



**Effects of Oil  
on Wildlife**  
7th International Conference  
Hamburg · Germany · 14.-16. Oct. 2003  
[www.eowconference.org](http://www.eowconference.org)



*Proceedings of the 7<sup>th</sup>  
International Effects of Oil on Wildlife  
Conference Hamburg, Germany  
Oct 14-16, 2003*

# 30-Years of Oiled Wildlife Response Statistics

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## **Abstract**

International Bird Rescue Research Center (IBRRC) has responded to and managed the rehabilitation programs in over 150 oil spills and thousands of individual oiled animals during the last thirty-three years.

In the past, wildlife biologists and professional from other fields have discussed the release rates of rehab, efforts without mention of the many variables that contribute to mortality.

IBRRC has worked since its inception to develop oiled and non-oiled wildlife, capture, rehabilitation and veterinary protocols to improve the field of oiled wildlife rehabilitation. As new advancements were made and then applied, significantly higher release rates and more efficient, timely and cost effective responses were experienced.

This paper will analyze the last thirty years of oil spill statistics from oil spills that IBRRC has responded to and how new protocols were applied which improved release rates.

**Keywords:** Bird Oil Spill Response, Rescue, Rehabilitation, veterinary protocols, release rates, cost effective responses

## **INTRODUCTION**

Oiled wildlife rehabilitation has been and continues to be a field full of challenges and innovation. It seems that just when you've solved one problem three more

become apparent. Looking back, many of the innovations that have helped revolutionize this field seem so obvious and necessary.

One wonders how could they ever have been left out. An emergency response is like jumping head first through a ring of fire without knowing what lies on the other side. Caring for oil affected water birds in large numbers is overwhelming, demanding and challenging. The many variables associated with rehabilitating these sensitive animals are what make a response so unpredictable.

One could easily expect that since there have been so many improvements in bird care; a predictably high rate of animal survivability would be forthcoming. This is a common yet grossly misinformed way to look at such a rehabilitation program. While preparing for this paper more than 20 variables were deemed important factors in determining the survival rate of oil affected birds. Among them are:

- Where did the oil spill occur?
- What type of oil was spilled?
- Was there a search and collection program?

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- If search and collection was done, who did it and was it effective?
- What sort of weather were the birds exposed to?
- What was the condition of the bird prior to oiling?
- Was stabilization done after capture?
- Were birds stable prior to transport?
- Was the transport timely?
- Was there a facility available?
- If a facility was not available how long before one was found/constructed?
- Does the facility have adequate water?
- Does it have enough hot water to wash birds?
- Is their adequate ventilation?
- What species were admitted?
- In what numbers?
- What product was used to remove the oil?
- Was any blood work done prior to the washing process?
- Was any blood work done prior to release?
- Were trained personnel overseeing all aspects of the event?

Then there are the special circumstances in each spill to consider. Anything and everything imaginable can go wrong from politics to putrid fish, there's just no predicting it. At the end of the day this work is not and cannot be a numbers game. The goal of IBRRC is to release back to the wild healthy birds whose care is based on the best information available.

Things have changed a lot since the Standard Oil tanker disaster that occurred in California under the Golden Gate Bridge in January 1971. When IBRRC first started responding to spills away from the main facility in Berkeley, California it sent minimal staff, sometimes only one person, to where the birds were being housed. The

response began with managing local volunteers by training them in basic husbandry techniques and overseeing them.

Facilities in the past were often woefully inadequate and supplies often hard to obtain. At present a response team member is at the spill often within hours of birds having been seen with oil on their feathers. In many coastal communities supplies have been stockpiled, key facilities have been pre-identified and more staff is on the way to head up a "full" response (a response where members of the response team head the various areas during the rehabilitation process including search and collection).

Birds are often captured more quickly, stabilized and admitted to the center in better condition than in the past. The washing process has become faster and more efficient using common dishwashing detergents rather than highly toxic solvents to remove oil from the bird's feathers. The rinse, like the wash, has become faster and more efficient reducing stress on the birds. These improvements have helped get birds back into pools in a more timely fashion. However speeding up these procedures does not necessarily equal faster release times or higher release percentages.

