

Review of resident dolphin program

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Executive Summary

Clearwater Marine Aquarium (“CMA”) which recently marked its 50th anniversary has undergone dramatic and sometimes turbulent change in the last few years. Recently, in a sixteen (16) month period four (4) of CMA’s rescued dolphins passed. In order to better understand these passings, as well as to assess its resident dolphin program, CMA established an independent review team of experts experienced in cetacean health and veterinary medicine, cetacean behavior and well-being, life support systems/water quality, and relevant marine mammal regulations, and animal/zoological organizations. The review team conducted an extensive examination of CMA while onsite and over nearly two months prior and subsequent to its site visit. The review team went to great lengths to give several dozen people affiliated with CMA an opportunity to be heard. The review team learned something different from each conversation with every person. This report is the result of the review.

To best understand the resident dolphin program it is essential to put CMA’s mission, history, growth, culture, and commitment to the dolphins in context. CMA is a marine rescue facility and “working hospital” dedicated to saving marine life and its mission of “rescue, rehab and release.” It is the only dolphin facility/organization in the United States with a resident dolphin population comprised solely of dolphins rescued from strandings. This makes for a dolphin population with a variety of health conditions, including hearing loss in many individuals, and consisting of dolphins rescued as dependent calves or juveniles. As dolphins are highly social animals, who learn from older role models, the dolphin group social structure itself is also compromised.

The human side of CMA consists of caring dedicated staff, many of whom feel called to help animals. There is also brokenness there as a result of various adversities and experiences, some not animal specific, including a less than optimal culture. Through it all there is an incredible eagerness to become even better at helping and saving animals.

The report’s detailed findings regarding the resident dolphin program benefit from hindsight as retrospective reviews always do. The review team found that, for the most part, the cases culminating in the four (4) recent mortalities were handled appropriately. In one situation, there was a two-day period where early and repeated blood testing would likely have identified a serious issue and accelerated treatment, but that may not have changed the outcome. Review of those and one other recent, ongoing case, yielded other insights relating to veterinary and animal care, animal behavior, animal welfare, environmental factors, life support systems, staffing, recordkeeping, equipment, biosecurity and, significantly, communications/group dynamics and culture. All of these factors are interrelated and potentially impact the dolphins, their health and well-being.

The heart of the report, like the hearts of CMA’s team members, is the biggest part and it posits a path forward to aid CMA’s continued advancement. Key recommendations include:

- Prioritize the creation and stewardship of a healthy dolphin group social structure
- Prioritize, to the extent possible, medical and husbandry behavior competency
- Enhance animal behavior and welfare assessment and monitoring
- Provide clear system for reporting animal welfare concerns with option for anonymity

- Bolster Animal Welfare Committee
- Continue and refine air quality monitoring
- Develop noise monitoring program
- Refocus veterinarians' responsibilities on animal health and veterinary medical care
- Review and improve outreach with veterinary consultants
- Evaluate staffing levels and responsibilities
- Continue to assess appropriateness of staff compensation and adjust for increased cost of living
- Remember the positive impacts CMA animal care and medical care have made
- Enhance collaboration with shared responsibilities
- Hold more Animal Care/Veterinary Care joint meetings including weekly rounds
- Executive leadership should shadow their staff, including overnight shifts, to build mutual trust.
- Consider moving life support systems away from a sterile "swimming pool" type system towards a more natural system.
- Consolidate information in records and increase electronic recordkeeping
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I. Introduction

A. Clearwater Marine Aquarium initiated independent third-party review

Clearwater Marine Aquarium (“CMA”) authorized this independent third-party review to thoroughly assess all aspects of its resident dolphin program including: animal care and welfare, veterinary care, habitats, water quality and life support systems, environmental and other relevant considerations. CMA then assembled a diverse group of experts with substantial dolphin-related experience in animal behavior, training and welfare, veterinary care, and water quality/life support (collectively, the “review team”). The review team consisted of two American College of Zoological Medicine Board-certified (Aquatic) veterinarians with a combined cetacean experience of 55 years (Stamper 35 years, Croft 20 years), a cetacean animal manager with over 30 years of experience, a water quality expert with over 40 years of experience, and an animal welfare lawyer with 34 years of cetacean and regulatory experience.

B. The review team conducted an extensive examination

Upon undertaking this project, the review team requested, received and reviewed extensive background information, records and plans, and conducted calls before visiting CMA for three days. While onsite at CMA, the review team inspected CMA and its satellite Marine Mammal Stranding Station, including facilities, all dolphin pools, dolphin social structure, individual dolphin’s health status, veterinary records including necropsies, food preparation and storage, life support systems, water chemistries, the veterinary clinic, and working relationships between staff. The review team observed some animal training and veterinary procedures that included the fish preparation and kitchen cleaning process, viewing an out of session interaction between staff and Apollo, viewing a medical procedure and a husbandry (gruel) session with Apollo and conducting 30 minutes of informal behavioral observations of Nicholas, Hope and Izzy. During the site visit, the review team met with and interviewed numerous executive leaders/managers, animal and veterinary care team members, life support staff, and others including outside consultants, behaviorists, veterinarians, and a veterinary pathologist. Individual review team members conducted additional meetings with management and staff in their areas of expertise.

Following the site visit, the review team and individual review team members interviewed and met with additional executive leaders/managers, staff and consultants and other independent outside experts such as a cetacean auditory expert scientist, and a cetacean respiratory expert. There also were numerous supplemental requests for additional documents, information and records. These materials were reviewed, as well as an extensive array of animal training videos compiled by Animal Care staff. The review team has been in ongoing communication, including regular and lengthy calls since the CMA site visit to continue and conclude its review, and in order to develop and present this report.

The review team notes its appreciation for the candor, commitment, dedication, passion and responsiveness of each and every person interviewed (a number multiple times). Access to people, places, information and records was unfettered. This cooperation and openness made a more accurate and comprehensive evaluation possible.

C. The report

This report reflects the review team's assessment based upon the efforts noted above and the team members' substantial professional experience with dolphins, animal care and welfare, veterinary care, water quality/life support systems, and zoological organizations. Each and all of the team members contributed to this report and concur in its contents, conclusions, and recommendations. It is the review team's intention that this report provides CMA and its dedicated team constructive ideas for advancing their good work in saving dolphins and safeguarding those entrusted to their care.

II. Background / Context

A. History

CMA (and a predecessor organization) came into existence in the 1970s. The original or older portion of the CMA facility was previously a water-treatment plant. In 1984, CMA was home to Sunset Sam, which its website reports was “the first dolphin to survive a stranding in the state of Florida.”

B. Mission

CMA’s motto, “Rescue, Rehab, Release,” is at the heart of its mission. CMA identifies itself as a rescue center and a “working hospital.” CMA’s Animal and Veterinary Care teams’ often heroic efforts have helped make a difference for marine and aquatic animals such as dolphins, sea turtles and river otters. Those animals determined to be non-releasable due to their conditions and/or injuries are provided a forever home at CMA where they reside with other aquatic and marine species including birds and fish.

C. The dolphins

i. The resident dolphins

CMA currently cares for six dolphins onsite. The onsite dolphins include four bottlenose dolphins (*Tursiops truncatus*) and two rough-toothed dolphins (*Steno bredanensis*). The resident dolphins include the following four animals housed in the Ruth and J. O. Stone Dolphin Complex (the “Dolphin Complex”) and two residing in the Rescue Deck pool with some critical background information from the National Marine Fisheries Service’s (“NMFS”) non-releasability determination relating to each in parentheses.

Nicholas, male (stranded 2003, non-releasable as “highly dependent calf,” “limited chance for survival,” lacking survival and social skills, estimated age 20 years)

Hope, female (stranded 2010, “nutritionally dependent calf,” “lacks both survival and social skills to be successful in the wild,” estimated age 12 years)

Apollo, male (stranded 2021, non-releasable as “dependent calf,” with “hearing loss,” “compromised echolocation range,” inflammation, gastritis, estimated age 3 years)

Izzy, female (stranded 2022, non-releasable due to human and watercraft habituation/interaction causing “repeated injury” and “inability to forage” from “repeated illegal feeding by the public,” juvenile, 2022, estimated age 7 years).

Rudy, male (rough-toothed dolphin, housed in the Rescue Deck pool, stranded 2020, “severe hearing deficiency in echolocation range,” “unable to adequately hunt for food and avoid predators,” gastritis, estimated age 5 years).

Rosie, female (rough-toothed dolphin, housed in the Rescue Deck pool – as of May 16, 2023, stranded 2023, “unable to adequately hunt for food and avoid predators in the wild due to her severe hearing impairment,” juvenile).

Nicholas, Hope, Rudy and Rosie were all rehabilitated by CMA before becoming residents. Apollo and Izzy were rehabilitated (and/or rescued) by other organizations before being placed with CMA.

It is significant to note that all six dolphins currently residing at CMA were rescued as dependent calves or at a very young age, and all were lacking in appropriate skills to successfully survive in the wild including those needed for hunting, predator avoidance and social interaction. Three, Apollo, Rudy and Rosie have significant hearing loss impacting their echolocation and ability to hear other animals (and also had gastritis at time of rescue).

ii. Recent dolphin mortalities

Over a sixteen-month period from November 2021 to March 2023, four rescued dolphins passed. These included:

The iconic Winter in November 2021, female (bottlenose dolphin stranded 2005, entangled at approximately 2 months, eventually lost her tail flukes, “survival would be unlikely if she were returned,” estimated age at death 16 years)

PJ in October 2022, female (bottlenose dolphin stranded 2018, “significant hearing loss (likely deafness),” geriatric age, estimated age at death 51 years)

Hemmingway in January 2023, male (bottlenose dolphin, stranded 2019, “limited to no functional hearing and low-frequency in echolocation range was preserved,” pneumonia at stranding and then ongoing respiratory infections, estimated age at death 37 years)

Rex in March 2023, male (rough-toothed dolphin, stranded 2020, “severe hearing deficiency in the echolocation range,” “aspiration and fungal pneumonia,” “likelihood that he would be unable to adequately hunt for food and avoid predators,” estimated age at death 9 years).

Only Winter was rehabilitated by CMA.

