Home At Last

A Review of the Releasability of Long-Term Captive Orcas
with special consideration of Lolita/Tokitae at the Miami Seaquarium
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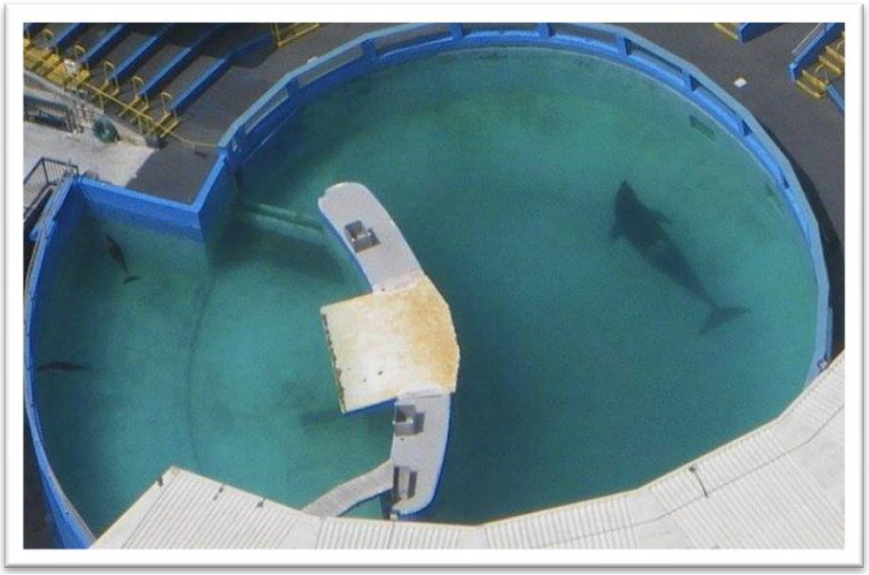

From this display tank…

…to a seapen in her home waters.

Summary

This report reviews relevant scientific knowledge to ascertain whether and under what circumstances a long term captive orca could safely be released or retired in its wild habitat. It concludes that a program of rehabilitation and retirement in native waters, with the ultimate option of potential release to rejoin the family of birth, presents little or no significant risk, either for the released animal or for wild populations.

Return to native waters is called for in many cases because survival for captive orcas is significantly reduced in comparison to their wild counterparts.

Many long term captive cetaceans have survived and thrived after release. (See Appendix C – List of Cetacean Releases).

Any communicable disease or susceptibility to disease or infection can be detected in a candidate for release prior to potential exposure with wild populations.

Long term captive orcas are capable of pursuing and catching live prey fish. Upon return to his native waters in Iceland Keiko immediately proved his ability to forage competently, using the echolocation ability that he had not needed for 18 years.

The large extended families of orcas are tightly knit societies, their neuroanatomy is massive, with intense gyrification, including spindle neurons (believed to enhance empathy) corresponding to their prodigious memory, indicating orcas have the ability to recognize and accept returned former captives even after a long absence.

Communication systems used by orcas are retained regardless of length of time in captivity, indicating orcas have the ability to effectively communicate even after a long absence.

Lolita, at the Miami Seaquarium, is an ideal candidate to proceed with a program of retirement for potential release.

Chapter 1 - Introduction

The question of releasability of long-term captive orcas can be reviewed by looking at each point in the rehabilitation/retirement/release process where a risk might occur. No orca has been seriously harmed during transport in the 34 year history of the industry, so no significant risk is involved in any stage of the delivery to the rehabilitation site. The longest transport took 63 hours. (Dudok Van Heel, W.H., 1986). Keiko required 24 hours out of water from Newport, Oregon to Westmannjar, Iceland. The total time out of water for Lolita would be less than half that time. When moving an orca it is routine protocol for the animal's known and trusted trainers or other personnel to accompany it during the flight and for a time thereafter.

When recovering from any illness, the most therapeutic environment for a cetacean is its natural waters, so the contact with seawater does not pose a problem. Orcas have adapted globally to a wide range of temperature variability, but the crucial factor is the rate of change more than the destination temperature. Since Lolita's water is kept at about 55 degrees, and the temperature of her home water is about 50 degrees, the change should not be beyond her ability to comfortably adapt. Thus, assuming all preparations are in order, the immersion into her native waters, in an anchored, protective sea pen, poses no significant risk. Food provision, medical care and human companionship would continue indefinitely if needed. Keiko showed no sign of shock or trauma upon his transport to Oregon or to Iceland. For Lolita the waters of her birth and early years, where she spent the first approximately four years of her life, will be familiar to her, There she could again taste seawater and feel the tides and currents, and have visual and acoustic access to open water and the creatures that live in her home environment.

Meeting her family pod would probably take place whenever they arrived within a few miles of the sea pen, but that meeting would not necessitate the release of Lolita, unless and until she was deemed ready for release by a panel of experts. If any risks are foreseen the gate would not be opened and Lolita would be retired and cared for in a bay and cove in the inland waters of Washington State. If all goes well she will be allowed to swim with her family, and will be closely watched at least until it is certain that she has successfully reintegrated with her family.

The species *Orcinus orca* has no predators, so there is no danger that a released orca would be subject to predation.

Any reintroduced orca should, if possible, be returned to its native waters in the proximity of its closest relatives, who share the same vocal dialects and cultural traditions, to maximize a sense of familiarity and opportunities for recognition and acceptance by family members. There is no dispersal from Lolita's extended family, and relationships among family members show few, if any, signs of aggression, so there is little reason to expect rejection from her pod of birth, although acceptance is not expected to be immediate and may require days or weeks, or possibly longer.

Legitimate questions arise in Lolita's case because she has been separated from her family for over 4 decades. To assess whether her family would recognize and accept Lolita, a simple experiment involving a long distance vocal communication, in essence a telephone call between Miami and the Puget Sound could be arranged almost immediately upon authorization by Seaquarium management. The quality and duration of such a call would indicate recognition by vocal communication.

There are other lines of evidence to anticipate the response of her family. There have been successful releases of cetaceans similar to orcas after long captivity. In 1968 a male pilot whale (much like orcas in their social and family cohesion) was released from a display tank to the open ocean off California after more than seven years in captivity, and was sighted in the company of other pilot whales three years later. A bottlenose dolphin escaped after 17 years in captivity in the Bahamas and was observed 8 months later looking fit, in the company of other dolphins (See Appendix C – List of Cetacean Releases).

