CHAPTER 6

WELFARE

Behaviour

6.1 Critics of oceanaria contend that the mental and physical welfare of cetacea suffers in captivity because their environment is so different. Project Jonah has stated that '... it is not possible to adequately cater for the needs of an intelligent, social, free-ranging animal like a dolphin in captivity'.[1] They believe that boredom, frustration, compression of activity and sensory deprivation are caused by captive conditions.

6.2 Some criticism of cetacean welfare centres on observations of the animal in the two different situations. Dr Sidney Holt believes that:

> 'One has only to see animals in the wild in comparison with the appearance of those that have been for any time in captivity to see vast differences in condition and behaviour.'[2]

6.3 Critics have been alleged that cetacean behaviour in captivity exhibits symptoms of stress analagous to human reactions in captive situations. Hindley argues that:

> 'many species of animals seem to experience the full range of human emotions including grief, anxiety, and depression. There is also considerable evidence to indicate the development of psychotic and neurotic behaviour under prolonged and extreme stress.'[3]

Pilleri maintains that captive conditions for cetacea are 'equivalent to the increasingly deprecated solitary confinement of man' and that cetacean behaviour in this situation displays typical symptoms of prison neurosis.[4]

6.4 Animal welfare scientists consider that stress in animals is difficult to define and measure. They conclude that assessments must be based on as much knowledge as possible about behaviour, physiology and external appearance without projecting human emotions and expectations onto the animal.[5]

6.5 Andersen has suggested that:

> 'In the psychic environment there may be many serious causes for a high mortality but it is almost impossible objectively to define these causes. Dolphins have only few objective signs which can give us a hint of their psychic state of health. It always ends up with a kind of feeling or believe (sic).'[6]

6.6. Lee rejected the argument that:

> 'largely by inference from the effects of solitary confinement on humans, it is concluded that cetacea suffer in captivity.'[7]

He considered that:

> 'the conclusion that cetaceans respond similarly to humans in confinement, whether it is based upon relative "intelligence", brain size or structure, or behavioural capacity is highly subjective. It is even possible to argue that cetaceans by virtue of their behavioural capacity, may enjoy the environment of a marine park.'[8]

6.7 He contended that the only objective way of assessing the effects of capture and captivity on cetacea is to examine evidence of responses which are typical of animals experiencing adverse environments:

> 'These responses are increased mortality and reduced longevity, impaired reproduction, physiological stress and abnormal behaviour.'[9]

6.8 In a core paper for the Global Conference on the Non-Consumptive Utilisation of Cetacean Resources, Pilleri identified behavioural changes and physical degeneration in captive cetacea which, he concluded, did indicate stress.

6.9 Pilleri considered that:

> 'the lack of space in aquaria and the complete isolation of cetacea or the reduction in the size of their communities, leaving only a few specimens together, have an extremely adverse effect which results in serious psychic disturbances in the animals.'[10]

6.10 He found that behavioural disorders manifesting psychic disturbance included stereotype gestures such as the adoption of iterative routes, establishment of pecking orders, aggressiveness towards other cetacea and people, suicidal tendencies, masturbation and homosexuality.

6.11 Stress, he considered, was caused by the cramped conditions in oceanaria. Cetacea were used to travelling long distances in large schools. This situation could not be emulated by oceanaria and 'desocialisation' occurred as a result. As well, captivity removed the fight for existence and the ambivalence between wanting and not wanting, owing to fear, became intensified and stereotyped to form severe tensions. A final cause of cetacean stress was that the bond with their own

spatio-temporal system is seriously disturbed and contact with humans and dressage can never replace the relationships prevailing in the wild.[11]

6.12 Pilleri also argued that captive cetacea displayed many physical signs of degeneration as a result of their captive environment. These included probable brain size reduction with atrophy in the areas most responsible for controlling the means of communication, ultimately resulting in the cetacea ceasing to emit sounds underwater. This was because captivity made no demands on the sensory organs. Cetacea, fed dead fish, did not need to track down prey and they could find their way around the pool without using their sonar. Other physical signs included adiposity or conversely, weight loss, and the fin of the orca, usually rigidly upright in the wild, drooped in captivity. Finally, Pilleri considered the possibility that dressage might affect the polyphase sleep pattern of cetacea.

