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Husbandry and hand-rearing of a rehabilitating California gray whale calf

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Abstract

Successful attempts to hand-rear or rehabilitate large cetaceans have been limited due to the unique housing and nutritional requirements of a baleen whale. When a female California gray whale calf (JJ) arrived at SeaWorld of San Diego, a coordinated effort was made to rehabilitate and hand-rear the orphaned calf. Our goals initially were to stabilize her health, then to provide the reserves and skills necessary for her return to northern feeding grounds. We describe the methods and approaches used to develop appropriate diet, feeding techniques, and encourage natural feeding behavior prior to her eventual release. The ability to rehabilitate the calf provided an exceptional opportunity to learn more about hand-rearing large cetaceans.

Key words: husbandry, gray whale, rehabilitation, hand-rear.

Introduction

Reidarson *et al*. (2001) described the medical treatment of a female California gray whale calf (JJ) during its fourteen-month rehabilitation at SeaWorld of San Diego in 1997 and 1998. Soon after the arrival of the comatose neonate, she was force-fed a mixture of 6 l of warm water and 3 l of 50% dextrose via a flexible plastic tube (4.5-m long × 4-cm diameter). Within 30 min, JJ opened her eyes, became alert, and started swimming slowly around the pool. For the next 10 hrs, we made a series of forced feedings of artificial milk formula via the stomach tube every 2 hrs, which continued to improve her condition and vitality. Here, we describe the methods and approaches used to develop appropriate meals and feeding techniques during the subsequent fourteen months. Initially, our goals were to stabilize her health with good nutrition and then later to provide enough nutrition and calories to promote the development of fat reserves adequate to support her during several weeks of traveling to northern feeding grounds once released. Finally, we wanted to encourage the development of natural feeding behaviors while minimizing the opportunities for JJ to imprint on and become dependent on humans during her convalescence and recovery.

Materials and Methods

Housing

Within a month after JJ's arrival at SeaWorld, her body mass was increasing by around 0.5 kg per hr and it was clear that she would soon outgrow the small holding pool. Consequently, on day 34 we moved her to a substantially larger pool on the main grounds of SeaWorld. The new habitat had a main pool that was 9.1 m deep with a 6-m long underwater acrylic viewing panel, and an adjacent smaller medical examination pool that was 3 m deep. The smaller pool was connected to the main pool by a narrow 8-m long by 4-m deep channel. A false bottom in the small pool could be raised using four large hand-cranks that permitted relatively easy logistics for periodic physical examinations without requiring the water in the pool to be lowered. At first, JJ was kept in the smaller holding pool. Her willingness to feed voluntarily at the side of the pool decreased substantially, but once the gate to the larger main pool was opened she swam immediately into the large pool, quickly acclimated, and then voluntarily approached several areas of the perimeter wall to accept formula from the feeding tube. JJ remained in this pool complex until a few days before her scheduled release.

Formula development

We experimented with formulas of various composition and consistency, but started with a slurry of fish and commercially available milk matrix and amino acid supplements (Table 1). We thawed frozen blocks of herring in a refrigerator for 20 to 24 hrs, then removed the heads and tails and passed the remaining fish parts through a commercial meat

Table 1. Ingredients for 1 l of milk formula used to raise a rehabilitating California gray whale calf (JJ) to weaning.

Ingredient	Quantity
Ground herring (heads removed)	230 g
Zoologic 33/40[a]	45 g
Zoologic 30/55[a]	25 g
Heavy whipping cream	50 ml
Dextrose	7.5 g
NaCl	4.5 g
Lecithin[b]	3.5 g
Taurine[b]	125 mg
Dicalcium phosphate	18.75 mg
Water	*ca* 500 ml

[a]Zoologic Milk Matrix, Pet Ag, 201 Keyes Ave., Hampshire Illinois 60140
[b]Natures Life, Garden Grove, California 92841

grinder to reduce it to a fine pulp. We then blended the fish pulp with water in small household blenders, added the dry ingredients (Table 1), and transferred the slurry to a 4-l commercial blender. We blended the mixture to a smooth consistency and transferred it to a 20-l cooler reservoir (Fig. 1). We repeated this procedure five times to create 20 l of formula for each feeding and then added a variable amount of heavy whipping cream to increase the formula's caloric density.