Even after these assurances, it is understandable that for many people, the most vexing question remains: What would happen in the case of a long term captive orca, like Lolita, upon meeting her family pod? Lolita's extended family, the Southern Resident community, is the most extensively studied community of orcas, or any cetaceans, in the world. There is no dispersal from the family and they are predictably found for most of each year in a protected inland sea. Neither males nor females ever depart from the community for the duration of their lives. Thus family memberships are permanent for both sexes, and although the return of a long term captive is obviously highly unusual, with their demonstrably long memories and lifelong bonding, the three surviving females who were alive and present when Lolita was captured would likely retain the memory of their long lost family member. The other family members would likely take their cues from the elder females and would recognize the calls and other indications that Lolita had learned the traditions of her family. Therein lies the most fascinating scientific value of allowing Lolita to communicate with, and potentially rejoin, her family.

Vocal communication calls are unique to each orca community. Lolita still uses her family's calls, which would presumably be understood by her family.

In the wild, orca females average over 50 years longevity, and can live well beyond their eighties. One female, J2 Granny, is estimated to be over 100 years of age.

So it appears that other than a general unease with the idea of returning Lolita to an ocean environment, the actual steps involved are biologically viable. Contingency plans will allow a smooth adjustment to retirement if she is unable to swim freely and rejoin her family.

This report will attempt to establish each of these points while describing a general outline for releasing a long term captive orca, and will offer an overall proposal for the reunification of Lolita with her native habitat and family pod. Each section is presented

briefly, in summary form, with references where appropriate. Taken as a whole, it is hoped that any realistic concerns or questions about the proposal to retire Lolita to her home waters for potential release to rejoin her family are answered here.

Chapter 2 - Survival rates in the wild and in captivity

Current data can be confusing and misleading without understanding the historical circumstances of the populations that have been studied, but the scientific community was aware by 1980, after only a half a dozen years of research, that life spans of orcas in natural habitats are approximately equivalent to human life spans. The data are also clear that orcas in captivity suffer from extreme stress, injuries, disease and infections, and survive on average less than nine years in captivity. According to research done in 2011 by The Orca Project:

> Marine parks such as SeaWorld tout their ability to provide environments adequate to keep orcas alive. However, this claim is not supported by the evidence. Approximately 161 orcas have died in captivity to date (August, 2015), not including stillborns and miscarriages. Based upon the MMIR data, we have calculated the mean duration of captivity (MDC) to be less than nine years. This is regardless of whether an orca was extracted from the ocean, or born at a theme park.

SeaWorld's explanation of longevity comparisons between wild and captive populations states: "The issue of killer whale lifespan is one that is often misconstrued and overly simplified. The simple truth is that no one knows." But then they go on to say that they do know: "The data we do have show that killer whales at SeaWorld are living as long as their counterparts in the wild."

But how long do they live in natural habitats? Based on 14 years of field work on Northern and Southern Resident orcas, Olesiuk, et al. (1990) concluded:

> Females have a mean life expectancy of 50.2 years, typically give birth to their first viable calf at 14.9 years of age, produce an average of 5.35 viable calves over a 25.2 year reproductive lifespan and have a maximum longevity of about 80-90 years.

and

> Males have a mean life expectancy of 29.2 years, typically attain sexual maturity at 15.0 years and physical maturity at 21.0 years of age, and have a maximum longevity of about 50-60 years.

Based on a comparison of the estimates arrived at by Olesiuk, et al., with data derived from National Marine Fisheries Service records for captive orcas, Small and DeMaster (1995) found that non-calf mortality of captive orcas was significantly higher than those in the wild:

> Survival of the wild population Olesiuk, et al. studied, based on approximately 250 non-calves, was significantly higher than our estimates for non-calf captive killer whales.

Thus, mortality is significantly higher in captivity for all ages. Small and Demaster (1995) also note that survival of killer whales in captivity has not improved recently:

> ...over the 5-year period between 1988 and 1992 compared with estimates based on data through 1987 [i.e., since 1965]...survival in captivity for killer whales...remained the same.

A 2005 paper by Olesiuk, Ellis and Ford listed the following life expectancies:

> 46 years for Northern Resident females from 1973 to 1996 and 30 years from 1996 to 2004; 50 years for Southern and Northern Resident combined females from 1973 to 1987; 39 years for Southern Alaska Resident females from 1984 to 2001; 31 years for Northern Resident males from 1973 to 1996 and 19 years from 1996 to 2004; 29 years for Southern and Northern Resident combined males from 1973 to 1987; and 31 years for Southern Alaska Resident males from 1984 to 2001. (The complete breakdown is in Table 14 on page 55 at the above link.)

The 2005 Olesiuk, et al. paper is the best summary of orca lifespans to date with hard data, however, those data are from a populations that were quite likely significantly culled by random shootings prior to the start of the field studies. The estimates for Northern and Southern Residents in Olesiuk, et al. are based on observations beginning in 1973, but mortalities from shootings may have been high for decades prior to that date, which could have significantly biased the lifespan estimates downward, because many animals would have added to the ranks of older age classes during the study if they had not been killed. Olesiuk et al, p. 4:

> ...it is possible substantial numbers may have been injured or killed opportunistically by fishermen, fisheries personnel, and sportsmen during an era of widespread predator control. Bullet wounds were evident in up to 25% of the animals taken during the live-capture fishery in the 1960s and early 1970s (Keyes cited in Hoyt 1981).

Another important caveat to qualify the data in Olesiuk, et al., is the effects of bioaccumulative persistent toxins on lifespans. For this see: Ross, et al., High PCB Concentrations in Free-Ranging Pacific Killer Whales, *Orcinus orca*: Effects of Age, Sex and Dietary Preference (2000). Both No. and So. Residents show high levels of these toxins (either dumped into marine environments when banned in the late 1970s or blown in by wind currents from Asia), which could have significantly reduced the lifespans described in the data in the 2005 paper. These toxins tend to compromise immune systems, especially when combined with food shortages. Fortunately, these pollutants are now in decline in the Salish Sea (Ross, 2013).