6.13 He concluded that the combination of unhygienic conditions, stress and physical degeneration had much to do with the high mortality rate of cetacea in oceanaria.

6.14 Nick Carter had also arrived at the conclusion that cetacea suffered from stress in captivity. He stated that:

> 'there is no longer any question that psycho-physiological effects have been, and continue to be, prime causes of the suffering and consequent high mortality rates among captive dolphins.'[12]

Carter, citing work done by Robson,[13] described various situations in which respiratory problems ending in death were caused by psycho-physiological reactions.

6.15 He referred to several case histories where physical signs or abnormal behaviour were the consequence of capture, holding or transport induced stress. A dolphin developed a duodenal ulcer when it became nervous because of crowds peering at it through a glass wall. Several dolphins became aggressive towards humans and cetacea and some had to be released. A pilot whale developed symptoms of psychoneurosis. One day, as it was being watched by crowds through the glass of its tank, it deliberately swam at the glass and smashed it.

6.16 Saayman and Tayler have written:

> 'Among the most important prerequisites for the maintenance of a healthy breeding colony of dolphins is an adequately spacious pool, the acoustical properties of which should cater to the acute auditory perception of dolphins ... Inadequate spatial conditions may lead to abnormally severe aggression. The widely varying composition of free-ranging groups of dolphins ... indicates that provision should be made in captivity for the animals to associate or disperse at will. Ideally, an offending dolphin should be able to retreat from both the sight and sound of a more dominant animal. Furthermore, dolphins rely primarily upon acoustical mechanisms for navigational and discriminatory purposes ..., but in captivity they are often maintained in small and shallow circular tanks with concrete walls and glass windows. These holding facilities represent, in effect, acoustical reverberation chambers which may grossly disturb an animal with a highly developed auditory perceptual system. The clinically sterile conditions of many oceanaria, although presenting favorable viewing conditions for the public, deprive the dolphins of all contact with marine flora and fauna, the latter representing their prey. In the case of inshore dolphins, which usually inhabit murky seas, crystal clear water in captivity may further inhibit their normal acoustical repertoire. The absence of the above prerequisites may, indeed, lower the physical condition of the animals, a factor in itself likely to distort the

> results of behavioral studies. In summary, while it is relatively practicable to provide many terrestrial mammals with favorable seminaturalistic conditions in game reserves, it is difficult, if not impossible, for the majority of institutions to reproduce in captivity the necessary prerequisites to cater for the unique socioecological adaptations which the dolphin has made over millions of years.'[14]

6.17 There is considerable difficulty in establishing whether certain behaviour in captive cetacea indicates suffering or stress. There are over 50 different species of small cetacea with vastly differing life patterns so the reaction of each captive species must be assessed against the behaviour exhibited by its wild counterparts for an accurate analysis. However, often little is known about the history, distribution, environment and activities of many of these species.

6.18 Certain broad behavioural patterns are displayed by most cetacea in the wild including formation of schools, co-operation among members, epilemetic (care-giving) behaviour, formation of complicated social structures and separate feeding, resting and play activities. Within these behavioural patterns there are significant differences. Some species are deep sea animals which are only seen out in the ocean and rarely come near the shore. Others have been observed remaining close to the coastline, swimming into the shallow shore for rest. Some cetacea swim long distances on a seasonal basis while others are observed always in the same area. While some species feed and are most active during the day, others are nocturnal feeders and species such as orca are equally as active day and night. Tropical and temperate oceanic dolphins typically form large schools, while schools of species found near the shore are much

smaller. Single dolphins may be encountered in bays and rivers. Orca, killer whales, live in family groups for life. They form small, extremely stable, polygynous pods. Pseudorca, false killer whales, also form highly cohesive schools. Species such as Tursiops truncatus, bottlenose dolphin, Stenella, spotted dolphin, Sousa, white dolphin and Lagenorhynchus, pacific white sided dolphin, create large and highly fluid schools often divided into sub groups which may remain stable only for short periods before changing. Delphinus delphi, common dolphin, greatly disturbs the surface of the water when it travels, unlike Lagenorhynchus or Lissodelphis, northern right whale dolphin which can hardly be seen in the water. Globicephala macrorhynchus, short finned pilot whale has been observed lying for long periods at the surface in stationary schools, blowholes and anterior portions of the back exposed above the water.[15]