Just before feedings we transferred the formula from the coolers to commercial, double-boiler soup warmers and heated it to around 35°C. That allowed the formula to flow smoothly through the feeding tube. The warmed formula was then transferred back to the 20-l insulated coolers and then immediately offered to JJ. Preparation of the formula engaged one person dedicated to the task for a 10-hr shift each day.

Delivery of the formula

During her first three days of rehabilitation, we fed JJ using a tube inserted into her mouth and stomach. At first, JJ tried to suck on our hands when we inserted the tube into her mouth and then she soon began trying to suck on the tube directly. Consequently, we modified the feeding device and encouraged the sucking behavior. We devised several attachments for the end of the tube that might serve as a nipple that would allow JJ to suckle directly from an artificial teat. JJ wrapped her tongue around a 1.9-cm diameter garden hose, but her suction was too strong and collapsed about a meter of the hose, stopping the flow of the formula. We then tried more rigid tubing, but she was not able to grasp its smooth texture and quickly rejected it. We also tried to dispense the formula from various tubes using a double-action hand pump to aid the flow of the formula into JJ's mouth. That appeared to hold her interest and lead to her first voluntary efforts to suckle. However, those efforts were hampered because JJ continued swimming during the feeding attempts. Nonetheless, we swam along side her towing the insulated cooler with the warmed formula, which was placed in a floating tire inner tube.

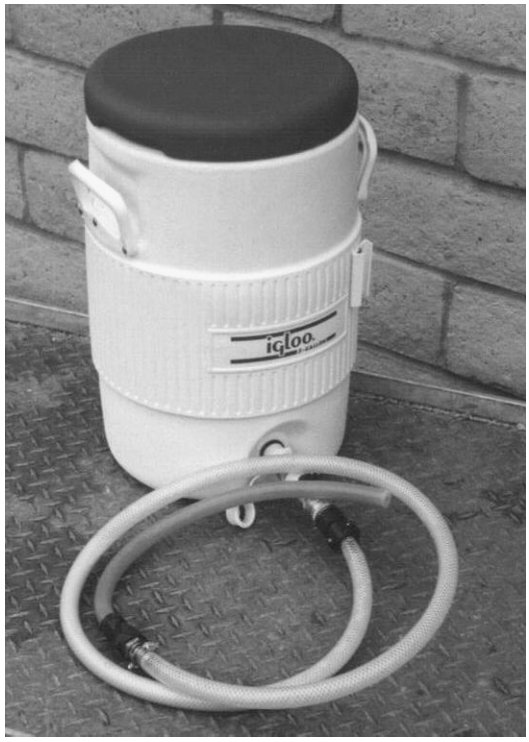

Figure 1. Twenty-litre insulated cooler and feeding tube with flexible rubber tube nipple used to deliver formula to a rehabilitating California gray whale calf (JJ) at SeaWorld of San Diego.

We also added sections of various materials to the ends of more rigid tubes to construct an acceptable nipple. We found that latex surgical tubing was acceptable to JJ and so stretched it over the end of harder beverage tubing (Fig. 1). JJ began actively sucking from this arrangement about five days after her arrival at SeaWorld. We soon shifted to a thicker-walled rubber tubing (1.27-cm internal diameter × 2.8-cm outside diam) because it was easier to clean and sanitize. We used that arrangement until we began using a thicker formula on day 46 and then started using a slightly larger tube for the nipple until JJ was weaned from formula.