The four dolphins that passed over the last eighteen months ranged in estimated age from 9 to 16 to 37 to 51. Winter was rescued as a two-month old calf with serious injuries resulting in the loss of her tail flukes. Her young age alone, not to mention her disability, would not have allowed her to survive but for her rescue. The other two bottlenose dolphins were rescued at rather old ages (mid-30s and late 40s). Hemmingway had serious respiratory issues and hearing loss, PJ had significant hearing loss and was probably deaf. The rough-toothed dolphin, Rex, suffered from aspiration and fungal pneumonia during his initial rehab and had severe hearing loss impacting his echolocation. PJ, Hemmingway (both of whom were older) and Rex (a rough-toothed dolphin) all had significant hearing loss.

iii. CMA's unique dolphin population

CMA is the **only** organization/facility in the United States with its resident dolphin population comprised entirely of stranded, rescued, rehabilitated and non-releasable animals. That means every dolphin CMA has cared for and those currently entrusted to CMA's care originated in the wild, were rescued in a state of distress, and even after rehabilitation were determined to be non-releasable because of their condition and/or injuries. So, all of the dolphins under CMA's care could not be returned to the wild because they were not likely to survive due to health condition(s), impairment(s) and/or limitations, and were then placed in a totally foreign situation at CMA to adapt, continue their recovery and live out their lives.

By the nature of stranded animals, these are extremely complicated cases and it would be expected there would be a higher rate of disease incidents. All of these animals have some degree of underlying disease conditions and many have some level of hearing loss which may be a chronic low-grade stressor especially in social situations that do not mimic those seen in the natural environment. Some of the dolphins at CMA have had clearly visible injuries like Winter's missing tail flukes. Most of them have seemingly invisible conditions, including many suffering from hearing loss and impaired ability to echolocate. Given that dolphins' primary sense is hearing, which they use to communicate, echolocate, navigate, forage and avoid threats, a sensory deficit in this area is significant.

iv. The importance of social structure for highly intelligent social animals like dolphins

All of the dolphins placed with CMA or transferred to CMA were at one point deemed "non-releasable" by NMFS. NMFS' non-releasability determinations all speak to the importance of placing stranded, rescued dolphins with other dolphins because of the need for interaction with other conspecifics for these highly social species. It is essential that individual dolphins have companionship with other dolphins as well as a healthy social group. Within the wild population, bottlenose dolphins live in a fission-fusion society where group composition changes frequently. There are three different categories of dolphin groups: nursery groups consisting of females and young offspring, juvenile groups of both sexes, and adult pair bonded males. An individual animal's social and behavioral learning takes place at every stage of life as an animal matures and moves through these groups into adulthood, with intensive social learning taking place as a juvenile and sub-adult, as older dolphins help to show younger ones how to conduct themselves in the group.

D. Organizational framework

i. Executive leadership

The CEO has served just over half a year and leads an executive team assembled of trusted colleagues he has worked with previously as well as pre-existing and new executives with formidable experiences of their own. All are committed to CMA's mission and understand many of its challenges, though they have looked to this review to further illuminate those challenges and opportunities for further improvement. Within the Executive leadership is the Chief

Zoological Officer (“CZO”) who oversees the animal side of CMA, and the Animal Care and Veterinary Care departments report directly to the CZO. (The CZO also serves as Executive Director of the CMA Research Institute, which focuses on fieldwork and conservation research.)

ii. Animal Care

The Animal Care department is responsible for the day-to-day care, feeding, enrichment and training of the rescued dolphins. Animal Care also assists and works with Veterinary Care during medical exams and procedures. Animal Care includes the Rescue Team responsible for marine mammal response, rescue and short-term care at the off-site satellite Marine Mammal Stranding Station. (Although not a focus of this review, rescued sea turtles are currently under the Veterinary Care department, not Animal Care.)

The Animal Care team at CMA itself consists of three leaders, the Vice President of Zoological Care (providing overall leadership), the Animal Care Program Manager (engaged in many administrative support functions), and the Animal Care Program Supervisor (oversees staff on a daily basis). Staff consists of Senior Animal Care Specialists, Animal Care Specialists, and Associate Animal Care Specialists.

The Dive Team is within the Animal Care department and is responsible for cleaning the dolphin facilities at CMA as well as assisting in veterinary and other procedures as needed.

iii. Veterinary Care

The Veterinary Care department provides medical care for the rescued dolphins. The Veterinary Care team consists of the Attending Veterinarian or Veterinarian of Record, the Associate Veterinarian, and veterinary technicians (“vet techs”). During a recent round of staff cutbacks, the position of Veterinary Clinic/Hospital Manager, who was responsible for much of the administrative tasks in the department, was eliminated. Many of those duties have been absorbed by the Veterinarian of Record.

iv. Life Support Systems

The Life Support Systems department operates and maintains the systems and monitors water quality. It is led by experienced managers with decades of experience with developing and operating advanced systems. It includes the Director of Engineering and Manager of Water Quality.

E. Dolphin facilities and Life Support Systems

CMA maintains dolphins onsite in the new Dolphin Complex, where the bottlenose dolphins reside, and at the Rescue Deck, which houses the rough-toothed dolphins. Offsite, dolphin(s) are maintained and rehabilitated short term (pending placement) at the Marine Mammal Stranding Station at Fred Howard Park in Tarpon Springs on land provided by the city and Pinellas County.

i. Seawater Makeup System

The intake system for the entire facility brings natural seawater from Clearwater Bay thru a treatment system and distributes it to the facility. The system produces 180gpm of seawater. The treatment consists of intake pumps, thru two sand filters, two UV sterilization units and thru pressure carbon filters. This intake water feeds the Dolphin Complex and Rescue Deck

ii. Freshwater Makeup System

The freshwater is directed to fill a storage tank and then pumped to allow freshwater backwash of certain filters within CMA. This reduces the saltwater being dumped into the sanitary sewer.

iii. Dolphin Complex

The Dolphin Complex system consists of high-rate pressure filters, ozone contactor and degas towers, backwash recovery system and ozone system. It is approximately 2 years old. The current system is oversized for the current animal load. The coliform levels in the pool are consistently zero. Phosphorus level are around 14mg/l. The algae is being controlled by the restriction of lighting and the use of lanthanum chloride. Pool 5 receives direct sunlight because of its location in relationship to the windows. The result is that the pool requires more frequent cleaning to remove algae from the system. This causes short-term turbidity problems within the system.

iv. Rescue Deck

The Rescue Deck System has a 250,000 gallon pool. Chlorine is added to maintain the chlorine level into the pool of around 0.5-0.6mg/l. There is no ozone on this system and the pool is not completely covered so algae is a significant problem on this pool. The staff must scrub the pool almost weekly with 2-4 divers 4-6 hours/week. (Note: As predominantly hearing animals, dolphins should be monitored for any adverse effects due to noise from scrubbers and SCUBA.)

v. Marine Mammal Stranding Station System

The Marine Mammal Stranding Station facility consists of a 75,000+ gallon circular fiberglass pool, sand filters, temperature control (heating/cooling) chlorine storage and feed system.

F. Growth and change

Although CMA's existence dates back to the 1970s, the last decade or so has been marked by dramatic growth and change. The 2011 motion picture, *Dolphin Tale*, featuring the inspirational story of rescued bottlenose dolphin, Winter, warmed the hearts of millions, especially people whose own challenges were similar to those Winter faced. The movie and a sequel, as well as Winter's presence at CMA, drove increased attendance and revenue. This culminated in the expansion and modernization of CMA highlighted by the new 1.5-million gallon Dolphin Complex completed in 2020. The tremendous amount of construction at CMA temporarily disrupted activities and operations.

CMA experienced even more disruption since 2021 as there have been four different chief executive officers in the last three years (including one interim) each with their own distinct leadership style and management practices.

The most upsetting change(s) at CMA have involved the passing of four resident dolphins over the last year and a half, including Winter as well as PJ, Hemmingway and Rex. These beloved dolphins, their rescues, lives and passings, have impacted everyone at CMA and many others who cared deeply about them.

Even recognizing that all dolphins are mortal and that the caregivers have endlessly given their all and the best they could muster, “loss” still hurts. Everyone deals with this in their own way and in their own time. Some means of coping include questioning, self-reflection and even less constructive pursuits. The continued sense of mourning was evident to the review team and our hearts are with those still processing everything.

There is burnout and “compassion fatigue” throughout the ranks, especially in the Animal Care and Veterinary Care Teams, brought on by recent dolphin passings, long days, overnight shifts necessitated by critical care cases, irregular and changing schedules, responsibilities exceeding time allotted, and low (and/or perceived to be even lower) wages. All of these factors are exacerbated by not knowing exactly what is happening in the disease process, the unknown of whether the animal is going to live or die, the constant rollercoaster of the animal rallying and then unexpectedly having issues leading to problem solving the next unknown, and the seemingly unending care for animals who arrived at CMA with compromised health. This is a concern for each individual, and these teams. As an organization, it has other consequences in terms of morale and effectiveness.

In a noteworthy significant positive development, CMA has recently earned accreditation from the Alliance of Marine Mammal Parks and Aquariums (“AMMPA”), which is an international association and the accrediting body for marine parks, aquariums, zoos and research facilities. Alliance-accredited organizations are the gold standard in marine mammal care. (AMMPA Accreditation Standards & Guidelines [here](#)). It is evident that the accreditation process fostered much self-reflection at CMA and advanced the development and refinement of enhanced professional practices.

CMA has evolved as it has grown and changed and that evolution remains a work in progress with a normal maturation process. As manifested by the establishment of the review team and by this report, the new leadership has a desire to understand and work towards resolution of identified issues.

One thing that has not changed is that the staff is incredibly hard working, focused, dedicated, and passionate.