6.19 A further problem in using behaviour to assess cetacean welfare is that there are wide variations in reactions to capture and captivity by different species and by different individuals within the same species. In one study of a live capture fishery in Southern California, reactions to capture and initial captivity were observed as covering the range from advanced shock to calm, uneventful behaviour. One species suffered from sharp-edged ulcers for which the cause was considered to be stress. Another species started swimming and eating normally almost immediately and had no physical or behavioural signs of stress. One species has been known to make high speed runs at the walls of the enclosure. Reactions within the same species were also shown to differ markedly according to the age of the individual. Reactions of remaining members of the pod in the wild also varied. In some cases individuals waited by the captured animal until it was taken into the boat. Other species left their companion immediately. Members of some species became aggressive when their companion was captured.[16]

6.20 All overseas reports of capture and transportation of cetacea indicated that they all showed signs of considerable stress during this period. This has been, or could have been mitigated in some cases with improved capture and transportation techniques. However, obvious behavioural and physical abnormalities seem to occur in all cetacea during capture.[17] Frequent injections of drugs and force feeding immediately after capture would confirm that cetacean welfare is considered to be severely at risk during this time.

6.21 Concepts of normality may vary according to the period of time the animal has spent in captivity. Cetacean behaviour immediately after the animal is placed in captivity seems to be considered normal, by overseas accounts, when heartbeat and respiration are normal, the cetacean is feeding voluntarily and aggressive activities and chaotic swimming patterns have abated.[18] Cetacea which have been kept captive for a considerable length of time or which have been born in captivity will be considered normal if they carry out most aspects of known social patterns such as courtship, mating, consort relations, birth, rest and play.[19]

6.22 As well as age, species and individual behavioural variations, different captive conditions and treatment of captives such as size of tank, presence of other cetacea, extent of human intervention, training techniques and numbers of performances daily may elicit different behaviours.[20]

6.23 Evidence indicates that there are a great many variables which must be taken into account when assessing cetacean behaviour in captivity and in drawing any conclusions about whether a particular form of behaviour indicates that the animal is suffering.

6.24 Defran and Pryor, after reviewing available evidence, have concluded:

> 'not all species have been kept routinely or with equal success. Such factors as availability, ease of collection and transport, and state-of-the-art medicine, husbandry, and training technology have favored the maintenance of some species over others. Additionally, the ease of maintaining a species in tank settings seems to reflect in part the ecological characteristics of the natural habitat of the species. The shallow, coastal water favored by the bottlenosed dolphin in the northern areas of the Gulf of Mexico apparently preadapt it well for tank living. In contrast, open-ocean pelagic species such as Dall's porpoise, Phocoena dalli, seem to have much greater difficulty in adapting to the tank environment. The sociobiology of the species, especially the degree of dependence on con-specific tank mates, also plays a part in the adjustment process.'[21]

6.25 More information is required to establish specific behaviours under particular conditions for objective stress measurement. This includes:

- normal patterns of behaviour of particular species in the wild;

- comparisons of behaviour patterns of cetacea which have been held in captivity for a short time and for a long time;

- comparisons of patterns of behaviour of cetacea captured in the wild and those born in captivity;

- differences in behaviour associated with variations in species, sex, age and weight;

- variations in environmental conditions such as size of pool, water conditions, food, noise, light and presence of other cetacea;

- details of husbandry methods;

- effects of different approaches to training, performances and human intervention;

- use and effect of anti-stress agents; and

- aetiology of diseases.

6.26 There is general acknowledgement even among those who support oceanaria, that cetacean behaviour is changed by captivity and that adverse effects may result.