By the eighth day of JJ's rehabilitation, she was voluntarily suckling from the feeding tube and no longer needed to be restrained for feedings. This

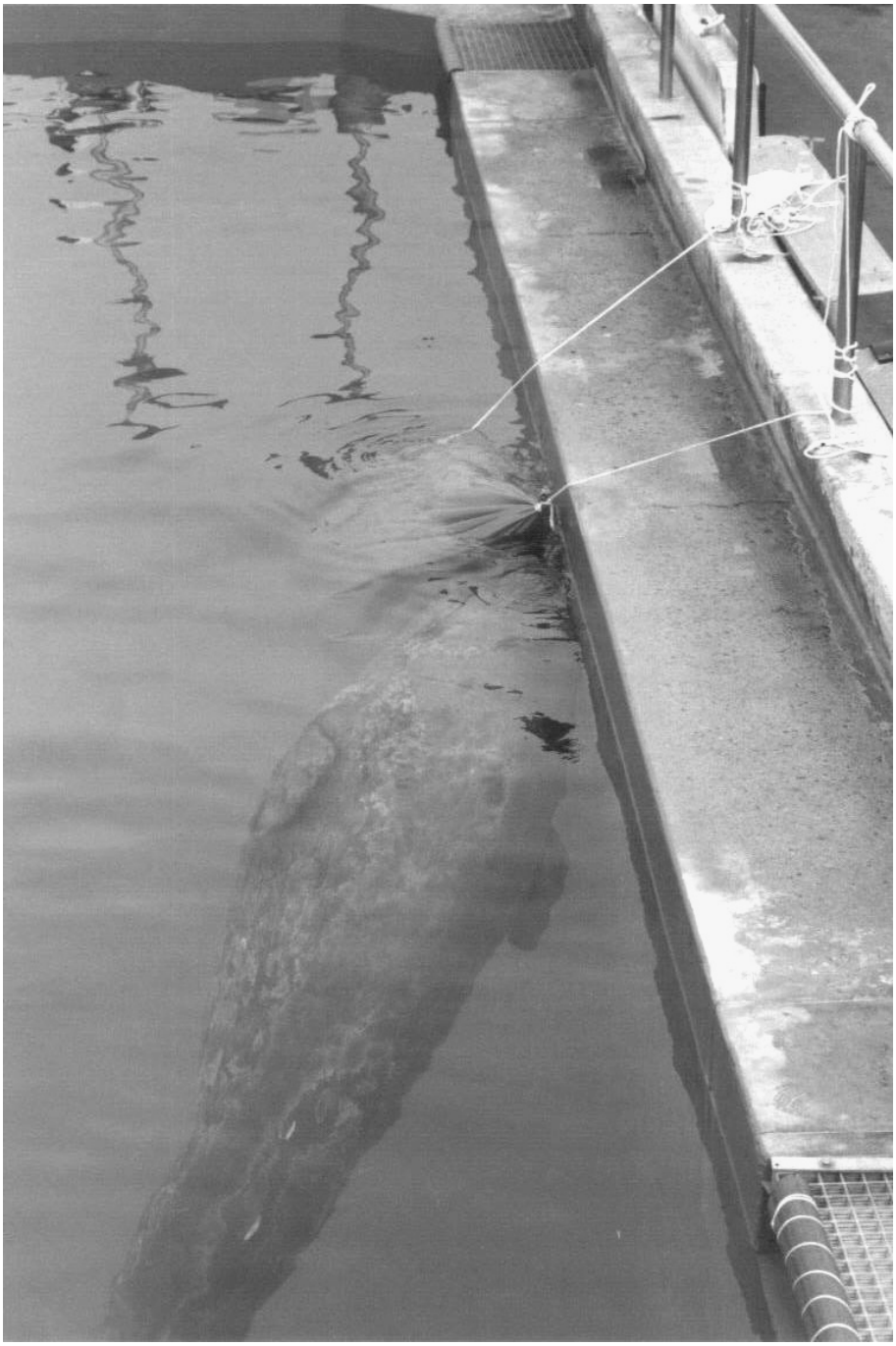

Figure 2. Tethered water bladder used as a surrogate adult female gray whale for rubbing against by a rehabilitating California gray whale calf (JJ).

allowed us also to raise the water level in the holding pool, giving JJ substantially more mobility. However, JJ began making more contact with the wall of the pool, which further irritated her skin wounds. Her behavior of routinely nudging the walls could have been a natural tendency because

Figure 3. A California gray whale calf (JJ) sucking on the feeding tube during delivery of formula. Notice the water bladder/surrogate mother that the calf routinely stationed on when feeding.