The assertion that lifespans of free-ranging orcas in natural habitats are similar to human lifespans is based partly on the data in those papers, adjusted for the above

caveats, but also on some rather astounding parallels in the phases of life for orcas and humans.

Emma Foster, et al. (Foster, 2012) describes an important element of orca natural history: female reproductive senescense, or menopause. A striking similarity between humans and orcas comes clear in the female post-reproductive lifespans of both species.

Orcas and humans (and pilot whales) are the only mammals known to science (so far) to exhibit extended (decades-long) menopause. For both humans and orcas, females are reproductive for about 25 years from their mid-teens until around 40 years of age, but often live 3 or 4 decades after their last offspring is born. In natural orca populations, mating is governed by cultural traditions (along with diet, language, etc.). The first calf is born when the mother is about 14-15 years old. Most human females are biologically capable of having their first baby at about that age. (At SeaWorld, females are often bred much earlier, at 6 or 7 years old, indicating either artificial inducement by hormonal supplements, or the absence of cultural restraints, or both.)

We don't have exact birth years for the older orca females born before photo-ID studies began in 1973, but several females have been post-reproductive since studies began, and are still alive, indicating they are at least around 80 now, and some are older. That is roughly equivalent to human life spans.

Olesiuk, et al. (2005), p. 33:

> It has become clear that killer whales can live much longer than the 25-30 years suggested by annuli in teeth (Mitchell and Baker 1980; Christensen 1982, 1984) or survival rates of captive animals (Small and DeMaster 1995). Most of the females that were in their teens when our study began 3 decades ago, are still alive today. Indeed, several of the females that were post-reproductive, suggesting they were at least in their 30s or 40s when the study began, are still alive.

Male maturation rates are also very similar for humans and orcas, with sexual maturity beginning in early to mid-teens with full maturity in late teens to early twenties. This indicates that full male lifespans in undisturbed populations may also be similar to human lifespans.

Absent the pre-1973 mortalities from shootings, and the accumulated toxic contamination from persistent organochlorine pollutants (now declining), the data would undoubtedly have shown many more females in their 80s and 90s or older, and more males in their 60s and 70s or more, roughly equivalent to human lifespans. It is entirely possible they would have even longer average lifespans than humans.

Orca captures began in earnest in 1966, so if survival for the captives had not been seriously reduced by the effects of captivity, there would be many captive orcas over

40 years old. From 1965 to 1978, 68 orcas had been caught, most, if not all, at 1-3 years of age, in the US, Canada, and Iceland, and delivered to display facilities worldwide. None are still alive today except Corky (captured from the Northern Resident Community in 1968, now at SeaWorld in San Diego) and Lolita.

Bacterial pneumonia is the most common cause of death for captive dolphins (Sweeney and Ridgway, 1975) and orcas (Greenwood & Taylor, 1985).

Thus, the claim that Lolita is just fine where she is, that she is healthy and happy, is not supported by the evidence. That is similar to saying that Nelson Mandela survived 27 years in prison and became the leader of his country, so we may assume that his South African jail must have been a healthy environment.

The only reasonable conclusion is that the conditions of captivity, even in the best of circumstances, leads to early death for orcas. From this insight one can further conclude that for Lolita, neither a move to another park nor to a new tank built on the Seaquarium site would appreciably improve or lengthen her life.

Increasing public awareness that the killer whales who are confined to tanks tend to die in their youth is contributing to the public's perception that captives are neither healthy nor happy. As accurate information about survival rates in captivity becomes widely known, the experience of attending marine parks is increasingly seen as condoning the mistreatment of whales and dolphins. This evolution of public opinion has begun to redefine killer whale shows as an unpleasant experience, which has in turn reduced attendance at marine parks and thus revenues at the gate. The morale of many of the thousands of marine park employees could also be affected as they discover the factual longevity statistics. Many marine park employees have themselves been led to believe that the whales that have died under their care were approaching their maximum life span, and that they would have had a much more difficult life, and probably would have died sooner, in their natural habitats. Those employees are discovering that they have been misled by their employers.

There is no significant risk involved in Lolita's transport and phased reintroduction to her native waters, whereas her early demise is statistically probable if she remains in the Seaquarium facility or in any captive setting. Returning her to the waters in which she was born is the only course of action that allows her a chance of enjoying normal longevity.

Chapter 3 - Precedents

The introduction to List of Cetacean Releases (Appendix C) contains the following:

> Currently, a major point of contention in the issue of release or reinstatement of captive cetaceans is whether the dolphin or whale will readapt to catching live prey after it has been fed piecemeal in prolonged captivity. Another point of contention is whether released animals will spread acquired pathogens to the wild community, or have sufficient immunity from pathogens in the wild. A third point concerns the question of whether a released cetacean will readapt socially, or be condemned to a life of loneliness.
>
> These points must be responsibly addressed, but if post-captive release is dangerous and irresponsible, then why has it been done so many times by organizations that are generally considered responsible?

Cetacean Releases contains accounts of a total of 121 bottlenose dolphins that were set free. Twenty-nine of these were held for more than one year. Three were released into Biscayne Bay by the Miami Seaquarium after 1 year, 2 years, and 10 years of captivity. Six were inadvertently released by the U.S. Navy after more than a year in captivity, and another eight were let go after less than a year. Only in a few cases was any attempt made to determine if the animals survived, but at least six of the 29 that were held more than a year were sighted several months later in apparent good health.

In 1991 two pilot whales that had stranded on the coast of Florida were rehabilitated by the Miami Seaquarium and released. Though most of their family had presumably died in the stranding, these two were sighted by the US Coast Guard in 1994, with their radio tag harnesses still intact, in the company of other pilot whales.

Keiko lived more than five years after his return to his native waters off the coast of Iceland. He thrived there and foraged on his own in the North Atlantic Ocean.

Ishmael, the orca trained by the U.S. Navy to return to a signal from a boat while miles out to sea. After five months of exercises, Ishmael refused to return to his small holding pen and was never seen again. (See US Navy, Project Deep Ops, 1972)

For the sake of this inquiry into the releasability of a long term captive orca, the most informative releases were that of a female bottlenose dolphin named Bahama Mama and a male pilot whale named Bimbo. Bahama Mama was held for 17 years in the Bahamas until, with no preparation for release, she escaped (Claridge and Balcomb, 1993). She was sighted repeatedly up to 8 months later in good health and in the company of other dolphins. After 17 years in captivity she immediately rejoined a population of wild dolphins.