G. Culture

Fully understanding CMA, and rendering appropriate, constructive and workable recommendations necessitates discussion of the state of the organization and its culture, both of which are in flux due to changes in leadership and recent events.

i. Caring, dedicated helpers saving marine life

Staff and leadership alike (along with board members, interns and volunteers, though outside of this review) are extraordinarily caring and wholeheartedly committed to helping the animals. This is consistent throughout the organization. Love and respect for the animals is the great unifier. This manifests during crises when other differences are sublimated in order to work together to do whatever is needed for the animals. Many note that this work is their calling.

ii There is brokenness and a need for healing on the human side

There is brokenness on the human side of things at CMA. It seems that there is a less than constructive and perhaps even dysfunctional or “toxic culture.” This is marked by trust issues relating to leadership and among and between others at CMA. It is not limited to animal-related operations. Trust is built incrementally and over time. It is easily broken and dissipated in many ways. The recent dolphin passings have further eroded confidence and trust within CMA and amongst some departmental leaders. Exhaustion and frayed feelings compound this, especially where there have been departmental and/or interpersonal professional differences, and in the absence of a broader healing or a transformative vision forward.

iii. Encouraging indicators for moving forward

Amidst the shared love and respect for the animals and the commitment to help animals, another noteworthy characteristic observed throughout nearly every interview was a keen interest in getting better. The review team found it extraordinary that most everyone expressed a willingness to learn and an openness to finding ways to improve themselves and their individual and collective efforts on behalf of the dolphins.

III. Findings

A. Recent dolphin mortalities

i. Cautionary note

In reviewing all four cases the veterinarians on the review team had the very significant advantage of hindsight. Critical cetacean cases move very quickly and often require veterinarians to make decisions without full information (before all diagnostics are back or balancing the stress of handling an animal for additional diagnostics versus treating symptomatically) or the ability to execute an ideal plan (staffing issues, animal cooperating, availability of appropriate drugs due to supply chain issues, etc.) In nearly all situations in the four cases, veterinary staff appeared to adapt, respond quickly and reasonably to the case presentations, reaching out extensively to appropriate veterinary colleagues and pivoting as the cases evolved.

ii. Summary discussion and individual cases

A comprehensive review of the cases including the pathology reports found no one etiologic commonality between the four cases. Medical records and review of the staff found, for the most part, due diligence of pursuit of the best medical care for the dolphins. One reasonable general commonality is gastroenteritis. In the cases involving gastroenteritis, we did find differing opinions between veterinary input which is normal based off the experience of the various veterinarians. The different approaches each have advantages and disadvantages. More aggressive approaches may target the digestive tract directly and hit harder against a very pathogenic bacteria but require reseeding the digestive tract to restore normal bacterial flora and may further contribute to antibiotic resistance. More holistic microbiome approaches aim to preserve and promote healthy bacterial flora and use less antimicrobials but may not reduce very pathogenic bacteria in time for the animal to mount its own immune response. The approach taken will depend upon individual case factors and it is impossible to predict the outcome had an alternative approach been taken.

a. Winter

Winter's unusual body conformation (scoliosis/kyphosis due to not having flukes) created additional risk factors to her health. Her abdominal cavity was extraordinarily deep according to the pathologist and her abnormal swimming motion and history of behavioral regurgitation may have predisposed her to intestinal torsion/twisting. The appropriate diagnosis was made ante-mortem and there was an impressive attempt to try to surgically correct this life-threatening condition. Surgical intervention could have been pursued sooner but there were differences in opinion about if the condition could be medically managed and no successful surgical interventions have yet been documented in cetaceans so while this was the only chance at resolution the prognosis in this case was grave.

b. PJ

PJ was a geriatric animal (estimated to be 51 years old which is well within the upper range of life expectancy for *T. truncatus*). The clinical case presentation was very acute and the pathology (skull fractures and cerebral hemorrhage) was not something that could have been treated.

c. Hemmingway

It is unclear what may have precipitated the intestinal torsion in this case as the pathologist did not find underlying evidence of gastroenteritis. The appropriate diagnosis was quickly made ante-mortem (based on lessons from Winter's case) and there was an impressive attempt to try to surgically correct this life-threatening condition in a timely manner but this condition (intestinal torsion) has a grave prognosis in cetaceans even with surgery.

It should be noted that it is nearly impossible to assemble a skilled team in time for these types of events given the expertise, individual schedules, equipment, and geographical locations of individuals (i.e. veterinarians/specialists securing flights to arrive on site.)

This case was made more challenging by the lack of voluntary husbandry behaviors and difficulty handling this animal. This animal, in particular, did not have any trained husbandry behaviors despite being at CMA for 2.5 years. It was reported that staff time was spent teaching him more management behaviors: swimming in a straight line (to adjust an apparently learned behavior from earlier in his rehab) and heads up stationing while displaying times of inattentiveness (as it was challenging to maintain his attentiveness). It is acknowledged that Hemmingway was an older animal at the time of his stranding, and his age and health may have added to the challenges of training for husbandry and medical behaviors.

There were not any notes on white blood cell morphology on some of his in-house CBCs. While this would not change the case management it is best practice to include this in any cetacean CBC.

Intestinal torsion was observed in two of these cases. A review paper on intestinal volvulus in cetaceans documenting this condition in a range of species in managed care as well as the natural environment is referenced (Begeman L, St. Leger JA, Blyde DL, Jauniaux TP, Lair S, Lovewell G, Raverty S, Seibel H, Siebert U, Staggs SL, Martelli P, Keesler RI. Intestinal volvulus in cetaceans. *Vet Path.* 2012;50:590–596). Clinical signs of torsion are typically acute and nonspecific. The most consistent clinical abnormality was acute dullness and anorexia (lack of interest in food) both of which can be seen with any type of illness. Other less common clinical signs are regurgitation, vomiting, bloat, and excessive gas production. Potential risk factors may be chronic, pre-existing gastrointestinal disease, gastrointestinal parasites (common in free-ranging animals but very uncommon in managed care), very large meal after fasting (unlikely in managed care), anatomic abnormalities (such as those seen in Winter), or change in behavior and abnormal movements. Hemmingway was handled for thoracic radiographs (lung x-rays) to follow up on pneumonia (which was important for making clinical decisions about

treatment) prior to his volvulus. This may have been a risk factor but the authors have handled hundreds of cetaceans for radiographs without subsequent torsion.

Intestinal torsion is usually rare but to our knowledge has never been successfully resolved. Diagnosis is often based on ultrasound where a lack of normal GI motility/peristalsis, fluid and/or gas distention of the forestomach and intestines, peritoneal effusion (fluid in the abdomen) can be seen. Diagnoses were made correctly in these cases which can be challenging to diagnose as other non-surgical gastrointestinal conditions can present similarly. The veterinary staff learned from Winter's case and made the diagnosis in a very short time frame and tried to assemble a team to surgically address the situation. Making the diagnosis and assembling an emergency surgical team within 72 hours, as was accomplished with Hemingway is laudable and consistent with a high standard of care.

d. Rex

It is unclear what precipitated what appeared to be gastritis with subsequent fatal septicemia. He had been successfully treated for pneumonia with meropenem which is a potent antibiotic but appeared appropriate based on culture and sensitivity from bronchoscopy and lack of response to previous antimicrobials. This may have negatively impacted his microbiome and allowed opportunistic organisms in the digestive tract to take over. Transfaunation may be helpful in these cases and was being pursued but requires some pre-planning to ensure donors are healthy and samples are safe for use in order to be able to transfaunate shortly after antimicrobial therapy.

In hindsight, and there may have been reflection on this, even though the animal had normal blood and physical exam results the day prior, immediately checking bloodwork on this animal when he appeared 'off' (i.e., decreased appetite and low energy) about three days before his death could have helped, though often those decisions are made weighing the clinical presentation with stress of handling and are much easier to make retrospectively. It is recognized that outside labs have delays in delivering results in a clinically timely manner, especially in light of weekend downtimes. However, blood sampling earlier and more often would likely have picked up septicemia markers and electrolyte imbalances as benchtop laboratory analysis was available for some of the relevant analytes. Given ongoing hydration treatments, blood draws might not have required additional handling. Septicemia in all species, including cetaceans, has a poor prognosis for success even with appropriate treatment which is aggressive intravenous +/- local antimicrobials. Adding blood culture to diagnostics for acutely ill animals, especially those with a marked drop in serum iron, may help to identify cases of sepsis and guide treatment. However, with the rapid clinical course and mortality associated with sepsis, culture may not yield results in a timely manner. With that in mind, proactive antibiotics in the face of dropping iron (and possible white blood cell count issue) might be beneficial when waiting on blood culture.

It may simply be a recordkeeping issue, but consultations between and among in-house and outside veterinarians on this case were not necessarily reflected in the records.

B. The resident dolphins

The health and well-being of the resident dolphins is paramount. The resident dolphins have inherent health problems and social issues based on the circumstances surrounding their stranding (e.g. age, condition, hearing loss) and rehabilitation.

i. Apollo's recent case treatment

Apollo appeared to suffer from a bout of gastroenteritis following handling for radiographs (to assess respiratory condition). His case was reviewed with the Veterinarian of Record during the onsite visit. Some anecdotal information on potential medications was discussed based upon review team veterinarians' personal experiences and review of the culture results at the time. In addition, the following ideas were discussed and applied to his case as indicated by the CMA veterinary staff:

- Further investigate the elevated serum iron as iron storage disease and/or metabolic syndrome may predispose affected animals to further illness
- Consult with a veterinary nutritionist with expertise in cetaceans to help advise on a gruel formula that would be easy to digest but calorically dense enough to prevent further loss of body condition

There may have been things considered or undertaken that were not necessarily fully reflected in the records, such as analysis of potential drug interactions as more medications were added, and changes in treatment approach prompted by different veterinarians and/or consultants.

Since many of the recent clinical cases presented after handling for out of water medical procedures (Hemingway and Apollo within 1-2 days following handling; it is unclear from the medical records if Rex was handled out of water the day prior to his ultimately terminal presentation) it may be worth review (internal +/- external) of these procedures to ensure that handling stress is minimized. The review team observed an in-water procedure and did not note any concerns but did not witness a procedure where the cetacean was pulled from the pool for additional diagnostics. Improved voluntary husbandry behavior competency reduces (but does not eliminate) the need for manual restraint and pulling animals out of water for diagnostics.

ii. Apollo, Rudy and Rosie have significant hearing loss

Both Apollo and Rudy have significant hearing loss in the echolocation range and ability to hear other animals, which is a serious deficit for auditory animals. Rosie has a "severe hearing impairment." These sensory deficits impact them and their interactions with other dolphins and staff, and may be a potential stressor. Apollo is only about 3 years old and was diagnosed upon stranding two years ago. Rudy is about 5 years old and was diagnosed upon stranding 3 years ago. Rosie is a juvenile and she was diagnosed upon stranding in February 2023. Stranded rough-toothed dolphins apparently are more likely to be found with hearing loss when rescued.

iii. Dolphin group social structure

Resident dolphin population management plan lacks the importance of establishing an appropriate dolphin group social structure, including experienced role models for each individual dolphin as a supportive factor in dolphin health and well-being, rather than a possible stressor that can potentially contribute to poor health.