When IBRRC began laboratory analysis it was determined to move from qualitative analysis (external evaluation) to quantitative analysis (internal evaluation) to monitor each bird's health.

With this in mind it is necessary to consider and mitigate the internal effects that the oil has on the birds. Birds that in the past would have been plugged into the system immediately are now being carefully screened for their internal health and triaged appropriately. More birds may survive the washing process but many must wait days in order to be strong enough for it. Birds regain their water proofing faster but many must wait longer to attain the proper weight and blood values deemed suitable for

release. When birds are held longer in captivity and monitored internally it increases the likelihood that otherwise undetectable health concerns are discovered. This can mean longer stays for some birds or euthanasia for others translating into higher mortality. The goal of the modern more comprehensive approach to bird care is to release the healthiest birds possible, those that have the best hope for long-term survivability in the wild. With more comprehensive care in modern spills perhaps the phrase “live long and prosper” better suits the new approach to bird care.

## METHODS AND MATERIALS

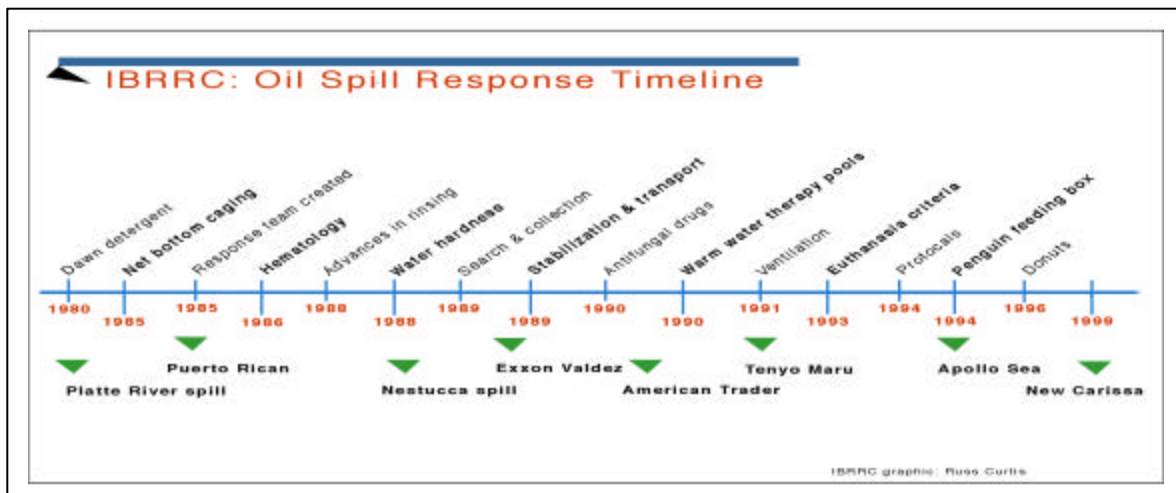
An extensive review of IBRRC records compiled over the last 32 years was conducted. A database was created that includes all of the variables listed above and more. A review of oil spill records, published and non-published literature produced by IBRRC personnel and other associated authors were conducted. As such, an historic perspective has never been compiled. Interviews with key personnel were conducted to get historic perspectives and any undocumented information. Those developments that were considered to have the greatest impact were listed and examined. A time line (see Figure 1. below) was developed to represent the historic scope of these developments.

## RESULTS AND DISCUSSION

### Development of Protocols

The majority of the species seen in oil spills were not kept in zoos or aquariums and little information was available on the care of these species. Existing information with the addition of current IBRRC oiled animal care was compiled and used as protocols for staff and volunteers. IBRRC produced the first comprehensive booklet addressing the rehabilitation of oiled birds in 1978, *Saving Oiled Seabirds*. By 1985 an updated version was produced entitled: *Rehabilitating Oiled Seabirds: A Field Manual*. This manual was considered the most complete and current information available on the subject. By the mid 1990’s new information gained through spill responses and clinical research done in IBRRC’s rehabilitation program highlighted the need for an updated version of current protocols for caring for oiled birds.