Pilot whales are possibly the most similar to orcas among the 76+ species of cetaceans. Though slightly smaller, their social systems and general behavior greatly

resemble that of orcas. Bimbo is a pilot whale that was captured in early 1960 when he was an adolescent at a length of 17' 6". He performed well for about three years, until his companion, a female pilot whale (possibly his mother), died. His behavior changed dramatically, becoming alternately agitated and depressed. After twice smashing through observation windows, he was released into the Pacific Ocean in 1967 (Valentry, 1969). Bimbo was positively identified in 1969 and again in 1974, by U.S. Navy dolphin collectors, both times in the company of a community of pilot whales.

The first release of a prolonged captive orca occurred in 1998 when Keiko was returned to his native waters. Keiko was caught at about the age of two, whereas Lolita was about four years old when she was captured. While in Mexico Keiko very nearly expired from the effects of extreme deprivation in captivity. In addition, Keiko's family was virtually unknown. All in all, Keiko was a less ideal candidate for release than Lolita, and yet he lived five years, much of it foraging competently, in his native waters.

A wild orca named Springer, or A73, from the Northern Resident Community, was discovered in Janaury, 2002, alone and emaciated in Puget Sound, some 350 miles from her family's territory. Experts identified Springer’s natal pod by her vocal calls and by examining photographs of her eye patch.

The National Marine Fisheries Service (NMFS) made the decision to capture the young orca and try to reintegrate her into her pod. On June 12, 2002, Springer was captured and moved to a seapen in Manchester, Washington. On July 13, Springer was transported to her family’s summer range in Johnstone Strait, BC and held in a seapen at Dongchong Bay, Hanson Island. She was released the next day when her family pod appeared within vocal range. In October that year Springer was seen traveling with her pod to the open ocean. The following July, she returned to Johnstone Strait with the same pod.

In July 2013, 11 years after her rescue, Springer was seen off the central British Columbia coast with a new calf. As of 2015, Springer has been observed each summer since her release with her pod in Johnstone Strait, becoming the only cetacean in history to be successfully reintegrated into a wild population after human intervention. Again in 2015 Springer was identified with her now 2-year old calf alongside her.

Precedents on record indicate that Lolita’s return to her native habitat for retirement or release would be safe and successful.

Chapter 4 - Disease issues

The issue of communicable pathogens must be seriously considered and all possible measures must be taken to avoid any transmission of disease from Lolita to her family, or from her family or the Salish Sea marine ecosystem to Lolita, and the required protocols are included in Lolita's Retirement Plan.

However, for decades a wide array of alarming and unfounded statements have emerged from representatives of the marine park industry to discourage the release of certain valuable marine mammals.

According to the Miami Seaquarium web site (Appendix M):

> If moved to a new environment, Lolita could be at risk of transmitting or acquiring disease agents she has either become resistant to or has no resistance to, respectively. Not only is this a risk to Lolita, but also to the free ranging killer whale population.

An unsigned letter from the Miami Seaquarium dated September 9, 1997 states:

> Keiko will never be released. He has an incurable viral infection called papillomavirus. While it can be controlled with medication, it remains in the animal's system for the remainder of its life. The infection of papilloma in the killer whale is the first time it has been diagnosed in the species. Many animals get it, dogs cats, horses, and even people. Because of this contagious infection, Keiko will never be introduced to wild populations.

The letter goes on to say:

> If those people who (sic) would ask you for money for Keiko's release, or for Lolita's, be aware that they are asking you for money under less than honest circumstances.

In January, 1998, a team of six veterinarians and pathologists appointed by the USDA found no such contagious disease on Keiko. The USDA said:

> Immunological test results are apparently within known normal parameters, and there was no evidence of recent viral challenges to 48 different viruses.

The government of Iceland, which is highly protective of the productivity of the marine environment, has concluded that Keiko presents no threat to native species.

Prior to any departure from Miami, Lolita should and would be given the same comprehensive examination that was performed for Keiko under the auspices of the USDA. It is worth noting that nowhere in the Seaquarium web site or in the cited letter is it stated that Lolita actually has contracted any such pathogens.

Among the hundreds of marine mammals that have been released over the years after human contact, including the many dolphins, pilot whales and manatees released by the Seaquarium, there are no incidents of suspected infection of, or by, wild populations.

There is no evidence that Lolita has any contagious disease, nor is there reason to believe that she lacks immunity to any diseases found in her native habitat, to which she would have been exposed early in her life when natural immunities are developed. Nevertheless, it is a clearly necessary prerequisite to any consideration of her return to her native habitat that she be examined thoroughly to remove any doubt that her reintroduction to her home waters would be entirely safe for her and for her family.

Nolan Harvey of the Free Willy/Keiko Foundation said: (*Oregonian*, October 25, 1997):

> "Of course, we're concerned about that [disease] issue," "It's a justifiable issue, but it's also an excuse for a lot of people. Stranded animals come into contact with humans and with other animals that are not necessarily their species. They've been releasing marine mammals back into the wild for years. We can test him for every possible thing," he said.

Chapter 5 - Foraging Ability

The Seaquarium web site states:

> Lolita has lost her ability to forage and catch live fish. Pursuit of prey is a full time job for wild killer whales and often requires complex cooperative "pack hunting" techniques.

Only once has any marine park allowed a scientific investigation of the theory that a long term captive would lose its ability to catch live fish. Two researchers (Newman and Markowitz, 1993) released live coho salmon with two orcas in a tank at Marine World Africa USA. The two orcas, captive for 24 and 13 years, echolocated on the fish, then caught and ate them.

Keiko also demonstrated his ability to catch live fish. According to the *Seattle Times* (May 16, 1998):

> Keiko the celebrity killer whale is gulping down 10-pound steelhead these days as if they were guppies...They started by feeding him dead fresh fish, then advanced to stunned fish that didn't swim much. Now, a couple of months into training, Keiko is chasing live steelhead and slurping them down...During a recent live-fish training session, Keiko tracked four steelhead to their doom without delay, swallowing them head first. He eats about half his diet now in live fish.