C. Environmental Factors

Environmental factors may impact the dolphins generally and some dolphins more or less than others given their different conditions and sensitivities. Negative impacts can be stressors which when sustained over time can affect health and well-being.

i. Water quality

This is discussed in greater detail in the Life Support Systems Analysis in the Appendix but is included here as it is a critical environmental factor. Overall water clarity is acceptable, especially in the Dolphin Complex. On one hand, keeping water too clean in the Dolphin Complex has the potential to prevent a diverse bacterial community which competes with potential pathogens and primes the immune system for a healthy immunological response. On the other hand, algae growth, especially in Dolphin Complex Pool 5, the Rescue Deck, and Marine Mammal Stranding Station presents water quality and cleaning challenges and forces the use of chlorine in the Rescue Deck and Marine Mammal Stranding Station. Cleaning algae has short-term clarity and turbidity effects and potentially other impacts. Use of chlorine at the Rescue Deck and Stranding Station also presents challenges. Although many dolphin and marine mammal facilities utilize chlorine as a disinfectant, the trend is to reduce, minimize and eventually eliminate this in dolphin facilities. The elimination of chlorine presents water quality challenges by allowing algae, diatoms and other pathogens to propagate in the exhibit and eventually impact viewing quality for the animals and public. The trend is the move away from chlorine by maintaining algae and clarity control using more natural systems.

ii. Air quality

a. At CMA

At the time of the review team's site visit, CMA had begun to assess air quality and overall building health. As this report was being finished, the results of that study were made available to the review team. Air quality was measured and compared to outside controls both with the doors opened and after being closed for 12 hours. This work is a good starting point and the proposed remediation plans refer to environmental cleaning of rooftop HVAC units and certain building surfaces, and addressing the impact of feral birds (also noted elsewhere in this report).

b. Marine Mammal Stranding Station

Current rehabilitation environment at the Marine Mammal Stranding Station facility could be improved to further aid in the health of individual animals undergoing rehabilitation (and possibly the resident dolphin population at CMA). The area where the

rehabilitation facility is located and the high vegetation/dirt road right next to its open-aired plan provides an environment that is suboptimal for dolphins with highly sensitive respiratory tracts (both dolphins that have been/are being rehabbed have shown signs of respiratory issues). These respiratory events can lead to lung pathologies that are undetectable/subclinical but provide architecture that can make dolphins more prone to respiratory disease/pneumonia down the road. High populations of biting insects, even though not proven, provide a potential mechanism for disease spread as well as potential inhalation hazards if population levels get too high above the dolphin's blow hole.

iii. Noise

There currently does not exist a system for acoustic and noise monitoring in which to assess environmental noise impacts on the individual animals, including any potential issues relating to pool cleaning equipment.

iv. Dolphin Complex public viewing

The design of the Dolphin Complex does not provide for dolphins to escape from public view or view of other dolphins if they were to choose to do so. The individual rescued animals, once cleared from rehabilitation, move from an area with no underwater viewing to the Dolphin Complex where they are in constant view of the public. This can be a possible stressor for affecting animal well-being.

D. Communication/Group Dynamics/Culture

Communication is happening at all levels between the Veterinary Care and Animal Care departments (although the effectiveness of some communications could be improved). Interviews with staff indicated a spectrum of staff, at all levels of responsibility, feeling various levels of being informed (some feeling completely included, others needing more information). Examples include roll-out of second full-time veterinarian (where at least one Animal Care staff member though she was a relief veterinarian) and the lack of communication on necropsy results for deceased animals as people will create their own stories when facts are not provided.

The tension within the staff is normal (and not entirely unique to CMA) during serious medical cases because these are challenging situations; everyone has different past experiences which can provide divergent frames of reference and cetacean cases are especially difficult. These differences can be healthy if managed appropriately with trust, collaboration, and mutual respect with the ultimate shared goals of promoting overall optimal cetacean health and welfare.

With the recent deaths, trust between Animal Care and the Veterinary Care leadership appears somewhat broken. There appears to be a downward spiral of confidence both within the Veterinary and Animal Care leadership and teams including some uncertainty regarding clinical decisions. Somewhat toxic organizational culture has resulted in some questioning the approach of engaging in outside consultations; specifically, whom has been consulted and who is making the decision. This mistrust has sometimes resulted in over-communicating regarding

consultations, potentially reinforcing some staff's perceptions regarding effectiveness. This in turn leads to more transparent communication which fosters similarly self-defeating interactions.

There is a lack of clear definition of staff/departmental expectations, roles, and responsibilities between Animal Care and Veterinary Care. This can create friction with perceived over-stepping or over-reaching actions and ambiguous accountability with responsibility.

Culture at CMA needs to allow for less fearful accountability and discussion of opportunities. Encouraging staff to report mistakes by avoiding placing blame on individuals but rather examining the system and policies in place ("Just Culture" model) may help pave the way for identifying and addressing vulnerabilities in a constructive way.

E. Veterinary Care

i. Approach to veterinary treatment

Veterinary leadership has a progressive approach to medicine and is seeking experts to manage and adapt to the cases as they evolve. There is a satisfactory understanding of cetacean medicine, however, medical experience is maturing as is understanding of the holistic animal for a complete medical assessment including the behavior/physiological complex. Veterinary consultations are appropriate and often helpful, but would benefit from holistic case reviews during complicated cases (a full retrospective morbidity and mortality rounds of the four cases is planned with veterinary colleagues). There is a difference in approach to medical cases between a consulting veterinarian and the current veterinarians. This difference has been manifested in several ways including heated discussions in the presence of Animal Care and Veterinary Care staff which has seemingly eroded confidence in the in-house veterinarians' medical approach and led others to question the means of engagement employed by the consulting veterinarian. Furthermore, lack of complete communication/follow-up between the staff veterinarians and the consulting veterinarian led to communication between the consulting veterinarian and the Animal Care staff (to check on the animal), further compounding the issue.

ii. Animal behavior/medical behavior competency

Medical behavior competency in some of the dolphins, particularly those residing at CMA for a shorter time period, appears to be lower than in other collections, although as noted above, CMA's resident dolphin population is unique in that all of its animals have been rescued. It should also be noted that when animals are not feeling well, progress with training can be slow. Lower medical behavior competency in some CMA dolphins may be a product of the eclectic nature of the rescued dolphins and hearing loss in some of them, but care needs to be taken to avoid a shifting baseline. Assuring medical behavior competency can improve preventative care and reduce the stress of having to capture dolphins for medical procedures, especially considering netting animals which has safety risks for both dolphins and staff. This may be a matter of prioritizing and accelerating, as appropriate, training of dolphins for medical/husbandry behaviors upon placement at CMA.

iii. Veterinary responsibilities beyond veterinary care

Veterinarian(s) is/are responsible for too many tasks and program outcomes (registrar, nutrition, hospital manager, new staff trainer). The veterinary workload and responsibilities are unsustainable. Part of this overextension is from expectations and history of the organization and partially due to reluctance to delegate. It is understood that under the Animal Welfare Act, the attending veterinarian has broad responsibility with regard to veterinary care and to “oversee the adequacy of other aspects of animal care and use.” 9 C.F.R. § 2.40(a)(3)

iv. Veterinary consultants

There is confusion with the role(s) of the consulting veterinarian(s).

F. Animal Care

i. Animal behavior/welfare

There is a lack of a variety of formal animal management programs. These include:

- a comprehensive program for animal behavioral observation and documentation of same
- a robust animal welfare monitoring program
- an acoustic and noise monitoring system
- an anonymous animal welfare concern reporting structure

Within the current resident dolphin population, there exists some concerning and abnormal animal behavior: regurgitation (though in one case that may have originated with Rex while in the wild perhaps due to hearing loss in echolocation range impacting foraging), and self-injurious behavior (tail-smacking). These behaviors need to be monitored in order to develop strategies for reducing or eliminating them.

ii. Staff burnout/fatigue/stress

Staffing numbers, especially during critical medical cases, are taking a toll especially with several closely consecutive cases (staff are tired, “burnt-out,” working very long hours in many cases in addition to having a second job, low morale). Intensive medical cases alone take a toll physically and mentally on the teams caring for the animals. When critical care includes 24-hour monitoring, this adds to the strain on individual team members as well as the group.

iii. Staffing/dive team

Over the last several years, as CMA’s dolphin facilities have grown, its dive team has become considerably smaller. Appropriate levels of safety have been maintained, but pool cleaning, maintenance, and Veterinary and Animal Care support functions can be impacted and constrained.

iv. Recordkeeping

Handwritten animal records and lack of or insufficient computers or tablets to input pertinent animal information can result in improper documentation of important animal related data and impairs the ability of the teams to easily review past information and identify patterns and trends.

The use of WhatsApp to communicate between the Animal Care staff and Veterinary Care staff has allowed for extensive real-time communication, but has the constraint that these observations and conversations are not in the Tracks medical record system.

v. Equipment

During food preparation, it was noted that old plastic tools/utensils were used in the preparation of the dolphins' fish diets. Food preparation procedures need to adhere to high levels of scrutiny in all aspects of the process to avoid contamination and to ensure a high-quality diet for the dolphins.