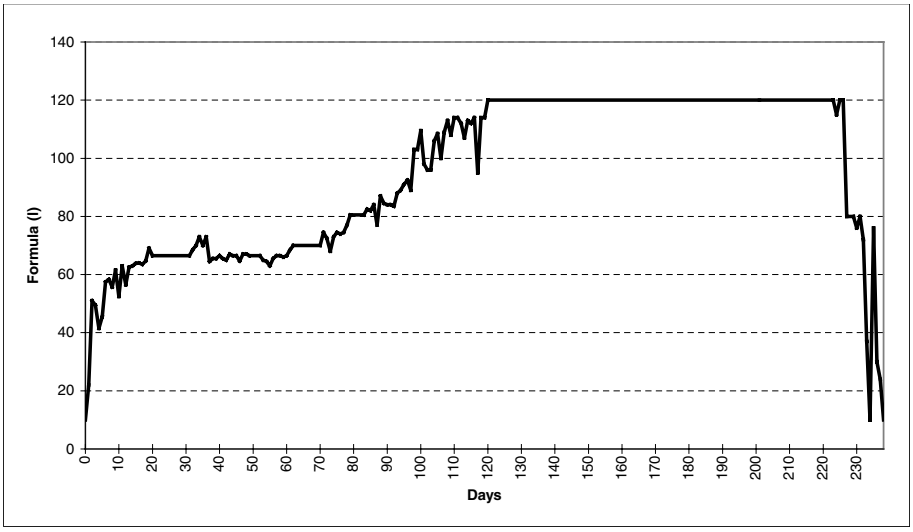

Figure 4. Daily intake of formula by a California gray whale calf (JJ) during her rehabilitation at SeaWorld of San Diego. Days measured from arrival at SeaWorld in January 1997.

similar-aged gray whale calves swim close to and regularly nudge their mothers when attempting to suckle. To reduce the abrasive effects of the wall on JJ's skin, we tethered a water bladder, from a queen-sized waterbed, to the side of the pool (Fig. 2) as a surrogate for a mother's body. JJ showed quick and keen interest in this surrogate. Indeed, she spent substantial time vigorously nudging and pushing on it, sometimes pushing so violently that the bladder would break and often needed daily repair. We were also able to use the surrogate as a feeding station, which JJ would