With the creation of the OWCN in California, in 1993 also came the opportunity to update these protocols. Through collaborative efforts, mainly between the IBRRC and the OWCN, the IBRRC’s existing protocols were updated and modified for use within the OWCN, October 26, 2000. As this field is still learning much about the treatment of oiled birds this document is under constant review



and regular updates will be forthcoming.

### **Use of Detergents in the Wash**

From the 1950s through the 1960's various methods and products were used to remove oil from bird feathers. A brief list includes, powdered chalk, fuller's earth, mascara remover, butter, lard, detergents, castor oil, mineral oil, and waterless hand cleaner (Berkner, 1977). Industrial solvents such as Shell Solvent 70<sup>®</sup> were effective at removing oil and were commonly used in the early 70's. The toxic nature of these solvents made them a hazard to work with. These solvents produced fumes and sensitive bird skin absorbed additional toxins. Such exposure to highly toxic chemicals had negative effects on the birds including mortality (Berkner, 1977). After extensive testing of various products by IBRRC staff (Berkner et al., 1977) it was decided to use Lux Liquid Amber (DW 300). This product was effective at removing oil but was irritating to the birds skin and difficult to rinse from the birds plumage. After further testing the liquid soap Dawn<sup>®</sup> dishwashing liquid was found to be the most effective and practical way to remove oil from bird feathers. The criteria used to test more than 22 products are as follows:

- Able to remove any oil, fresh or aged, quickly and easily,
- Leaves pelage or plumage waterproof and otherwise normal,
- Minimally toxic to both animals and people,
- Minimal hazard in storage, use, and disposal, and is
- Inexpensive

The opportunity to use Dawn dishwashing liquid in an oil spill came in 1980 during the Platte River Spill (1980). The staff was pleased with this products ability to remove the fuel oil from the birds' feathers during the washing process. Dawn<sup>®</sup> dishwashing liquid or an analogous

detergent have been used predominately since 1980 with positive results.

### **Net Bottom Caging**

Maintaining aquatic birds in captivity presents many challenges to the rehabilitator. One of greatest challenges is accommodating the unique physiology of aquatic bird species. Diving birds that use their feet for propulsion such as loons (*Gaviiformes*), grebes (*Podicipediformes*), and the sea ducks (Mergini tribe of the *Anseriformes*) have their legs located far to the posterior of their bodies (The Sibley Guide to Bird Life & Behavior).

This diving adaptation precludes their ability to stand on their feet for any length of time. When out of the water these heavy bodies birds rest all their weight on their keels. Other sea birds such as the auks (*alcididae*) that utilize wing propelled diving, rest all their weight on their hocks. Diving birds have sensitive webbed feet that become dry and cracked out of the water. Hocks and keels in these species are not equipped to sustain the birds weight for long periods of time. Within days of being out of water these species can develop keel sores, hock swelling, and foot lesions (IBRRC in house non published data).

Additionally when these birds excrete waste materials the urates will accumulate on the feathers. Such contamination leads to feather rot (Thorne, 1986) resulting in complete loss of water repellency until new feathers grow in. When any one of these conditions occurs the bird has little chance of surviving the rehabilitation process.

During the Puerto Rican oil spill (1984) keel and hock lesions as well as feather rot were major concerns for the staff. The facility at Fort Cronkite was too small and the 624 birds admitted were over crowded in make shift pens. These pens had solid bottoms the substrate had to be changed regularly to keep them clean. The main species affected in this spill were common

murre and western grebes two species susceptible to cage related lesions.

After the birds that had been in-house for the longest period of time began to develop lesions and feather rot the staff began experimenting on with net bottom caging. Net with 1/4-inch mesh was stretched tightly over a frame (Holcomb, 1988). The frame was placed on the bottom of the pens with enough space underneath to allow fecal material to fall through, thus eliminating feather rot. Since the netting like a trampoline gave a little under the weight of the birds the birds weight was distributed over a slightly larger area the staff observed a delay in formation of pressure related lesions by a couple of days.

Net bottom caging does not eliminate fecal contamination or pressure sores but its development by slowing these serious problems has had a positive impact on bird survivability.