6.27 The Animals on Display Workshop stated that:

> 'bringing animals into captivity alters their natural state. If captivity causes adverse effects, these effects, on balance, are outweighed by such benefits as enhancement of human appreciation for all animals, conservation of species, and advancement of knowledge.'[22]

6.28 Norris was equivocal. In 1980 he wrote:

> 'most that is known in any depth about the behaviour of dolphins has come from observations of captive animals. Yet the environment of captivity, which is at best a pool a few dozen metres in longest dimension and 5 or 10m deep, can allow only certain aspects of normal behaviour to occur. Intragroup relationships may persist, but are usually distorted because relationships seldom remain intact. At best only hints of normal movement and activity patterns can persist where feeding schedules are determined by the work days of trainers.'[23]

However, he also indicated that:

> 'captive dolphins, given adequate numbers, sex and age distribution, (more than 3 to 5) will establish quite normal social patterns between members. They play, seek special sleep partners, instruct their young, caress and sometimes quarrel.'[24]

Later:

> 'in the captive environment the movement patterns of wild animals are of course restricted, but because such animals continue to swim nearly all the time, just as their wild relatives do, they may move as far in a day. Stereotyped "zoo patterns" are very seldom seen in the adaptable species, though oceanic animals may circle much of the time and should not be kept except in special experimental situations.'[25]

6.29 Ridgway was also unsure. He stated that:

> 'it is possible that survival in captivity is related to the psychological stress caused by the captive conditions. Major illness episodes have been shown to occur after major life change events in humans. (Rahe et. al. 1967.) This does not necessarily apply to other species.'[26]

6.30 There is both overseas and Australian evidence of behavioural abnormality in captive cetacea which may be attributable to stress.[27]

6.31 However, some findings on behaviour have been considered contentious or have been refuted. Norris denied that cetacea go mute in captivity. He pointed out that:

> 'Well over half of all scientific studies of their sounds have been done with trained animals in tank environments, and in fact,

> George Pilleri (1982), who has raised the question, has himself published papers on the sounds of captive dolphins.'[28]

With regard to brain atrophication claimed by Pilleri, Ridgway has stated:

> 'during the past 15 years, I have examined the brains from dolphins that died at four of the largest oceanaria in the United States. My series includes dolphins that had been in captivity for as long as 16 years. I have found no evidence to support the claim of Pilleri (1983) that "cetacea kept in captivity actually do display many symptoms of degeneration".'[29]

Ridgway has also denied that dolphins go mute in captivity. He states that:

> 'My present studies concern the sonic repertoire of dolphins captive for as long as 22 years. I have recorded as many as 50 000 sounds from an individual in a single 24-hour day.'[30]

6.32 Abel claims that Pilleri's observations on behaviour and physical abnormalities were distorted by the very small size of tank being used.[31] It should be noted also that Pilleri observed that when a male cetacean was placed in a larger steel tank with a capacity of 30 cubic metres:

> 'The greater width ... allows the animal more freedom in its movements and during the last six months new swimming patterns have been observed. The individual movements are not stereotyped; the changeover from one pattern to another is very irregular and impossible to anticipate.'[32]

6.33 Forms of behaviour attributed to captive cetacea such as stress, aggression, dominance, masturbation and relationships with other cetacean species have also been observed for wild cetacea and documented in the literature cited. Some animal

welfare scientists consider that conflict, frustation and stress experienced by animals in the wild are probably helpful in survival and reproduction. It is not always possible, on the available evidence, to know whether the nature and extent of these forms of behaviour in captivity differ from those which occur in the wild.

6.34 It is not possible to generalise from examples of behaviour in specific cases to conclude that all cetacea suffer in captivity. Information on cases often does not identify species, age, numbers of other cetacea present and the conditions under which the cetacean was kept captive. Carter, for instance, citing the case of the dolphin with the duodenal ulcer stated:

> 'it was found that this animal alone, of the entire group, had become nervous because of the crowds that peered at him through a glass wall.'[33]

6.35 Available information does confirm that all cetacea suffer some stress during capture and transportation.

6.36 In Australia, two observations about apparent stress in cetacea were documented at African Lion Safari, Warragamba by F. Smith.[34] and at Atlantis Marine Park, Yanchep by R. Fuller.[35]

Mortality and Longevity

6.37 It is generally accepted that analyses of mortality rates and longevity can be used for the objective measurement of the welfare of animals in captivity.