G. Life Support Systems

i. Staffing

Our review of the systems indicates that the Life Support staff are performing at a very high level relative to other facilities. On a scale of 1-10 (one being low and 10 being high) the staff are performing at 8. The biggest issue for them is the maintenance of the systems associated with the older portion of the old treatment plant system. The structural and mechanical portion of this area is beyond its useful life. It is understood that as a part of the current master planning, the idea is to replace the older systems.

ii. Dolphin Complex System

The makeup water system consists of an intake pump, sand filters, UV sterilizer and carbon filters. The UV is sized for 280,000mWsec/square cm. This dosage (if the UV bulbs are replaced yearly) should be adequate to protect the system for most pathogens. The capacity of this system is reported to be 180gpm. CMA is planning to upgrade this system by adding ozone to the system and removing/supplementing the UV. This improvement will significantly enhance the operation of the system. In addition, based on discussions below, CMA may want to consider increasing the capacity of this system.

The Dolphin Complex system is significantly oversized for the current dolphin load. If the current loading is maintained then the system should be easily performing and producing excellent water quality. The potential for improved animal health could occur by allowing the Oxidation Reduction Potential ("ORP") to drop (emphasizing biodiversity in the pool and eliminating the "sterile" system). This could be accomplished by reducing the ozone dosage and dropping the ORP in the pool to around 250mV (lower if possible) while monitoring the Total Coliform (as an indicator organism and to comply with Federal standards). This should be dropped slowly while observing the algae growth in the pool, color, turbidity and dolphin health.

iii. Rescue Deck System

The Rescue Deck System is operating marginally. This system consists of pressure sand filters, temperature control and chemical addition (chlorine). The use of chlorine instead of ozone is undesirable. Additionally, the lack of shading (direct sunlight) increases the severity of algae growth. The Life Support System staff are considering adding ozone to the system in conjunction with the design and installation of the manatee system. This approach seems sound. It also would be advantageous to provide complete shading of the pool from direct sunlight to minimize algae growth and this would also protect dolphin eye health. (A test is being considered at the Rescue Deck of an ultrasonic algae control device. It would be nice to have an algae control method to keep maintenance under control, reduce the noise associated with algae scrubbing and allow the removal of chlorine in the system.)

Algae Control. There are several issues concerning the algae control in these systems. The current use of shading (elimination of direct sunlight on the pools) is the predominant method of control. The use of lanthanum chloride is becoming more expensive and adequate algae control by “starving” the algae for phosphorus probably only works at lower levels (less than 0.1 mg/l Total Phosphorus). Potential approaches to controlling algae include the ability to shade the pools of concern; the potential use of ultrasonic algae control, which will need to be tested to validate its effectiveness once it is determined that the frequencies are compatible and safe for the dolphins (this will also include the acceptance of algae growth to cycle thru the more difficult species); and ongoing maintenance of an algae population that is consistent and less impactful on water quality in the pool. Some of these will require a constant education process for the public and staff.

iv. Marine Mammal Stranding Station System.

The Stranding Station Life Support System consists of an 800-foot-long ocean intake allowing for natural seawater, intake pump, two recirculating pumps which take water from the 75,000+ gallon rescue pool through high-rate sand filter, heat pumps, and chlorine storage and feed system. The light screen keeps the algae relatively under control but the staff are required to scrub the bottom of the pool and vacuum algae on a regular basis.

IV. Recommendations

It is important to note that some, and perhaps many, of the items below have been, or are happening at one level or another at CMA and these recommendations are directed towards putting CMA in the best position to advance the health, and well-being of the dolphins residing there.

A note on the constructive approach and philosophy underlying the recommendations.

These recommendations are roughly arranged by dolphins, environment, dolphins and people working together (i.e., with Animal Care and Veterinary Care), people working together, and other things (though some like life support are critical). The dolphins come first as they should and do in furtherance of CMA's commitment to its mission. The better the understanding of individual and collective dolphin behavior, health and well-being, the sooner potential concerns and issues can be identified, addressed and resolved. Environmental factors are always present though impacts may vary. Ultimately, these measures will help the people at CMA make an even greater difference by working together for the dolphins (and other animals). As noted above, the dolphins come first and that is the right place to end.

A. The resident dolphins

i. Prioritize the creation and stewardship of a healthy dolphin group social structure and population

The eclectic nature of the resident, rescued dolphin population is an unnatural social structure. This social and behavioral makeup of the resident dolphins is a risk factor for chronic stress and increased medical cases. Humans, while a good attempt to replace other dolphins, are not an adequate surrogate for an appropriate social structure. Focus should be placed on the health and well-being of the social group in addition to each individual dolphin. This can be accomplished by starting to manage the current dolphins as a group, adding some older dolphins to the group to be role models for appropriate social behavior. Consider adopting a social structure of well-adjusted females (preferably from a previous stable family structure) brought in to act as a family nucleus to teach stranded animals how to adapt and thrive in a managed-care situation. An appropriate social structure can be useful in reducing abnormal behavior such as the frequency of regurgitation and self-injurious behavior. Develop a long-term population management plan that includes a balance of dolphins born in managed care and stranded dolphins.

ii. Refine and prioritize special care and training to account for dolphin hearing loss/deafness

Deafness and hearing loss exhibited by some of the resident dolphins poses behavioral, health, sound, training, and welfare challenges. Welfare monitoring and training techniques targeting hearing impaired animals should have a special focus for assessing learning and social integration.

iii. Consider baseline and periodic dolphin auditory exams

Auditory tests should be considered for all dolphins to obtain baseline information (if needed) on their hearing or hearing loss. For those with no known hearing loss, testing should be considered above a certain age (e.g., 20 years old). This will help to monitor this critical sense and more appropriately manage and train the dolphins.

iv. Prioritize and accelerate to the extent possible (given that all the dolphins arrive with health issues and good training takes time) medical and husbandry behavior competency/training

Animal training takes patience and time in order to build, develop, and nurture a trusting relationship with each animal. CMA's unique animals present additional challenges to the Animal Care team in that each animal has its own medical and treatment history, physical and mental challenges besides each animal being unique on its own. Husbandry behaviors are built on the trusting relationship that develops with the Animal Care team and ideally are fully trained before asking for cooperation in sample collection and voluntary participation. With these unique animals and, at times, on-going medical issues, sometimes these behaviors are used before they are fully trained. There needs to be continued focus to grow the training program with special emphasis on management and husbandry behaviors that can support the health needs of the individual and the social needs of the dolphins and group. This will facilitate more regular proactive health monitoring for this uniquely challenging population and decrease stress of handling animals for diagnostics. It will also decrease the onus on the veterinarians to decide if an animal is "sick enough" for handling as clinical presentation in cetaceans can look very similar for serious medical conditions, self-limiting medical conditions that may not require treatment, or social/environmental stress.

v. Review, and if appropriate, refine out of water handling procedures to further minimize potential stress

B. Animal behavior/care/welfare

i. Animal behavior observations/behavioral studies/monitoring

Animal behavior observations play a crucial role in managing individual animals and a social group as a whole. Animal Care staff should conduct and document frequent and routine animal behavior observations to inform group management decisions and welfare assessments. This needs to include a consistent and formalized dolphin behavior monitoring system that is recorded electronically and used to produce routine behavioral reports such as time budgets, all occurrences of abnormal behaviors, and possibly behavioral diversity measures for animal welfare.

You can't manage what you don't measure. Animal Care needs to perform these ethogram-based behavioral studies which will help to inform their decisions especially for group animal management. CMA leadership may want to consider expanding CMA's work with behavioralists

or other consultants experienced with managing complex social groups. The Animal Care team will need more electronic technology and computers to accomplish this.

ii. Animal welfare monitoring

In order to fully commit to ensuring the animals thrive, a more robust animal welfare monitoring program must be developed that includes animal-based measures of welfare for both positive and negative indicators (distress), data collection, routine data analysis, and regular reviews from staff at various levels and departments. An animal welfare strategy for CMA needs to be created that emphasizes the importance of animal welfare within the organization that includes both reactive and proactive animal welfare tactics, an effective system for being able to report an animal welfare concern with follow through on the concern, and tracking of animal welfare plans and cases.

iii. Animal welfare assessments, recordkeeping and welfare action or improvement plans

Welfare assessments should all be recorded in the medical record system and welfare action plans created for any animals with suboptimal welfare.

iv. Employ Quality (and End) of Life or QOL assessments

Implement Quality of Life (QOL) assessments for any geriatric or critically ill animals. Engaging the Animal Care and Veterinary Care teams in proactive Quality of Life Assessments can assist in more informed and agreed upon decision-making. This system works well when the assessments can be quantified and trends tracked over time. (This aids in animal care, ethical and responsible end of life decision-making with staff engagement, and also has a beneficial effect on the grieving process.)

v. Use webcams and video footage as resources

CMA's extensive webcams collect an enormous treasure trove of dolphin observations that could be harvested for a better understanding of animal behavior when not impacted by staff and visitors. Perhaps university partnerships and students could help here. Recorded footage may also be helpful in understanding and addressing public concerns and/or complaints arising from the public's online viewing of webcam images in real time.

vi. Enrichment

CMA leadership should evaluate the effectiveness of the current enrichment program and safety of Environmental Enrichment Devices through ethogram-based behavioral assessments and current literature. The Cetacean Welfare Study targets the importance of environmental enrichment programs and social management factors associated with positive indicators (Lauderdale LK, Mellen JD, Walsh MT, Granger DA, & Miller LJ (2021). Towards understanding the welfare of cetaceans in accredited zoos and aquariums. *PLoS ONE*, 16(8), 1–26. <https://doi.org/10.1371/journal.pone.0255506>). One variable of note is the addition of new

enrichment on a more frequent schedule that was linked to increases of energy and positive social relationships..

vii. Establish system for anonymous reporting of animal welfare concerns and complaints and reviewing and resolving same

Establish and publicize an anonymous system for reporting, reviewing and resolving animal welfare concerns and complaints. This does not replace but rather augments the current welfare concern reporting. Trust in the welfare reporting system needs to be validated with the staff.

viii. Bolster Animal Welfare Committee

Make Committee more active, empowered and representative of other departments at CMA which have an interest in supporting animal welfare. As the Committee advances, consideration should be given to having one or two board members act as liaisons to the Committee to enhance and promote the board’s understanding and further support of animals’ interests and well-being. There should also be two independent members added from outside CMA.

ix. Consider creation of Animal Welfare Officer position

Consider a designated executive level “Animal Welfare Officer.” The Animal Welfare Officer is responsible for monitoring, promoting and enhancing animal welfare and related management and planning in coordination with other animal related department leaders and the Animal Welfare Committee. The Animal Welfare Officer may hold another title, and these may be two distinct but overlapping and mutually reinforcing positions. The Animal Welfare Officer must be knowledgeable about animal welfare and skilled in interpersonal relations such that they are both respected and approachable by other staff. The Animal Welfare Officer focuses entirely on animals and their welfare. To maximize and validate effectiveness, the Animal Welfare Officer should also help coordinate the organization’s animal welfare-centered research efforts, whether conducted by in-house staff or in cooperation with outside researchers. The Animal Welfare Officer may also provide an informal outlet for the review and resolution of animal welfare concerns in addition to the normal chain of command, and the more formal review by the Animal Welfare Committee including that of anonymous concerns.