### **The Response Team**

IBRRC had been using qualified staff to manage the rehabilitation of oiled wildlife at it's Berkeley rehabilitation facility since 1971 but this staff remained small and focused on bird care and volunteer management. In December 1985, during the Arco Anchorage spill, it became evident that a response team should be developed and initial members were identified at that spill. When IBRRC personnel arrived on the scene, local volunteers had already treated over five hundred birds. The birds were in very poor condition and most had to be euthanized.

There was only temporary housing for the birds; no facility to rehabilitate the birds had been identified yet. Having more trained staff to oversee the many aspects of bird rehabilitation including facility construction, volunteer management, bird care, veterinary care, washing, and waterproofing was greatly needed. By the end of this spill a core group of volunteers

was formed under IBRRC's management to respond to future oil spills.

The *Exxon Valdez* oil spill (1989) presented an extreme challenge to the newly formed response team. Team members had to be skilled in all aspects of rehabilitation including an extensive search and collection program. Three different rehabilitation centers were set up to handle birds in remote areas along the Alaska coastline. The coordination of a team spread out over such a large area was difficult. The need to provide standardized care to the birds required constant communication conveyed by regular meetings of the staff and key volunteers. The duration of this response (six months) was very taxing for the team but it allowed for the development of a strong management structure and team. The cohesion within the team helped hold it together as the team was constantly being challenged by the volatile politics plaguing this spill. During the Exxon spill international volunteers from Germany, Australia and Canada were trained and joined the response team. Without this cohesive team of responders, the response to the Exxon spill would have been a near impossible challenge.

Since the Exxon experience IBRRC has maintained and expanded its response team whenever possible. It was a larger more diverse and experienced team that faced the challenge of responding to the *Treasure* spill (2000). The huge number of penguins (20,000) oiled demanded a coordinated international multi-agency response. Five agencies comprised the management team; volunteers from more than 20 organizations around the world donated trained staff as support to the management team. By sheer volume it stands out as a stunning success for all the agencies involved. For IBRRC it represents the accumulation of many years of team building efforts.

## Hematology

As far back as the 1970's, IBRRC knew that blood analysis was valuable. Blood analysis had been impractical due to financial restraints. The center could not obtain funding for salaries for personnel and equipment needed to pursue work in this area. IBRRC first began to randomly sample birds during the Apex Houston oil spill (1985) and *Nestucca* oil spill (1988). Results showed that many packed cell volumes (PCV) appeared very low for birds based on normal values for other avian species (Campbell, 1988). The PCV measures the percentage of red and white blood cells in relation to the total blood volume. If the percentage is very low it is considered anemic, if it is very high it may indicate dehydration. Such low PCV's indicated that these birds were probably anemic. Release criteria at the time were primarily based on waterproofing and behavior. In the *Nestucca* oil spill (1988) birds began showing up on beaches just a couple of day after their release, the staff and veterinarians suspected anemia to be a contributing factor.

At one point it was a more common occurrence that birds would die during the rinse and wash process, as this was and remains a most stressful procedure for the birds. It is possible that these deaths could be attributed to low PCV's indicating the development of hemolytic anemia's (Fry and Addiego, 1987) and (Leighton et al., 1983). To lessen the chance of mortality, during the *Exxon Valdez* oil spill (1989), the staff veterinarian established blood parameters for birds to be washed.

These parameters were based on avian blood values for other bird species (Campbell, 1988). Birds that were considered anemic were not washed until their PCV had recovered. The team observed a sharp decrease in mortalities during the wash process. Now that blood

analysis had been established as a tool for evaluating oiled bird health IBRRC began looking into its release criteria. An adequate PCV, along with waterproofing, normal weight and behavior, now formed the criteria for releasing oiled birds.

## Advances in Rinsing

Rinsing a bird's feathers of soap is a vital part of completing the washing process. The detergent must be thoroughly removed from the feathers in order for a bird's water proofing to be restored (Berkner et al., 1977). The best way to accomplish this is with warm soft water at high pressure, which will insure penetration of the rinse water down to the birds skin.