Lolita was about four years old when she was captured. For at least three of those years she was chasing and catching her own fish, and without doubt she was engaging in complex, cooperative foraging strategies. A gradually phased, structured experiment to test her abilities to catch live salmon would be instructive, but has not been allowed or conducted by the Seaquarium, but there is no reason to believe she would have forgotten how. Seaquarium staff have claimed that Lolita was once afraid of an Atlantic spiney rockfish in her tank, which is not a meaningful test of her foraging abilities.

Empirical studies and deductive reasoning lead to the conclusion that Lolita is fully capable of rapidly regaining and practicing the skill of catching and eating live fish, individually and cooperatively, if given just a little practice.

Orcas, as members of the *Delphinidae* family that includes all dolphins, are known to share food with young or injured family members. It is reasonable to speculate that if Lolita should have difficulty obtaining sufficient fish in the days or weeks after her reunification with her family, other family members might assist her while she regained the needed skills.

Chapter 6 - Social systems and bonds

To maximize the likelihood of successful reintegration with its natal family when releasing a captive orca, there must be clear recognition and acceptance by its natural family. Family membership begins at birth and continues throughout the life of the animal. Orcas for which reliable field data is known maintain extremely tight cohesion of the family group. Within Lolita's extended family both the male and female offspring remain with their mothers for life. This indicates that a high survival value is placed on permanent inclusion of every member of the family.

This lifetime bonding presents both opportunities and problems. Keiko's family was unknown, and it is unlikely that he was ever in close proximity to them. He was apparently not accepted by members of other families or pods.

For Lolita the situation is much more promising. Each member of her family has been documented in photographs every year since the early 70's. Photographs taken at the time of her capture show at least six identifiable individuals that were too old for capture and were released. Three members of Lolita's family who were present when she was captured are still alive today, and one of those, L25 Ocean Sun, estimated to be in her mid-eighties, could possibly be her mother.

At this writing Lolita's extended family consists of 81 individuals, up from 71 when captures ended in 1976. The community is made up of three pods, J, K, and L pods, with 27, 19 and 35 members, respectively. The oldest females are the focal point of each family group within the three pods, though the overall authority system that guides the pods or the community is unknown. The three pods tend to travel separately or split into matrilines, but often swim together. All three pods are usually found within the inland waters of Washington and British Columbia from early June through September each year. J pod tends to frequent the inland waters of the Salish Sea during winter months, often foraging for salmon in the southern reaches of Puget Sound.

Perhaps the most revealing discovery of the field research was that the offspring never leave their mothers' company. For every other mammal known, either the males or females, or both, depart the family of birth at or before the onset of maturity and either join another group or become independent. For orcas, at least for the Southern and Northern Resident communities – over 300 whales altogether – the adult males remain within a few hundred yards of their mothers for her entire life, while females and their young may travel a bit farther away from time to time, but still remain well within acoustic range.

In the late spring or early summer of each year K pod and L pod usually return to the protected marine waters. Upon their return there is often a "superpod" greeting, lasting from a few hours to a day or more, in which the members of each pod mingle with members of the other pods, in groups of around a dozen at a time, in slow motions, rubbing and nudging one another, seemingly maximizing bodily contact while a wild

cacophony of vocalizations can be heard with a hydrophone. After this apparent ceremony, which may take place several more times during the summer, each pod or subpod departs in a different direction within the 400 mile long, convoluted inland sea.

Wherever they may be born, or wherever they may find themselves after capture, orcas tend to form into tight, highly organized families. The primary method of communication is vocal, but a variety of physical behaviors reinforce family bonds and relationships. Physical contact is commonplace among orcas.

In captivity, a primary method used by trainers to establish dominance over orcas is to separate families and social groups. "Time-outs," or turning one's back on an orca, is also a way to reinforce obedience. Food deprivation is used as a last resort to coerce cooperation. Still, the orcas tend to organize themselves into cohesive groups with clear leaders. As if to reinforce these bonds, physical contact among captive orcas occurs often during autonomous exercises and random activities.

There can also be friction while establishing role relationships in captive settings, for example if females do not agree about which one is dominant. At Sea World in San Diego, the Icelandic female Kandu was dominant when Corky, an older orca from the Pacific, was delivered there in January of 1987. When Kandu attempted to bite or ram Corky's tailstock, Corky kicked with her tail, which broke Kandu's jaw and severed an artery. Kandu died within a few minutes from loss of blood. There are many other examples of aggression among orcas in captivity.

In natural communities, relationships and rules are established early in the life of each member and transitions appear to be smoothly accomplished. Since females average over fifty years of life and may live into their eighties or more, there is a great deal of stability over the years. Only minor aggression between adult orcas of the same community has been observed. Although the general configurations of the social groups have been discerned, very little is known about actual relationships, even among the communities that have been intensively studied.

Given that three members of Lolita's family were present and aware that she was captured, combined with the species' large memory capacity and lifelong membership in cohesive family groups, it follows that Lolita would recognize her family, she would be recognized by them, and, after a time would likely rejoin them without any significant aggressive incident.

Chapter 7 - Communication

In recent years there has been a great deal of discussion about the capability of many animals to use language and possess culture. Gorillas, chimpanzees, and bonobos (smaller relatives of chimps) have mastered large and complex vocabularies using sign language (de Waal, 1997; Savage-Rumbaugh, Lewin, 1996). Field studies of elephants have indicated their ability to transmit cultural information and communicate across great distances through low frequency sounds (Moss and Shettleworth, eds, 1996; Payne, 1998). Studies with dolphins have demonstrated that they can communicate in syntax using printed symbols and gestures (Herman, et al., 1993; Morrel-Samuels and Herman, 1993) and form complex societies (Pryor and Norris, 1991).

Beginning in the early 1970's John K.B. Ford of the Univ. of British Columbia has been listening in on communities of orcas. After almost ten years he discovered that each community uses its own extensive and complex vocabulary of calls, and that each call is a discrete, recognizable sound, ranging from multi-note whistles, to honks, chirps, bleats, trills and ratchety sounds. These are not just a few calls among a background of moos and grunts, but virtually every sound seems to be a recognizable call. Hundreds of different calls are made by each community, and if you listen long enough, you'll likely hear each one again sooner or later, perhaps with a little different inflection or coming from a different voice. Orcas broadcast at about the volume of a fire engine siren, and sound travels five times faster and further through the water than in air, so it isn't difficult to eavesdrop on their conversations.