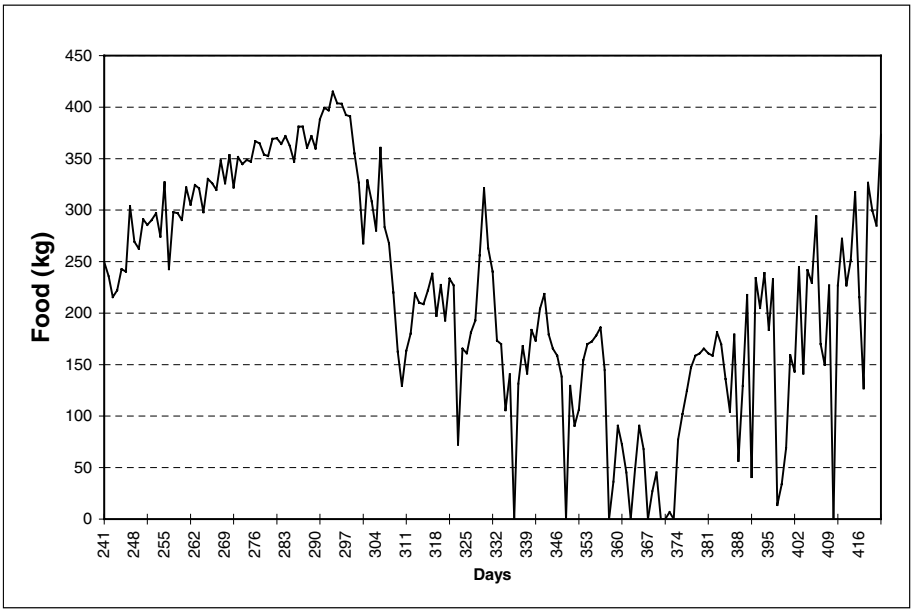

Figure 5. Daily intake of solid food by a California gray whale calf (JJ) during her rehabilitation at SeaWorld of San Diego in 1997 and 1998. Days measured from arrival at SeaWorld in January 1997.

consistently 'cue on' for voluntary feeding sessions (Fig. 3.).

Early on, we scheduled seven voluntary feeding sessions per day, roughly 3 hrs apart between 0500 hrs and midnight. The volume of formula delivered each time was around 9.5 l, through day 61 (Fig. 4). On day 46, we increased the caloric content of the formula by around 10% owing to concern over JJ's declining girth-to-body length ratio (see Reidarson *et al.*, 2001). We then gradually increased the volume of formula for each feeding session by 0.5 to 1.0 l during the next two months. By day 120, JJ was consuming around 20 l of formula each day. We also began offering her a variety of small fish, squid and krill from the side and bottom of the pool. Although JJ actively solicited solid food from us and also took some from the bottom of the pool, she was actually eating very little of it, but played with it briefly and then dropped it to the bottom of the pool. By day 213, her diet consisted of only about 1 to 2% solid food, so we took affirmative steps to begin weaning her off the formula.

Weaning

To transition JJ from formula to solid food, we first gradually reduced the powdered milk content of the formula by around 20% every other day for ten days. Then, when the formula was principally fish gruel, we lowered the temperature to more closely match the temperature of the solid food that we hoped she would begin eating instead. We also added small amounts of krill and smashed smelt to the formula as she suckled. By day 234, JJ started preferring solid food to formula and within another week she had weaned and was eating only capelin (15%), squid (60%), and krill (15%). After that, we placed the solid food in large piles (*ca.* 45 to 70 kg) on the bottom of the pool at least four times each day, first in the same location and then at variable locations as she began consuming more. We then began dropping it from the surface letting it settle to the bottom in a scattered carpet of food to further encourage development of natural feeding behaviors. Divers collected and weighed the uneaten food twice each day to record total intake. By day 276, JJ was eating more than 380 kg of solid food each day (Fig. 5).

Results and Discussion

Our dual goals during JJ's rehabilitation were to provide adequate nutrition for deposition of sufcient fat that would allow her to sustain a several week migration to northern feeding grounds and to encourage the development of behaviors that were compatible with nominal foraging after release. Between September 1997 and March 1998, JJ's body mass almost doubled from 4800 to 8200 kg and her body length increased from 7.5 m to 9.2 m. Fish accounted for around 45 tons of her solid food

dietary intake during the rehabilitation. To achieve the second goal, we provided numerous items and opportunities to enrich her environment and to promote the development of natural behaviors. Those included tethering kelp to the bottom of the pool, novel food items including live tubeworms, sea cucumbers, and marine snails, and even allowing a common dolphin (*Delphinus delphis*) into her pool for brief periods. We believe that those efforts, in additional to experimental feeding techniques, dietary modification, and encouragement of the expression of natural feeding behaviors should maximize her chances for the short and long term in the Pacific Ocean.

Acknowledgments

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Literature Cited

Reidarson, T. H., McBain, J. F. & Yochem, P. K. (2001). Medical and nutritional aspects of a rehabilitating California gray whale calf. *Aquatic Mammals* **27,** 215–221.