The high pressure needed for the rinse was difficult to obtain, resulting in longer rinsing time increasing the stress to the birds. For many years the staff relied on an assortment of garden spray nozzles, and various other devises for rinsing birds. During the Arco Anchorage spill (1985) a plumber (who was hired to install a water system for the wash room in a temporary bird cleaning facility) installed the Spa 2000<sup>®</sup> shower head. We found this showerhead to be ideal for rinsing soap from the bird's feathers. The design of this showerhead increased the pressure of the water for rinsing birds. Using this showerhead the staff observed that the time it took to rinse a bird was reduced while the efficiency of the rinse was increased. This little showerhead has traversed the globe in the bags of IBRRC staff responding to oil spills aiding the rinse process as it goes.

## Water Hardness

During the *Nestucca* oil spill (1988) birds were washed and rinsed according to IBRRC's protocols. When birds were placed in the out door pools for waterproofing, their surface feathers slowly began to take on water and they gradually became waterlogged. The staff observed the bird's feathers actually losing their

waterproof qualities. The feathers were found to have developed a white film while in the water. After many frustrating days of problem solving and eliminating possible factors that could be the cause of this problem, the decision was made to look at the feathers using photomicrography to determine what was affecting the feathers.

A local university offered to run some tests on the feathers. Their conclusion was that hard water was the cause of this problem. Calcium carbonate was bonding to ions from the detergent remaining in the feathers from the wash (Clumpner, 1990). The water in Grey's Harbor was very hard and laden with minerals. Water softeners were immediately installed. When the birds were put into pools with softened water they responded normally becoming water repellent in the usual amount of time. At the Berkeley facility, where all original research on wash products had been conducted, the water was not hard and this problem had never been seen to this extreme prior to this spill. A simple water hardness test kit is now part of every response case or can be purchased at location.

### **Search and Collection**

It was commonplace for the IBRRC to be called to an oil spill only after large numbers of birds were collected and had already overwhelmed local communities. For the most part, the general public and wildlife agency personnel collected many of the birds after they had become too weak from hypothermia, exhaustion, or emaciation to escape. Many birds were found dead or would die soon after collection.

The IBRRC staff recognized the value in trying to capture birds before they became so weakened. In some cases, when volunteer or wildlife agencies were in charge of animal collection the effectiveness and determination of the search and collection activities was a constant concern

for the IBRRC staff. Despite this observed need there was little opportunity in the early years for the IBRRC staff to engage in search and collection activities. They were not alerted to spills in time to mount an effective program and the team was too small to divide up into various programs.

The extreme geography of the Prince William Sound necessitated the need for an aggressive search and collection program in response to the *Exxon Valdez* oil spill (1989). The oil was dispersed over great distances along the Alaskan Coastline. The region impacted typically experiences harsh weather, cold rough seas and has a rocky shoreline that is difficult to access. This combination of factors required IBRRC team members to become involved with the coordination of the search and collection efforts. This was the first time the IBRRC had this level of involvement in such a program. After the *Exxon Valdez* experience the IBRRC was determined to make the timely capturing of oil affected birds a priority.

This determination was put to the test during the *American Trader* oil spill (1990) in Long Beach. Unfortunately many brown pelicans (*Pelecanus occidentalis*) (an endangered species in California) were oiled. Many of the brown pelicans affected by the oil did not become immediately debilitated but rather sought shelter on the isolated jetties and rock pilings in the Los Angeles harbor. It was only a matter of time before they would succumb to the toxic affects of the oil (Leighton, 1990). A special team was assembled to capture these birds using new methods designed with brown pelicans in mind.

Boats were sent out on a daily basis to patrol the LA harbor. Oiled pelicans still capable of flight were baited to the boat by tossing small fish in the water. The birds could then be netted off the water from the boat. Pelicans that were reluctant to fly or