Orca communities are made up of separate pods, and Ford found that each pod has developed a few calls that the other pods don't use. The Northern community is also divided into three "clans," with several pods in each clan. Clans are defined linguistically; that is, most of their calls are unique to each clan. The Southern community is considered all one clan on the basis of the similarity of the three pods' calls.

There are two other known orca communities that inhabit the waters around Vancouver Island, called Transients and Offshores, respectively. None of the members of any of the four communities mingles or interbreeds with any of the other communities, and each community uses a totally distinct vocabulary of calls. Other communities around the world have now been recorded and each also uses its own set of calls, and has none in common with any other community. The call systems are believed to change gradually over time.

This means that orcas communicate and determine their behavior by using highly complex symbolic call systems. These findings have been replicated by many researchers since Ford began his pioneering work.

These communication systems have been found to be retained in the memories of captive orcas regardless of length of time in captivity, indicating the ability to effectively

communicate even after a long absence (J. Ford, pers. comm.). Lolita has been recorded making calls that are the same as the calls made by her family — the calls Lolita learned in the four years before she was captured.

According to Dr. Hal Whitehead (submitted manuscript):

> Evidence is accumulating that important information is transmitted from cetacean mother to daughter, or more generally within cetacean matrilines, by instruction or social learning. Examples include the use of sponges as foraging tools by bottlenose dolphins in Shark Bay, Australia, and killer whales intentionally stranding on beaches to catch seals (Guinet & Bouvier 1995; Chapter 6). These are forms of culture, and their transmission mechanism makes them particularly interesting.

Thus, it seems possible that cetacean societies, and especially those with stable matrilineal groups, such as killer, sperm and pilot whales, contain cultures which are qualitatively more similar to those of humans, than is the case for terrestrial mammals. Vertically-transmitted culture may then explain curious attributes of these species such as non-adaptive mass strandings and low genetic diversity.

Keiko also expressed himself in distinct calls, although Keiko was only two years old at the time of his capture. According to the Free Willy/Keiko Foundation web site:

> Early analysis of Keiko's calls indicates that even after thirteen years away from other killer whales [Keiko was at Marineland of Niagara Falls, Canada until 1985] and spending time with dolphins, his calls still resemble those of wild orcas. So it appears that he hasn't completely forgotten his native dialect.

Lolita could be connected electronically to her family at any time by long distance telephone transmission, simply by placing a speaker and a hydrophone in her tank and in the water within a few miles of her family. The resulting conversation could confirm that she is still able to communicate with her family. Beginning in 1987 a series of proposals have been presented to the management of the Seaquarium to conduct similar experiments to confirm that Lolita still vocalizes using her native calls, but the park has consistently rejected the idea.

After Lolita is placed in a sea pen in a protected cove in her native waters, within weeks or months her family would inevitably swim by in their normal travels, communicating vocally among themselves as they typically do. Lolita would presumably hear them and would respond, to which they would probably respond. It is assumed that they would approach her and meet her from the other side of the net, which would be a clear indication of mutual recognition. The reunion to follow would be one of the best documented greetings in history.

Mutual recognition is expected. The logic is compelling. Each community has a set of calls, which are symbols – meaningful within their cultures, meaningless to outsiders -

that it uses to coordinate behavior and maintain social relationships. Recordings of Lolita show that she still retains the memory and the use of those symbols, although she is, in a sense, talking to herself. It's as if she still knows the secret handshake and initiation rituals. These calls will inevitably be of interest to her family. The event will probably be unprecedented in the collective memories of Lolita's family, but among Transient orcas which share the same waters, adolescent females have been known to depart from the maternal group for several years, then return and rejoin them.

The principle of parsimony is that the simplest and most obvious explanation, or prediction, is probably the correct one, at least until further information is available. The best guess is that her family's renewed relationship with the long lost Lolita will be re-established by vocal communication, and will be maintained and deepened after the initial encounter. What will happen in the initial encounter remains to be seen.

Chapter 8 - Consciousness and Memory

Consciousness is a slippery subject to study even in humans, and memory is also difficult to measure and compare. And yet, if we are to understand and communicate with each other we need to assume that we are conscious of our surroundings and of one another and able to remember things. And if the plight of a captive orca is to become real for us, we need to have a sense that the animal is aware of its surroundings, and that it is capable of recalling past events. Recent theoreticians have concluded that indeed many species are capable of such feats (Griffin, 1976, 1984).

Marcia Henton was Lolita's trainer for eight years from 1988 through 1995. In a 1996 TV documentary called *Lolita—Spirit In the Water,* Henton explained her relationship with Lolita:

> It's like having a best friend that you get to see every day, only it's not a human, it's an orca. I've been able to go back into her journals 20 years, and look up old signals, and those signals are what trainers use to communicate with the animals. And I know for a fact I haven't used a certain signal for the time I've been here—eight years. So I can walk up here and give her a signal she hasn't seen in at least 8 years, and she remembers it (KOMO-TV, 1996).

The neuroanatomy of an orca, with a brain size four times human brain size, is certainly sufficient to indicate an extremely large memory capacity. A large brain requires a great deal of oxygen, which is an expensive commodity, especially for an ocean-dwelling animal, so such a brain must have high adaptive value and be consistently used.

A recent investigation of short term memory in bottlenose dolphins (Mercado, et al., 1998) found that dolphins proved to be able to repeat a wide variety of behaviors on a command meaning "repeat what you did last." The authors report: "The results suggest that dolphins can flexibly access memories and that these memories are of sufficient detail to allow for reenactments."