6.38 Overseas evidence shows that cetacean mortalities are high in captivity and that life expectancy is reduced. A summary of all information sighted on overseas mortalities is included in Appendix II.

6.39 However a number of problems exist in assessing mortality and longevity data. Information on longevity and mortality rates for different species of cetacea in the wild is far from complete and it is not always possible to compare captive and wild rates. There is, however, some limited data. Gaskin concluded that the maximum life span of Delphinus Delphis is about 25 years[36] and that the life span of free-ranging Tursiops is up to 20 years.[37] Bigg considered that orca may live from 48 to 100 years in the wild.[38] Ridgway believed that mortality in the wild is between 10 and 20 per cent annually.[39] Spong found a 9.3 per cent mortality for orca over a ten year period.[40]

6.40 The evidence on mortalities is disputed by a number of critics on both sides of the debate. Belford noted that few data on captive cetacea had been provided by independent scientists not employed by or associated with aquaria and he went on to illustrate that there have been considerable differences between the results of various surveys.[41]

6.41 Norris characterised Pilleri's documentation of capture mortality as a 'series of undated instances whose total numbers or trends cannot be assessed'. He claimed that newer methods of capture and husbandry have made significant changes. Species which are good captive animals have been identified and difficult forms are now no longer sought. Captive mortality rates for bottlenose dolphins, the most commonly kept species, have dropped and:

> 'Present data indicate that in the best organizations life spans for it may exceed those in nature and births are frequent.'[42]

6.42 Pilleri, in turn, has criticised the findings of decreased mortality in oceanaria by the Animals on Display Workshop,[43] based on the census of captive marine mammals in the United States from 1979 to 1983, calling the statistics '... nothing more than a meaningless bag of incommensurable relations'.[44]

6.43 Abel has written,

> 'I am aware of the selective mortality statistics being used by Project Jonah Victoria in opposition to Marine Parks. However, many of the figures quoted have not been quantified, and presented in perspective to the current legislations, guidelines or status of Marine Parks in Australia in 1984.'[45]

Project Jonah, Victoria, has countered by alleging that:

> 'While figures from overseas dolphinaria have been difficult to come by, accurate figures from Australian dolphinaria have been quite impossible to obtain.'[46]

6.44 Abel drew attention to the study of cetacean mortalities made by Walker (See Appendix II). He considered:

> '... that it has been misused in another attempt to substantiate and give scientific credibility to the arguments put forward by todays activists.'

He pointed out that Walker observed that a thorough, systematic, detailed examination of possible variables that may potentially affect changes in the mortality of cetaceans captured in the future is much needed. These studies should provide additional information to update clinical and husbandry techniques in order to cover capture mortality. He went on to say that Walker further stated that the greatest mortality of all species concerned occurs in the first year of captivity and that the

data presented in the paper on longevity and mortality rates are actually analysed over a two year period. Several major advances have been made in the techniques mentioned and as a result mortalities in these first two year periods have been overcome. Abel argued that the result of Walker's paper now would show 100 per cent survival when we now keep only those species, Tursiops or Sousa in captivity.[47]

6.45 Abel considered that it is necessary to identify: the source of the statistics being quoted, the species involved, the circumstances under which they were collected, the reason for collection, whether the statistics included stranded animals, the capture conditions, whether the statistics were within a 5, 5-10, 10-15 or 15-40 year period and whether the cetacea were collected prior to or after whale protection legislation and guidelines.[48]

6.46 Statistics for mortalities during capture for oceanaria and for cetacea in captivity in oceanaria in Australia show that generally Australia has a better record than overseas in catching and keeping cetacea.