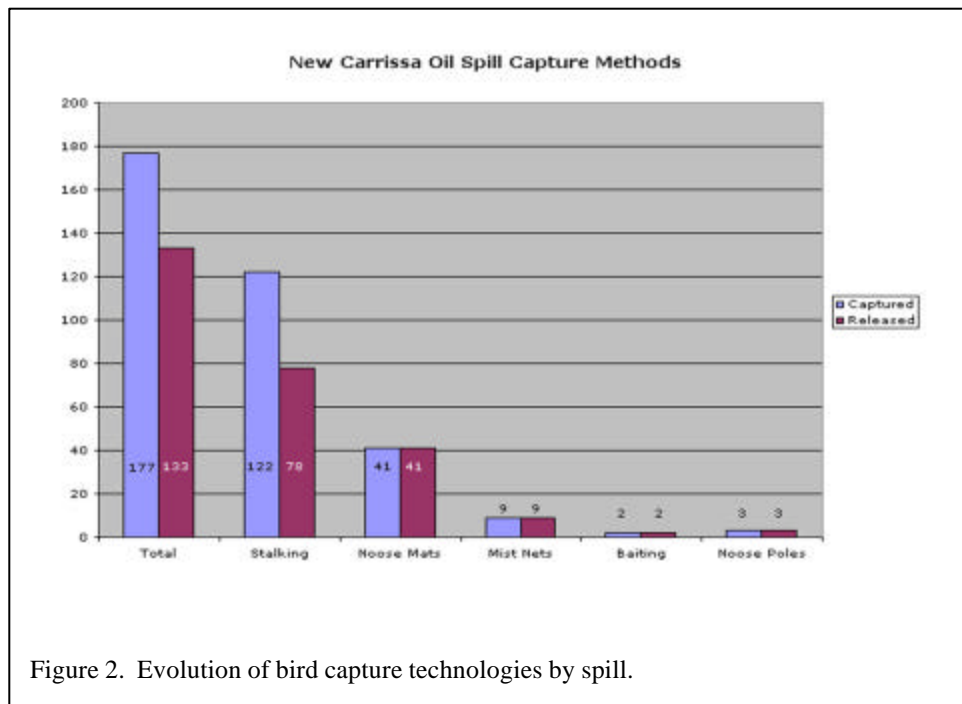
were cautious of humans could be approached from the water using a boat. A net gun was employed to immobilize oiled birds on the rocks. Personnel from the boat were then able to retrieve the struggling bird. This search and collection program proved to be very successful in capturing these endangered birds before they became critically debilitated.

By the time the Los Angeles earthquake of 1994 ruptured a pipeline along the Santa Clara River (Four Corners oils spill, 1994) in San Bernadino County the response team had been routinely coordinating search and collection efforts during spill response. The team had become familiar with various types of terrain and was well versed in the evasion tactics used by many species of birds. Largely due to the presence of trained IBRRC personnel in the field, the identification and capture of 23 very small sora and Virginia rails (*Porzana carolina* and *Rallus limicola*) was possible. These species are not commonly found during a response due to their size (70g) and their

secretive nature. Consequently, few staff members had the experience of working with these species in a spill. Although small and shy these birds proved to be tough customers.

Not only did they handle the stress well, they thrived in artificial enclosures, devouring the live invertebrate foods offered. In the *Kure* spill (1997) in Humboldt Bay the search and collection team captured 41 dunlin (*Calidris alpina*). Again, as with the rails the staff was overly concerned for these little birds, as they seemed to thrive on the care provided by the rehabilitation staff. The high survival rate of these birds (78% for the rails and 97% for the dunlin) was only possible because of the aggressive search and collection program and the nature of the bird.

Using shore bird capture techniques such as noose snare traps learned during the Cape Mohican oil spill (1996) (many shore birds were observed oiled but few were typically captured as they became prey to predators as soon as they began to succumb to



hypothermia and exhaustion), IBRRC was able to capture 16 endangered snowy plovers (*Charadrius alexandrinus*) oiled during the *New Carrissa* oil spill (1999). These birds were from a population of just 100 individuals, which are being closely monitored. Like the dunlin they responded very well to the rehab process with a 100% release rate.

The success of the search and collection program is directly responsible for the IBRRC's exposure to large numbers of oiled shorebirds. Being able to work with these species presented new challenges for the team, they met the challenge and learned how shore birds respond to the rehabilitation process. Working and learning with common species like the rails and dunlin gave the team important experience that is relied upon to successfully care for the endangered snowy plovers.

