euthanasia within 30 days of birth.

D/E: *Death, Established.* Death/euthanasia of any animal which has been a resident in the

collection for longer than 30 days.

DIS: Disposition. Includes exports from the collection, releases, sales, escapes.

BRD: Breeding. Reproductive details/observations. Any oestrus, menstruations, matings, courtship, sexing of previously unsexed individuals or any other reproductive matter.

INT: Internal Movement/Transfer. Any movement of an animal from its residing enclosure, be it within a section or onto a different section. Transfers/exports out of the collection NOT included.

TAG: Tagging. Animal identification by banding, tagging, notching, tattooing, naming or any other method of identification.

W/L: Weight/Length. Weight or length measurements.

Rx/Tx: Treatment. Any medical treatment administered to animals, wither by Vets, or continuing treatments administered by animal care staff. Include observations of anything related to treatment. Flag if veterinary examination is required using VET code.

VET: Vet Examination Required. Note if veterinary/examination is required.

OTH: Other. Any notable observation made in reference to daily routine or animals, e.g. behaviour, change to routine, etc. Also anything else of interest e.g. animal management procedures, diet change, maintenance, etc.

(Based on those codes used at Taronga Zoo)