C. Environmental factors

i. Water quality (see dolphin facilities – Life Support Systems)

ii. Air quality

a. Gaining a better understanding of cetacean air quality sensitivities

It would be helpful to CMA and the entire marine mammal community to have a better understanding of cetacean air quality sensitivities, including differences and similarities with humans. This is particularly important because current regulatory standards are minimal and focus on ventilation, and “minimiz[ing] the accumulation of chlorine fumes,

other gases, and objectionable odors.” See Animal Welfare Act regulation 9 C.F.R. § 3.102(b) (facilities, indoor ventilation).

b. Monitor and regularly test air quality at CMA

The recent air quality study should be refined and periodically repeated, particularly each time there is ground-disrupting construction near the facility. Refinements should include a longer-term assessment of the Dolphin Complex air quality and ventilation over several days and during various seasons to capture variation in the immediate area; determining baseline air quality along the coast approximating dolphins’ natural habitat (with transect sampling in the bay, 1 mile, and 5 miles out to understand the particulate load in the facility and out in the wild); performing a volatile organics (VOC) sampling to make sure there are no other chemicals in the environment that might cause long-term subtle changes to lung tissue (this should also be performed at the Stranding Station during off-shore winds); and enhanced understanding of different air quality sensitivities between dolphins and humans. Pollen, dust, and microbiological air levels should also be seasonally measured at the Dolphin Complex, Rescue Deck and Stranding Station

Even with this information, if the population is having chronic respiratory issues, it might be best to follow recommendations from the Association of Zoos and Aquariums penguin community as penguins are also highly susceptible to airborne respiratory issues. Recommendations for penguins include 15 air-turnovers per hour, using a 3-micron filter in indoor facilities.

c. Marine Mammal Stranding Station

- Test air quality when there are offshore breezes and seasonally. There is greater concern about testing for particulates at the Stranding Station.
- If particulates are found to be elevated above CMA controls (ideally, offshore controls) it is strongly recommended that there be a more controlled air quality environment for the Marine Mammal Stranding Station as a means of protecting indoor air quality given the surrounding dirt road, vegetation and concentration of airborne biting insects.

iii. Noise monitoring program

Soundscape needs to be measured, monitored, and understood. Add an acoustic monitoring program to routinely assess the noise levels within and around the habitat and at times of events likely to cause noise disturbance as well as a 24-hour measurement over several days.

iv. Dolphin Complex public viewing

Assess the need for 360-degree viewing by guests. The animals cannot remove themselves from view by the public. This should also be considered when animals are managed as a group so that they have spaces to also remove themselves from view from other animals.

v. **Feral birds**

The team is trying to get wild bird exposure within the Dolphin Complex and on the rescue desk under control as bird waste in the water or seagulls dropping fish captured in areas affected by red tide is a concern. Consider a falcon show as a possible addition to the collection. Consider UV film or other antiavian window dressings on the glass to prevent collisions.

D. Veterinary Care

i. **Veterinary responsibilities**

Veterinary responsibilities should be focused on medical care, rather than too many administrative and other tasks (e.g. Registrar, Veterinary Clinic/Hospital manager). This is especially important with such highly regulated special needs animals subject to intense public attention and scrutiny. A nutritionist consultant would help since this is an important subspecialty and may be able to offer recommendations for animals experiencing gastrointestinal issues. The Veterinarian of Record should not be the Registrar for the organization. This needs to be transferred to another staff member focused on the collection. Consider restoring the Veterinary Clinic/Hospital Manager position.

As the veterinarian(s) delegate(s) responsibilities, there needs to be benchmarks for that delegation. Do this in a timely manner for appropriate distribution of responsibilities which will allow the veterinarians to focus on clinical cases.

Similarly, enhanced trust and delegation of husbandry and medical training (and perhaps eventually some medical sampling) to the Animal Care team would be helpful. It is admirable that the veterinarians seek to build rapport with the dolphins, but in light of their broad current responsibilities, deferring to Animal Care staff may be a more efficient investment of time and resources. As one of this report's authors has previously written, under the Animal Welfare Act, "...veterinary decisions or judgments must be made by the attending veterinarian rather than by management or caregiving non-veterinary staff. In some zoological organizations there may be extensive discussion of animal health and treatment amongst key staff. This may even extend to engaging in a somewhat collaborative decision-making process. That judicious deliberation is wonderful [when mutual respect and trust have been established]..." (James F. Gesualdi, *Excellence Beyond Compliance: Enhancing Animal Welfare through the Constructive Use of the Animal Welfare Act*, 2014) at 68.

ii. **Veterinary case management**

a. **Diagnostics**

- **Blood sampling** should occur as early and often as possible once a dolphin appears ill or "off," especially given the speed at which cetacean care progresses.

- **Iron:** Veterinary Care team should investigate iron storage disease and metabolic disease as serum iron values above 200 (definitely above 300) should be suspect. When elevated serum iron levels are detected an iron panel should be pursued. These two disease complexes are baseline health issues that can trigger or compound medical cases.
- **Blood culture:** Blood culture can be used as an additional diagnostic tool to potentially identify cases of sepsis sooner.

b. Therapeutics

As medications are added within a given course of treatment, care should be taken to analyze and address potential drug interactions and continued efficacy.

c. General considerations

- **Immune function:** Look at immune function tests on each resident dolphin and compare to other managed and wild dolphins. If immune profiles are equivalent or below dolphins in the wild, the organization should try to determine if distress or lack of appropriate microbial exposure might be suppressing the immune system through analysis of social structure and hormone analysis. If it is determined that the cause of immune system suppression cannot be attributed to distress, then CMA should utilize microbiome diagnostics to determine current environment and adjust to encourage diverse microbial community within regulatory limits. (See Environmental factors, Water quality and Dolphin facilities/Life Support Systems.)
- **Animal and environmental microbiome:** Environmental and animal microbiome are evolving concepts. Consider commercial microbiome testing on top of cultures (Shedd Aquarium might be able to assist). The marine mammal community needs to better understand this microbiome especially in context to the perceived pathogenic *E. coli* (it should be examined if this organism is truly pathogenic and not just associated with the cases). Cultures are useful for sensitivities, but we should be trying to find microbiome balance for competition with potential pathogens. Methods for addressing diagnosed (gram study of gastric and feces) dysbiosis, when determined that it is out of control, may include complete elimination of gastrointestinal microbiome “starting from scratch” to reestablish the microbiome using transfaunation. Having serum bio-secure transfaunation aliquots ready to go to reset microbial community would be helpful.
- **Resistant bacteria:** There is a nasty circular reinforcing pattern of resistance development, especially with *E. coli* resulting in the need to use more potent antibiotics. This is both an animal and human health hazard. Instead of constant disinfection techniques, this dynamic is best combated by accomplishing a higher microbial diversity to outcompete the pathogens and help boost immune competence. Need to start eDNA analysis to understand microbial diversity and amounts to understand shifting patterns. This is a newly evolving technology that will take some time to fully understand.

Realizing regulatory levels of coliforms must be met, the goal of the total-coliform count in the water column should not be zero. There should be an aim to encourage microbial biodiversity. Fish in the system would help. Recommend eliminating chlorine if possible and sticking with ozone as sole disinfectant.

iii. Outside consultations are helpful in treating difficult cases like those at CMA

Just as the Veterinary Care and Animal Care team leaders could develop a more collaborative working relationship at all levels, Animal Care team and Executive leadership should better understand that external veterinary consultations can be helpful, especially in challenging and novel situations. Veterinarians have various levels of trust by Animal Care staff and try to be proactively transparent with staff. The veterinarian(s) recognize(s) the importance of getting outside opinions (and has/have demonstrated this) on cases they want additional information about and should be trusted they are doing this. That does not mean the veterinarian should be consulting with other veterinarians in front of staff as it may be misinterpreted without full context. Clear expectations for communication with consulting veterinarians need to be established and understood by staff Veterinary Care and Animal Care teams as well as the consultants to include a single point of contact to ensure case continuity and differences in opinion between veterinarians should be discussed in private. Consultation information in a fluid situation needs to be digested by the veterinarian(s) who then produce(s) a measured, well-thought-out and coherent plan to the Veterinary and Animal Care teams (preferably at the same time). Offering who was consulted can be part of that discussion but not needed every time.

- a. Utilize contract veterinarians as consultants, experts, mentors**
- b. Have pre-approved list of other consultants/experts to save time and reinforce expertise (while maintaining flexibility to reach out to new or different experts as novel situations emerge)**
- c. Expand opportunities to bring outside vets to staff onsite and virtually for professional development and relationship building in non-crisis situations**
- d. It is important to note who is being consulted in the veterinary records along with a brief summary of substantive portions of the discussion**

iv. Utilize independent pathologists for necropsies

Even though they should be present to learn, when possible, the clinical Veterinarian of Record should not be the Pathologist of Record for any portion of the necropsy on a cetacean in which they were clinically responsible. With respect to one case, even though the gross pathology was properly identified and recorded and there were two other veterinarians involved, the good practice of more independent necropsies avoids even the possibility of perceived concerns (histopathological findings were performed by an independent pathologist).

v. Morbidity and mortality reviews

The Veterinary Care team should keep on their current course of conducting regular morbidity and mortality meetings between inhouse Veterinary Care and Animal Care teams as well as the consulting pathologist. This will help disseminate post-mortem findings to staff in a timely manner and allow for a whole staff discussion about what went well or what could be done differently in the future. This forum may also increase the sense of team ownership around cases and outcomes. Continue with planned morbidity and mortality meetings with outside marine mammal veterinarians. This can be done at International Association for Aquatic Animal Medicine (“IAAAM”) conferences or remotely.