A story from the *Los Angeles Times*, May 20, 1998 (Appendix P), gives some insight into the memory of an orca. Elias Jonsson was involved in many of the orca captures in Iceland:

> One whale, he remembers, was seasick when it was brought to him after the trip home for six hours through choppy seas. When Jonsson got his hands on the animal, it was so dizzy it couldn't stay right-side up in the water, and he had to spend hours by its side, holding it upright so it could breathe. "After that, we got along so well that I never was afraid," he says. That whale was eventually shipped off to an aquarium in France, Jonsson says, and two years later he got the job of flying in a companion for it. The seasick whale hadn't seen him in two years, he recalls, but when he entered the aquarium, it finished its performance and rushed over to where he was standing, wagging its head and obviously

> showing that it recognized its former caretaker. "If that killer whale could remember him after two years," Jonsson figures, "why shouldn't Keiko remember how to hunt, or to recognize his fellows, after 20 years?"

Obviously the same can be said of Lolita. With the intensity of the social and family bonds now known to be the case among Lolita's extended family, along with her demonstrated capacity for long term memory of arbitrary show routines, deductive reasoning indicates that she remembers her family to this day. Moreover, Lolita was about four years old, several years older than the average captive orca at the time of capture, so the clarity of her memories of the days prior to her capture may help explain her unusually long survival in captivity.

Chapter 9 – Emotions

If consciousness and memory are difficult to measure, emotions are even more elusive. And yet, anyone who has an emotional bond with a dog or cat knows that they sometimes clearly demonstrate their emotions. Those who have spent time with Lolita or any other orca in captivity often come away with a sense that they have been touched, emotionally, by an intelligent and sentient being who knows them personally. Time after time stories come from people who have had the opportunity and the inclination to build trust with an orca, and afterward have been in awe of the strength of the bond that has developed. Lolita seemed to "look into my soul" according to former trainer Marcia Henton.

In 1965 Ted Griffin was the first human to spend a considerable length of time, 11 months, establishing a relationship with an orca. As Griffin explained in a 1995 interview:

> The whale was actually interacting with me and training me and creating a companion for him under his circumstances. It brought me to my knees when I realized that I was dealing with something of this enormous intellect and capability (KOMO-TV, 1996)

Charles Darwin began the scientific study of animal emotions with his book *The Expression of Emotions in Man and Animals* Darwin, 1873), but very little has been done to follow his lead until recently. In *When Elephants Weep* author Jefferey Masson describes hundreds of anecdotes in which animals demonstrate their emotions (Masson, 1996). Carl Safina delves deeply into the thoughts and feelings of animals, especially elephants, wolves and orcas, in *Beyond Words – What Animals Think and Feel*.

Marine parks seem especially averse to discussing emotions in their charges. Sea World refused to talk to Masson because his book "smacked of anthropomorphism." The sin of anthropomorphism is traditionally seen as a transgression for a scientist, although understanding animal emotions has high predictive value, helping us on a daily basis to determine what an animal will do, whether in nature, in captivity or with a pet at home.

Jane Goodall learned volumes about the emotional lives of the chimpanzees she observed for over three decades (Goodall, 1991). Goodall found she could relate to the emotional ties and upheavals of the chimps in her study. The members of Lolita's family, the Southern Resident community, also demonstrate their emotions. Orcas seem more distant than chimps from the human experience, and they are more enigmatic because they don't show facial expressions and they spend 95% of their time out of view underwater. But in terms of their ability to be aware, to communicate, to remember and feel emotions, orcas may be more similar to humans than chimps are.

When the three pods of the Southern community meet after a long separation, such as when K and L pods arrive in the inland waters in the early summer after spending the fall and winter out in the open Pacific, they generally join with J pod, which tends to spend the winter and spring in the protected waters. Upon meeting for the first time in six or seven months, what follows is a behavior known as "intermingling," which is a veritable festival of rubbing and touching orcas. Vocalizations often continue non-stop on these occasions. They usually form into small groups of 8 to 12 orcas from all three pods and begin tactile sessions in which they nudge and roll and tumble all over each other for 10 to 20 minutes, then disperse and form into other undulating groups.

There is every indication that they simply enjoy being together. Mothers play with their young, pairs of males travel together for long periods, associations of all ages and both genders occur continually. When resting, pods line up abreast, swimming slowly.

Lolita's emotional attachment to her family would facilitate her reintegration with them.

Chapter 10 - Conclusions

This report has hopefully set out various lines of evidence that, taken together, show that a carefully planned and carried out rehabilitation program that leads to the options of releasing Lolita to rejoin her family or retirement in her native waters, entails no point at which there is any discernable or significant risk to the orca's health or welfare, or to her family's.

To summarize the points made:

Statistics and historical records indicate that Lolita's survival in captivity into her 30's is an abberation and the risk to her life increases as long as she remains in the Seaquarium. It is also clear that a larger tank would not appreciably improve her prospects, nor would transport to another marine park.
There are a number of precedents in which dolphins and small whales have been successfully released after long term captivity.
USDA examination protocols would be followed to ensure that Lolita is in good health and that no communicable diseases would be introduced to native orca populations.
Experience with Keiko and other experiments have shown that foraging skills, including echolocation, do not disappear during long term captivity.
Unique among mammals, in orca communities studied to date, including the Southern Residents, neither male nor female offspring disperse from the matrilineal family of birth for their entire lives.
Call systems used by orcas are highly sophisticated and are unique to each community. Lolita still uses the calls of her family, although she is solitary. Thus mutual recognition between Lolita and her family is probable and would be easy to document.
Empirical experiments and a wealth of anecdotal evidence indicates that orcas retain important memories of performance routines and important relationships, whether with trainers or with other orcas, for long periods of time, in some cases for decades.
Given the stories told by trainers about their close relationships with orcas, and the observed demonstrations of affection between wild orcas, there is ample evidence that orcas are capable of a wide range of emotions, in many ways similar to human emotions.

Overall, the conclusion that follows from the above is that Lolita would be much better off if moved to her native waters in preparation for rejoining her family of birth.

Lolita can return home and can probably be released to her family. The evidence shows that she can resume her place in the family relationships that are essential in the natural life of an orca.

Chapter 11 – Recommendations

The goal of this report is to bring about an understanding in principle among decision-makers who will design the future of the Seaquarium or any development on that site that Lolita is at serious risk every day that she remains at the Seaquarium, and that the best way to enhance her well-being is to allow her to return home.

Keiko surpassed almost all expectations in his recovery from near death in captivity to the full bloom of health, and in his ability to catch live fish, use echolocation and to call out in his family's native vocalizations. He was found to be disease-free by a team of six veterinarians appointed by the USDA.