Table 2: Capture Mortality for Cetacea for Australian Oceanaria

	Females	Males	Deaths
Atlantis, Yanchep	4	3	0
Marineland of SA, Adelaide	3	2	0
King Neptune's Park, Port Macquarie	2	1	0
Pet Porpoise Pool, Coffs Harbour	0	0	0
African Lion Safari, Warragamba	3	2	0
Sea World, Surfers Paradise	7	7	0
TOTALS	19	15	0

Table 3: Australian Captive Cetacean Mortalities

OCEANARIUM		SPECIES	SEX	ESTIMATED AGE	CAPTIVITY TIME	DATE OF ARRIVAL	DATE OF BIRTH	DEATH	SOURCE	METHOD OF CAPTURE
Atlantis Marine Park Western Australia	1	Tursiops truncatus	M	5-9		1981			Capture	Breakaway Hoop
	2	Tursiops truncatus	M	5-9		1981			Capture	Breakaway Hoop
	3	Tursiops truncatus	M	5-9		1981			Capture	Breakaway Hoop
	4	Tursiops truncatus	F	5-9		1981			Capture	Breakaway Hoop
	5	Tursiops truncatus	F	5-9		1981			Capture	Breakaway Hoop
	6	Tursiops truncatus	F	5-9		1981			Capture	Breakaway Hoop
	7	Tursiops truncatus	F	5-9		1981			Capture	Breakaway Hoop
African Lion Safari New South Wales	2	Tursiops gilli?	F	20-25		16.1.73		16.3.73	Seaworld, Qld	Net in Shallow
	3	Tursiops sp.	F	25 +		16.1.73		10.8.73	Seaworld, Qld	
	4	Tursiops sp.	F	4-8		16.1.73		21.11.75	Seaworld, Qld	
	5	Tursiops sp.	F	15 +		26.10.73		11.11.73	Seaworld, Qld	
	6	Tursiops sp.	F	15 +		28.11.73		5.9.74	Capture	
	7	Tursiops sp.	M	12 +		5.10.74		27.7.76	Capture	
	8	Tursiops sp.	F	2-4		Nov. 1974		26.1.77	Capture	
	9	Tursiops sp.	F	7-9		12.12.75		9.2.81	Capture	
	10	Tursiops sp.	F	2		28.1.76			Capture	
	11	Tursiops sp.	M	10-15		23.3.77			Seaworld	
	12	Tursiops sp.	M	15-20		23.3.77			Seaworld	
	13	Tursiops sp.	M	15		23.3.77		14.12.79	Seaworld	
	14	Delphinus sp.	F	3 +		12.7.77		13.7.77	Stranding	
	15	Tursiops sp.	?				24.11.80	24.11.80	Captive birth	
	16	Tursiops sp.	F				8.3.82	8.3.82	Captive birth	
	17	Tursiops sp.	M				15.11.83	30.12.83	Captive birth	

OCEANARIUM		SPECIES	SEX	ESTIMATED AGE	CAPTIVITY TIME	DATE OF ARRIVAL	DATE OF BIRTH	DEATH	SOURCE	METHOD OF CAPTURE
Marineland of	1	Tursiops truncatus	M	18-20		1969			Capture	
South Australia	2	Tursiops t.	M	18-20		1969			Capture	
	3	Tursiops t.	F	6		1969		1983	Capture	
	4	Tursiops t.	F			1969		1975	Capture	
	5	Tursiops t.	F	18-20		1969			Capture	
	6	Tursiops t.	M	5			1980		Captive birth	
	7	Tursiops t.	F	3			1982		Captive birth	
Pet Porpoise	1	Tursiops t.	F	27	12 1/2	1974			Stranding	
Pool	2	Tursiops t.	M	18	12 1/2	1974			Stranding	
New South Wales	3	Tursiops t.	F	5			1979		Captive birth	
	4	Tursiops t.	F			1975		1975	Accidential netting	
	5	Tursiops t.	F			1978		1980		
	6	Tursiops t.	F			1984			Removed from stranded mother	
	7	Tursiops t.	?				1985		Captive birth	
Seaworld	1	Tursiops t.	F	32	19	1966				
Queensland	2	Tursiops t.	M	25	18	1967				
	3	Sousa chinensis	F	25	17	1968				
	4	Tursiops t.	M	25	16	1968				
	5	Tursiops t.	F			1971		1981		
	6	Tursiops t.	F	19	13	1972				
	7	Tursiops t.	F			1972		1978		
	8	Tursiops t.	F	17	13	1972				
	9	Tursiops t.	M	20	13	1972				
	10	Tursiops t.	M	16	12	1973				
	11	Tursiops t.					1973	?		
	12	Tursiops t.	M			1973		1977		
	13	Tursiops t.	M			1973		1977		
	14	Tursiops t.	M			1973		1983		
	15	Tursiops t.	F	18	11	1974				
	16	Tursiops t.	M	18	11	1974		1985		