E. Staffing

i. Staff responsibilities, tasks and staffing levels

Executive leadership and Human Resources should more closely examine Animal Care staff responsibilities and time invested in specific tasks, as well as staffing levels to identify potential changes, improvements and need for additional staff. Assess allocation of staff and time invested in different tasks to identify potential reallocation of time and tasks, as well as current staffing levels to ensure staff have the needed time to follow all protocols, procedures, and biosecurity measures. This will optimize efficiencies and inform staffing decisions to add more labor as gaps are discovered. Surge capacity should be accounted for in the assessment. This may result in lower turnover costs offsetting the additional labor costs.

During times of critical animal care, evaluate the number of staff needed and consider hiring temporary staff so that permanent full-time staff do not get burnt out working an excessive number of hours and off-shifts, that leaves them vulnerable to making mistakes. Keep Animal Care and Veterinary Care staff working at optimal levels of performance by making sure they have balance between work and personal life.

ii. Compensation

Continue to frequently review appropriate comparables for staff compensation, and adjust compensation for cost of living especially in this inflationary environment.

iii. Professional development

The Associate Veterinarian should be competent and confident to treat all species housed at CMA. For any species that they have not had prior experience with, training should be provided. This training can be “on the job” provided by the Veterinarian of Record, shadowing veterinarians at other facilities with high caseloads (such as SeaWorld or Navy), or didactic courses such as SeaVet, Marvet, and Aquavet.

The Veterinary Care team should consider having vet techs shadow and train for laboratory techniques at SeaWorld.

Explore additional professional development opportunities for Animal Care team, such as keeper exchanges with other similar facilities and increased participation and attendance at the International Marine Animal Trainers Association (“IMATA”).

iv. Manatee Program

The new Manatee Program: CMA will need to add veterinary and probably Animal Care staff for manatees. A “manatee-certified” veterinarian with a minimum level of manatee rehabilitation experience will be required.

F. Communication/Group Dynamics/Culture

i. Understanding CMA animal care and medical care have made a difference for rescued animals

Staff should recount the successful medical interventions that have made a difference in an animal’s life to put into context the recent string of deaths. Humans tend to dwell on failure and forget success. It is important as an organization to keep these successes in mind to get a more complete picture of medical care, including supportive animal care. All case histories add to one’s experiences and informs the next case resulting in better health and welfare for more animals over time.

ii. Enhance collaboration with shared responsibility

Cetacean health is a team process with everyone responsible in the process, and the responsibility for an animal’s health and well-being is shared by all. The more empowered and engaged individual team members feel in the ongoing process of caring for the dolphins, the more readily there is shared ownership in outcomes.

Ideally, there should be a culture of shared responsibility (with a goal toward learning from mistakes). The veterinarian(s) need(s) to delegate and trust those around them which depends on a culture that allows it. It is recognized that a somewhat toxic culture has built an atmosphere of trying to control all aspects around veterinary care to best control the outcome since the veterinarians may likely be held responsible for poor outcomes. This is not a healthy or sustainable way to run a total health care program. In a fully functioning health and welfare program there is a fluid communication/trust between the Veterinary Care and Animal Care teams. Natural differences of opinion are normal since everyone has different experiences which have worked for them. This is appropriate and healthy but can become detrimental when not managed correctly and trust is broken. Cetacean health is heavily influenced by the social and psychological state of the animal which is presented in the behavior of the animal (and can also manifest in physiological changes, which can be seen on chemistry labs). Because of this, the Veterinary Care team should pro-actively consult and use their in-house experts (the training staff and their consultants) to have a holistic plan to approach medical cases. This may require a level

of trust that is outside the current comfort level of some of the respective departments, but the expectation is the collaborative team approach celebrates improved health and wellbeing and also takes responsibility (and accountability) for other outcomes as a team. The Animal Care staff is best to assess and address behavioral aspects and needs to be trusted to best represent that aspect of the health care. This includes setting up the animal for the least stressful interactions in the context of medical interventions (with the goal of preventative medicine) which need to be very timely and determined by the veterinarians. Ultimate medical assessment of the organic status of the animal and treatments are the veterinarian's responsibility, but the veterinarian should rely heavily on behavioral assessments from the Animal Care team. The Animal Care team should seek external audits on behavioral assessment and training techniques once or twice a year to keep a check on group think.

iii. Articulating a cohesive treatment approach

In an effort to build trust, the veterinarian(s) should better explain “the why” of each move. Much of the staff feels this is happening. However, it is helpful for the veterinarians to think through their reasoning before presenting it to staff to avoid confusion or any misunderstanding.

There is an art to dolphin medicine, especially in a situation when an animal is deteriorating quickly, but evidence-based medicine, as practiced as CMA, should remain a foundational element when time allows.

Respectful questioning should be expected and welcomed to adjust the plan but once this happens, the plan needs to be set and executed with shared accountability for following the plan.

iv. Animal Care/Veterinary Care leadership collaboration, communication and meetings

CMA needs to determine how to best build trust and enhance collaboration between Veterinary Care and Animal Care leadership. Disagreement between the two groups is normal and healthy if managed in a respectful and collaborative way that does not undermine trust. The Veterinary Care and Animal Care leaders need to prioritize meetings between the two at least weekly. This may include offsite team building to foster and maintain the relationship.

All teams need to agree to make sure effective communication and professional courtesy is a priority. Understand the distinction between effective communication verses simple communication and fine tune strategies. Consider body language and crucial conversations for effective communication.

v. Joint weekly rounds

Veterinary Care and Animal Care teams should jointly do weekly rounds to review and discuss each dolphin and its treatment plan. This might help foster more open dialog and collaboration in a pro-active, non-crisis situation.

vi. Utilizing the Chief Zoological Officer to help work through differences

There needs to be a clear chain of command of who makes the final call and a mechanism to resolve differences of opinion on medical or welfare cases (i.e., three-way conversation with Chief Zoological Officer, Veterinarian(s) and Vice President of Animal Care or their designee), though veterinary decisions ultimately remain with the veterinarian (in consultation and, hopefully, collaboration with Animal Care).

G. Leadership/Trust

i. Clarify Animal Care and Veterinary Care roles

CMA Executive leadership should establish clear roles and responsibilities for Animal Care and Veterinary Care. These expectations need to be made very transparent to both departments from the department heads to the associate animal care specialists and veterinary technicians. Define each role and their responsibilities and mechanisms for accountability. Where clear lines can be delineated between Animal Care and Veterinary Care, make them apparent.

There will be numerous areas and situations where the lines are blurred but that is where true collaboration, open and honest communication, and teamwork are needed. This needs to be expected from all involved, and this collaboration must be professional and respectful. Everyone needs to be held accountable to these rules by establishing clear and professional standards for conduct that also should govern interactions with consultants.

Establish the above as the new working environment and work towards building trust at all levels within the organization through transparency, open communication, and answering the “why” behind decisions that are made at all levels.

ii. Executive leadership

To better understand the exact responsibilities and pressures on the staff, the administration should spend time shadowing their staff including after-hours (administration cannot leave until the staff does). Just as importantly, by “walking a mile in the shoes” of the staff, Executive leadership will go a long way in showing the staff respect and thereby building mutual trust.

iii. Human Resources

Further engage Human Resources to assist in building organizational trust, staff morale, and team building.

H. Dolphin facilities/Life Support System

i. Swimming pool vs. natural system

Proactively consider water quality and dolphin immune resilience. The current state of the art points to moving from a sterile “swimming pool” type system towards a more natural system, which has ramifications for both animal health, system operation and public perceptions. This applies to all three facilities, the Dolphin Complex, the Rescue Deck, and the Marine Mammal Stranding Station. The veterinary discussion addresses animal health issues. From the life support standpoint, although the existing system does not represent the “state of the art” for life support system design, modifying operational constraints can allow for moving more towards the natural systems with potential improvement in animal overall health. (Detailed discussion in Life Support System Analysis in Appendix.)

ii. Dolphin Complex

a. UV bulbs in Intake Treatment System (supplying Dolphin Complex)

UV bulbs, though replaced yearly, should be checked at shorter intervals, and a pathogenic test should be considered to make sure that the bulbs are not fouling.

b. Multi-species

It may be an advantage to consider the addition of fish (multiple species) into the system. The potential resistance to consider this is understood, but the potential for improved animal health is significant. This would require installation of a “refuge” for the fish to hide from the dolphins and an ability to treat the fish if necessary.

c. Medical pool

In the event true isolation of a dolphin is required, there may be need for an alternative to the existing medical pool in the Dolphin Complex. See Animal Welfare Act regulation 9 C.F.R. § 3.110 (b) (veterinary care)

iii. Rescue Deck

As recommended above, work toward eliminating chlorine if possible and sticking with ozone as the sole disinfectant.

a. Algae control

Consider additional cover/shading to manage algae and protect dolphin eye health.

iv. Marine Mammal Stranding Station

As recommended above, work toward eliminating chlorine if possible and sticking with ozone as the sole disinfectant.

I. Biosecurity

Biosecurity between otters/pelicans/cetaceans needs to be assessed to maximize biosecurity between the taxa. Evaluate whether labor/time is adequate or how it is being allocated.

The Animal Care team should consider using a Glo Germ exercise where an invisible powder mimicking bacteria is placed in key areas. The staff then works a regular shift. At the end of that shift, the rooms are scanned with a blacklight to reveal how the "germs" have traveled with the current biosecurity measures. The staff can react and modify their processes based on the information they gain from the experience.