Lolita's rehabilitation does not require the facility in Oregon. She can be placed directly into a sea pen in her well-protected inland waters. Her family is well known and is monitored on a daily basis, so follow-up observations would involve little additional effort. Relative to Keiko's program, Lolita's retirement/release would be a logistical picnic.

It is clear that the financial resources and the technical expertise can be made available to carry out Lolita's rehabilitation program toward retirement or release. The missing ingredient is agreement in principle with the management of the Seaquarium that the best course of action is to begin making arrangements for Lolita's return to her home waters. Orca Network wishes only to foster discussions with the management of the Seaquarium, and has no intention or expectation of conducting the program itself.

It is hoped that the biological viability of the plan to move Lolita to her home waters has been established in this report, especially by contrast with the dangers to her life if she continues as a performing orca. But in order to generate discussion of Lolita's possible move, it may be helpful to offer some ideas for the future of the Seaquarium. Since Lolita is the main attraction at the Seaquarium, her departure will probably mean the closing of the park in its present form. Therefore this is a moment of tremendous opportunity for the creation of a public attraction that is exciting and popular and that is also in keeping with the visions and wishes of the residents of Key Biscayne, the City of Miami, and Miami-Dade County, as well as the state of Florida.

The residents of Key Biscayne have expressed their opposition to traditional amusement park activities, such as roller coasters, water slides, wave pools, and other water theme park attractions. Nor does the prospect of a variety of retail outlets and restaurants have much appeal for those residents. The sheer volume of traffic on Rickenbacker Causeway is also very much an issue. It appears that the local homeowners are interested in seeing a park develop on that site that they can be proud of, and that does not disrupt either access to their homes and businesses nor the oceanside peacefulness that is the atmosphere they wish to preserve.

However, it seems almost inevitable that there will be some kind of public facility on that prime location, although perhaps even that assumption will be up for discussion. If

indeed the consensus opinion is that a public attraction of some sort is called for at the Seaquarium site, it will be necessary to conjure up a coherent vision of a park that suits the above criteria and is also financially viable, which means it must have popular appeal.

The expertise and interest at the Rosenstiel School of Marine and Atmospheric Sciences, next door to the Seaquarium, is available to help design a fascinating, exciting and highly educational attraction. Just a few ideas include simulated nature trips, an IMAX theatre, live video hook-ups to animals in the wild, plus films, lectures, discussions, photo exhibitions, all placing the participant in the sweep of nature in a marine setting, gliding along with dolphins, manatees, or orcas. Imagine settling into a contoured seat surrounded by a wrap-around screen, in an undersea world lit by dim blue-green light flickering with reflected sunlight. Manta rays, a variety of fish and sharks stream by, accompanied by the ambient sounds of the sea emanating from various directions. Gradually you hear faint calls. The calls grow in volume as the fish move faster before your eyes. Soon the white patches on orca bodies appear, along with vague outlines of killer whales. As they flow toward you and then away, you see the matriarchs and the generations that follow. The majestic adult males appear along the periphery. Now and then each of them makes a distinct call to the others.

The imagineers of today's theme parks and aquariums can create whole undersea environments that are vastly entertaining, a thrill to experience, and a deeply emotional educational opportunity.

While marine parks that display performing whales and dolphins are in decline (Appendix I), other aquariums and marine parks have sprung up across the country that have embraced an environmental philosophy and have flourished in recent years. The New Jersey State Aquarium in Camden recently unveiled Cyberfin, a virtual reality attraction that simulates the experience of swimming with dolphins (Appendix T). In mid-June, 1998, the Long Beach, CA Aquarium of the Pacific opened to a public eager to experience the living Pacific Ocean. Nashville, New Orleans, and Tampa have each opened modern, high tech aquariums recently.

A Canadian model for this approach emerged from a 1995 decision by the Biodôme of Montréal not to display live beluga whales, citing conservation issues and the desire to be sensitive to the opinions of environmental groups voicing opposition to keeping whales in captivity. Instead the Biodôme has installed a thematic display depicting the white whales of the St. Lawrence called *Belugas: The Next Wave*, featuring a variety of innovative presentation techniques.

Increasingly, aquariums are bringing the natural world into modern lives via wildlife films and live links with wild habitats. The real lives of animals can now be revealed. Orca researcher Dr. Paul Spong, commenting on plans to build an aquarium in China, says in a letter to Chinese officials:

> This summer, a live radio link from the wild will enable the public at large, and visitors to the Vancouver Aquarium, to listen to the undersea acoustic environment and the fascinating calls of orca whales as they communicate with each other. The project has already created a wave of media and public interest around the world. It is a truly educational development, and does no harm to the animals involved. By so doing, it points the way to the future. Soon, aquariums and zoos will feature live video and acoustic links to the natural world, complementing vivid documentary films about Nature... enriching the facilities which house them, and the public. A concrete example of this trend comes from the Monterey Bay Aquarium. This new facility rejected the display of captive whales and dolphins, and instead features a magnificent living kelp forest and a live link to the local undersea habitat. It is so successful that people often have to wait in line to get in.

Lolita could be a living presence in Miami for many years to come after her move to her home in the Northwest, as she first recovers and builds her strength and familiarity in the waters of her birth, then is seen foraging and cavorting amidst her kin in the currents she knows so well. Her voice and images of her travels could come directly to a presentation facility on Virginia Key, a main attraction among a wide array of fascinating interactive and multi-sensory experiences.

All parties agree that Lolita's well-being is of paramount importance. Given the information contained in this report, it is conservative to conclude that Lolita can be transported to a netted seapen in her native waters, the inland sea of Washington and British Columbia, with the options of remaining under human care for the rest of her life or, if she wishes and a panel of informed experts so advises, rejoining her family of birth.

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Epilogue

There is no question in my mind that the public interest in whales and dolphins will continue to grow, and there is also no question in my mind that the future lies in freedom, not captivity. Understanding more about these magnificent animals will benefit people as well as whales and dolphins... because these animals have marvelous qualities that we can learn from. But that learning has to take place in an atmosphere of mutual respect, not one of imposed dominance. Watching whales and dolphins performing tricks and swimming in circles in a concrete tank will do nothing to help understanding, or respect. - Dr. Paul Spong.