OCEANARIUM		SPECIES	SEX	ESTIMATED AGE	CAPTIVITY TIME	DATE OF ARRIVAL	DATE OF BIRTH	DEATH	SOURCE	METHOD OF CAPTURE
Sea World Queensland (Continued)	17	Tursiops t.	F	17	10	1975				
	18	Tursiops t.	M	9 1/2			1976			
	19	Tursiops t.			7		1976	1983		
	20	Tursiops t.	M			1978		1983		
	21	Tursiops t.	F				1978	1983		
	22	Tursiops t.	F	5			1980			
	23	Tursiops t.	M	19	4	1981				
	24	Tursiops t.					1981	1981		
	25	Pseudorca crassidens	F			1982		1982		
	26	Tursiops t.	F			1982		1982		
	27	Tursiops t.	M			1982		1982		
	28	Tursiops t.	F		3	1982				
	29	Tursiops t.	M		2	1983				
	30	Tursiops t.	F		2		1983			
	31	Tursiops t.					1983	1983		
	32	Tursiops t.	F		1 1/2	1984				
	33	Tursiops t.	F		1 1/2	1984				
	34	Pseudorca crassidens	M	1 1/2		1985				
	35	Pseudorca crassidens	F			1985				
	36	Tursiops t.	F	20	1/2	25.6.85				
	37	Tursiops t.	F	5	1/2	30.8.85				
	38	Tursiops t.	F	7	1/2	7.5.85				
King Neptunes Park, N.S.W.	1	Tursiops t.	F	15-16	12				Captured Point Plumber	
	2	Tursiops t.	F	14	7				Captured near Port Macquarie	
	3	Tursiops t.	M	8	5				Stranded in Kendall River	
	4	Tursiops t.	F	4	5 wks	1977		1977	Stranding	
	5	Tursiops t.	F	10	3 wks	1980		1980	Stranding	
	6	Tursiops t.	F	8-10	3 wks	1981		1981	Stranding	
	7	Tursiops t.	F	6	5 wks	1982		1982	Stranding	
	8	White River dolphin	F	14	7 yrs	1974		1981	Captured Harvey Bay. 12-18 months in Pet Porpoise Pool.	

OCEANARIUM		SPECIES	SEX	ESTIMATED AGE	CAPTIVITY TIME	DATE OF ARRIVAL	DATE OF BIRTH	DEATH	SOURCE	METHOD OF CAPTURE
Hamilton Island	1	Tursiops t.				1984		1984		
	2	Tursiops t.				1984				
	3	Tursiops t.				1984				
	4	Tursiops t.				1984				

Breeding

6.47 Lee has stated that:

> 'Physiological stress in mammals is usually accompanied by impaired reproduction. Established effects are infertility, in utero loss of embryos, in utero damage of embryos, delayed maturation and impaired lactation and parental neglect.'[49]