J. Recordkeeping

i. Consolidating information in behavioral and medical records

Consider transitioning Animal Care observations and some of the communication that is currently happening on WhatsApp to a medical record system as this will consolidate all information into one place for staff and regulatory or accrediting agencies and may be more searchable when trying to tie environmental or social variables to medical issues. This will require investigation and investment into infrastructure (computer terminals and/or tablets).

ii. Increase electronic recordkeeping

Increase the staff's ability to capture important data and store information through electronic record-keeping, which makes data more readily available for review, reporting, and for use in making animal welfare and management decisions.

iii. Recording substantive information from outside consultants

It is often challenging enough doing all that is required to treat ill dolphins. Nevertheless, thorough recordkeeping including substantive exchanges, feedback and input from consulting professionals is vitally important. Such recordkeeping can greatly enhance ongoing and future treatments, as well as review of prior conditions, illnesses, problems and trends.

K. Equipment:

i. Veterinary equipment

Functional, updated veterinary equipment is necessary for ensuring an adequate preventative health program.

ii. Planning for veterinary equipment replacement

Establishing an equipment matrix with estimated life of equipment and allowing for staggered addition/replacement of older equipment may help the Finance team to better understand and plan for this in future budgets.

iii. Food prep. equipment replacement/cleaning

Establish a regular replacement and cleaning protocol for use especially with plastic utensils and tools used in food prep, e.g., hoses in water during fish thawing procedure and drain traps.

L. Misc./Other

i. External communications

Communications Team needs to give timely messages or talking points to staff so they have appropriate responsive messages. There is a need to ensure that these talking points are being communicated down the chain to frontline staff and volunteers to ensure they are equipped to answer guest questions and/or to politely and promptly refer them to the appropriate staff or resources responsive to their inquiry or concern.

ii. Webcams on delay

Need to time lag the live video feed from the webcams to give staff some breathing room for items that cannot be explained in real-time and to prevent communication scramble when procedures are happening or unfettered visual information going out to the public without context.

M. Extending the reach of CMA's contributions

Help other dolphin rescuers, caregivers, and the public better understand the challenges, lives and contributions of rescued dolphins in forever homes like CMA.

i. Partnering with other rescue, marine mammal, and zoological organizations

Develop a program allowing professional staff from other reputable organizations to contribute staff and other resources to supplement and/or assist in CMA's good work and good works.

ii. Further study

Do an assessment of survival rates of stranded animals in managed care based on categories such as species as well as age and condition at time of stranding. This would enable more thoughtful evaluation of the recent mortalities in context and might also help advance rescue, rehab and care programs at CMA and elsewhere.

V. Conclusion

Many leaders and staff members interviewed were clearly very passionate and dedicated. This provides a solid foundation to make the above enhancements to the resident dolphin program, to aid in the professional development of leadership and staff, to foster greater collaboration, build mutual respect and trust, and enhance animal health and well-being. These recommendations can help CMA evolve from supporting the physical health of individual animals in need to one that supports the physical and psychological health and overall well-being of the animals and their social groups. Supporting the care and rehabilitation of the individual animal and continuing the support of the dolphins' transition into a healthy social group targets the goal for each individual and the group to thrive in CMA's care. That will elevate CMA's singular efforts on behalf of dolphins and advance its mission.

Appendix to
Review of resident dolphin program

Submitted to
Clearwater Marine Aquarium

June 12, 2023

Life Support Systems Analysis

I. Transitioning to a more natural system

Although the following discussion references the Dolphin Complex in particular, the concept is applicable and desirable for all of CMA's systems.

A. Modifying Operational Constraints

The current Dolphin Complex system is being operated with ozone (without chlorine) which is a good start. The discussions with staff have indicated that the TRO (Total Reduced Oxidants) is zero and Total Coliforms are consistently zero within the pool. However, with full flow ozonation and maintenance of ORP's (Oxidation Reduction Potential) around 550 mV, the recirculating flow is being oxidized at too high a level. This works for the current operational mode primarily because the animal load is extremely low (880gal/lb). If the decision is made to continue at this loading, the opportunity to move toward a more "natural system" is simply by reducing the ORP in the ozone contactor discharge "incrementally" from 550 to 400mV (and possibly even lower) while monitoring the TRO, ORP, Total Coliforms, turbidity (visually) and color (visually) in the exhibit. It appears that with the current loading the system may operate without exceeding the Total Coliform levels with a minimum of ozonation. Another option is to convert the Life Support System from full flow ozonation to a sidestream ozonation (slowly reducing from 100% ozonation to 10% ozonation), adjusting the ORP out of the ozone contactor and again monitoring water quality parameters mentioned above. This could be done while monitoring dolphin behavior and health. If the decision is made to increase the dolphin load up to the design load of the Dolphin Complex system (12-20 dolphins) a more refined method would need to be employed. This could be done by simply modifying the % ozonation and dosage. It would be likely that as the load is increased, several issues would eventually occur. These are listed below with the anticipated operational/facilities modification required to correct.

B. Potential issues with increased animal load

i. Total coliforms

a. Issue

Total coliforms would increase and possibly exceed the federal standards periodically (hopefully not continuously).

b. Potential Solution

As long as the levels are between zero and 1000 colonies/100ml, the system would not be modified, and no action taken. If the Federal standards are more continuously being exceeded, CMA could move back to a more sterilized operational mode by increasing

ozonation. Another potential operational change would be to increase water changes given access to makeup water. This could possibly require modification to the makeup system. This modification may require increased makeup capacity (a more open system), improving the disinfection/ozonation capacity of this system and possibly the installation of temperature control. The final option would be to improve the filter efficiency to increase turbidity control using more efficient filter systems. (This is covered more in “C” below)

ii. Phosphates

a. Issue

Phosphates would increase and stimulate algae growth (especially in Pool 5). Algae growth on the pool walls, breaking into the water column when cleaned, would cause a change in the aesthetic nature of the viewing through underwater windows and potentially shielding coliform removal.

b. Solution

This would probably require controlling phosphates using increased water changes (makeup water as described above), increasing the lanthanum chloride addition and subsequent costs, more extensive cleaning of algae (both with ultrasonic units and manual cleaning), and accepting more algae in the system by educating the public on the nature of algae and its place in the ecosystem.

iii. Turbidity

a. Issue

Increased periods of high turbidity (especially after cleaning events) resulting in “hazy” water at times or may possibly be continuous.

b. Solution

Accept the reduction in water quality, recognizing that crystal clear water is not normal in the environment. The added turbidity is not necessarily harmful to the animals and is an opportunity to educate the public on these issues. The public normally equate cloudy water with unhealthy water so staff would need to be prepared for the questions. If turbidity becomes excessive, then improvement to the turbidity control would need to be provided either by increasing the coagulant dosages into the sand filters, increasing the number of sand filters and pump flow, or adding a more efficient filter system including the use of Perlite (Defender) filters. This would obviously be an expensive solution and would need considerable evaluation.

iv. Color

a. Issue

Increase in green color in the underwater viewing windows.

b. Solution

This could be solved by doing water changes or by slightly increasing the ozone dosage (probably on a side stream)

II. Life Support System Figures

A. Dolphin Complex

i. Intake System



*Figure 1:
Intake Location*



*Figure 2:
Intake Piping*



*Figure 3
Intake Pumps*



*Figure 4:
Intake Filter*



*Figure 5:
UV Unit
COMMENT: Ozone to be
added*



*Figure 6:
UV Information*



*Figure 7:
Carbon Filters*

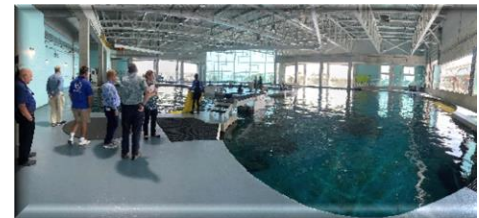
ii. Dolphin Complex System



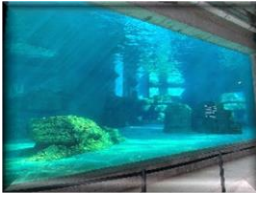
*Figure 8:
Ruth and Jo Stone
Dolphin Complex*



*Figure 9:
Dolphin Complex*



*Figure 10:
Pool
COMMENT: Medical pool does not
have isolated LSS System*



*Figure 11:
Main Tank
COMMENT:
Excellent Clarity/Low
Animal Loading.
Coliform Zero. Full flow
ozonation with high
ORP.*



*Figure 12:
Public Tank*



*Figure 13:
Algae Cleaning Causes Short-term
Turbidity in Tank 5.
COMMENT: Algae growth in
system driven by direct sunlight
from windows. Cleaning issues.*



*Figure 14:
Main Filters.
COMMENTS:
Mechanical Seals
Leaking. Use of
Defender Filters and
Fractionators to allow
for fish at heavy loading.*



*Figure 15:
BWR System*



*Figure 16:
LSS Piping at Degas Towers*



*Figure 17:
Ozone Injectors.
COMMENT: Ozone injection
used to control coliforms to
zero. Consider reducing
dosage to increase biological
diversity*



*Figure 18:
ORP Sensor*



*Figure 19:
Ozone Analyzer (Return from
Tank) 337mV.
COMMENT: Consider reducing
ozone dosage to drop ORP in tank
as low as possible. Modify system
operation to accommodate algae
growth.*



*Figure 20:
Lanthanum Storage.
COMMENT: Use of lanthanum
not effective to control algae at
higher Phosphate Levels.*



*Figure 21:
Flocculant*

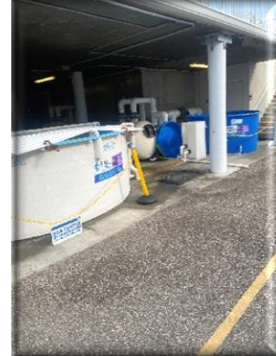
B. Rescue Deck System



*Figure 22: Rescue Deck Pool
COMMENT: Direct sunlight
requires chlorination and
scrubbing to control algae.*



*Figure 23:
Rescue Deck Pool*



*Figure 24:
Rescue Deck Pool Filters*



*Figure 25:
Rescue Deck Pool Chlorine
Feed Pumps*



*Figure 26:
Chlorine Storage
COMMENT: Ozone being
added with addition of
manatees.*

C. Marine Mammal Stranding Station



*Figure 27:
Stranding Station Facility*



*Figure 28:
Stranding Station Pool
COMMENT: Algae growth
requires scrubbing.*



*Figure 29:
Stranding Station LSS
System*



*Figure 30
Stranding Center Storage
Tanks*