6.48 In North America, a census for the period 1976 to 1979 found that 70 per cent of establishments containing cetacea which had been contacted had, or were in the process of establishing, breeding programmes and that there had been a marked increase in births for the period. Data collected by Ridgway and Benirschke for the period to 1975 indicated that, in the 53 per cent of zoos and 67 per cent of oceanaria surveyed in North America, there had been 107 Tursiop truncatus births in captivity. Of these, 22 were still alive in 1976. Cornell, Asper and Duffield found that between 1976 and 1979 there were more than 25 Tursiop truncatus births in captivity and 14 were still alive in 1979. Data were provided for numbers of stillbirths and early calf mortalities caused by lack of maternal care or inexperience on the part of the mother, for the most reproductively successful cetacean - the bottlenose dolphin. The number of stillborn or early deaths remained consistent at 45 per cent for the three years. The authors stated that:

> 'the data covered several breeding programmes and did not seem to be related directly to such problems as the effects of capture since all the births recorded were clearly conceived in captivity. The 1976-1979 values for stillbirths and early mortalities in the Bottle nosed dolphin are similar to those collected in a comprehensive survey of breeding in this species up to 1975 and reported in the Tursiops Breeding Workshop (Ridgway and Benirschke 1977).'[50]

6.49 Bryden has noted that 'one of the major obstacles to the detailed study of reproduction in dolphins has been the difficulty of breeding them in captivity'. He quotes Sweeney, (1977) as reporting 31 per cent of all Tursiops pregnancies in captivity resulting in stillbirth with mortality rate of survivors at 49 per cent in the first year. Most of these mortalities occurred as a result of inadequate maternal care. Bryden commented that 'it is difficult to advise on optimal husbandry practices likely to improve reproductive performance in captive animals, because so little is known about the ecology of dolphins in the ocean'. He discussed the advisability of having other dolphins of the same species present in the pool and the optimum pool size for breeding. He concluded that 'there remain many more questions concerning reproduction in dolphins than answers' but noted that work in reproduction needs to be carried out on both captive and wild populations and pointed to the important recent physiological studies at Sea World, California which revealed 'vital information about ovulation in dolphins'.[51]

6.50 Lee considered that some recent breeding programmes in the United States suggested that husbandry is available to improve reproductive success in captivity.[52] Warneke wrote that 'it has been observed that once a colony of experienced breeding animals is established, calving occurs regularly and survival of the young appears to be assured'. He cited the examples of Sea World, Florida and Sea World, San Diego, where loss owing to stillbirth and infant mortality was less than eight per cent between 1978 and 1982.[53] Lee, using the same two examples, pointed out that intervals between births were similar to those estimated for natural populations.

6.51 It should be noted that there is a lack of information on cetacean breeding and survival rates in the wild with which to compare captive breeding programmes. However, a descriptive

and critical review of existing methods for estimating reproductive parameters in wild dolphins and small whales is provided by Perrin and Reilly (1984).[54] The review includes pregnancy rate, calving interval, gestation period, age and sex structure and size and age at attainment of sexual maturity.

6.52 Statistics for births in Australian oceanaria are given below. All were conceived in captivity.

Table 4: Births in Australian Oceanaria

OCEANARIUM	SEX	SPECIES	DATE OF BIRTH	DATE OF DEATH	AGE	STATED CAUSE OF DEATH
African Lion Safari, NSW	?	Tursiops sp.	24.11.80	24.11.80	-	Drowning
	F	Tursiops sp.	08.03.82	08.03.82	-	Drowning
	M	Tursiops sp.	15.11.83	30.12.83	5 wks	Unknown
Marineland, SA	M	Tursiops t.	1980		5 ys	
	F	Tursiops t.	1982		3 ys	
Pet Porpoise Pool NSW	F	Tursiops t.	Dec 1979		5 ys	
	?	Tursiops t.	21.06.85		few mths	
Sea World, Qld	?	Tursiops t.	20.05.73	?		Heart aneurysm
	M	Tursiops t.	29.12.76			-
	?	Tursiops t.	5.07.76	11.04.83		?
	?	Tursiops t.	21.11.78	13.05.83		Septic-aemia & intest-inal haemorr-hage
	F	Tursiops t.	8.03.80			
	F	Tursiops t.	12.02.83			
	?	Tursiops t.	18.11.83	18.11.83		Stillborn
	?	Tursiops t.	24.06.81	10.07.81		Liver In-fection