Through the years the IBRRC has seen a need for and aggressively pursued the development of a search and collection team. This team has demonstrated its creativity balanced with adaptability to come up with fresh ideas on how to capture wildlife. Yet above all it's the dogged determination to rescue as many oiled animals as possible that has honed the team's skills. Search and collection teams deploy at all hours, in most weather, from land and by sea, taking in to consideration tidal activity, species habits, and most importantly human safety. The team employs various capture techniques including mist nets, funnel traps, spot lights, net guns, and the use of bait in order to maximize its collection success. Ensuring birds arrive at the center in the best possible condition from the field is the main goal of these search and collection efforts. The capability of the IBRRC's search and collection team can be gauged by its ability to successfully capture oiled birds especially those that are endangered or uncommon.

## **Stabilization and Transport**

Spills can occur in remote areas and transport of captured oiled wildlife to the rehabilitation center may take anywhere from an hour to as long as a day. Birds in colder climates may become hypothermic quickly and this combined with exhaustion is enough to kill many birds. In warmer climates, hyperthermia can pose a problem. When capturing birds in the field, the IBRRC realizes that basic stabilization can mean life or death for some animals. Stabilization consists of warming or cooling birds to help maintain a normal body temperature, providing oral fluids to combat chronic dehydration (Crocker et al., 1975), (Holmes et al., 1978) and providing them with much needed rest and privacy (Protocols for the Care of Oil-affected Birds). After initial stabilization birds can be transported to the main rehabilitation center. The less time it takes to transport birds the better. When at all possible a center should be identified as close to the spill site as possible.

The *Exxon Valdez* oil spill (1989) was the first major spill where field stabilization and transport were utilized extensively. Four regional centers were set up along the rugged Alaskan coast at Valdez, Seward, Homer and Kodiak Island. More than one center was needed in order to cover the vast coastline that had been oiled. Birds were often kept overnight on boats in the most remote areas. The birds were stabilized before they began the up to five-hour boat ride over rough waters to the nearest center. If not for basic field stabilization and transport (Holcomb and White, 1990) many more birds would have lost their lives to the Exxon disaster.

When oiled birds began coming ashore on the island of St. Paul in the Pribilof Island group located in the Bering Sea, IBRRC's regional oiled bird rehabilitation facility in Anchorage, The Alaska Wildlife

Response Center (AWRC), was activated to rehabilitate the birds. The Pribilof spill occurred in March of 1996. All the stabilization and transport lessons learned in the past were applied on this spill. IBRRC teams were sent to capture, stabilize and transport the birds to Anchorage. The remoteness and extremely limited resources (lack of adequate fresh water) of the Pribilof Islands precluded establishing a fully functioning rehabilitation center anywhere on the islands. The birds were stabilized for up to 48 hours and evaluated by staff before transport to Anchorage.

Stable animals were sent daily on a five-hour trip by air from St Paul to Anchorage where they were met and moved on to the AWRC. The Pribilof Stabilization and Transport program had a 97% success rate. IBRRC was able to release 77% of the birds captured and cleaned. This success was a positive endorsement of the stabilization and transportation guidelines the IBRRC had been developing since the Exxon spill.

Transportation of wildlife can be a contentious issue among wildlife groups and government agencies. The expense of such a program can be costly (*Exxon Valdez* oil spill 1989) and the birds may be exposed to increased mortality (*Apollo Sea* oil spill 1994, inappropriate transport boxes resulted in high mortalities). These concerns are valid and must be taken into consideration when such a program is considered. The IBRRC considers the use of transport as a way to get animals to the most appropriate facility and has helped to develop guidelines for animal safety during transport (Protocols for the Care of Oil-affected Birds, 2000). With the animals welfare made a priority IBRRC has experienced very few mortalities and has transported thousands of birds.

### **Antifungal Drugs**

IBRRC has been caring for alcidae (predominantly common murre) since 1971

and since the first spill these birds as well as other sea birds have proven highly susceptible to a respiratory infection called aspergillosis caused by the fungus *aspergillus fumigatus*. Although this fungus is commonly found in the environment, in captivity, sea birds and especially alcids seem highly susceptible to it. This may be due to immunosuppression from oil toxicity (Leighton, 1991), captive stress or use of corticosteroids and antibiotics (Tseng, 1993). By 1978 IBRRC recognized this disease as a major threat but was unable to combat it with drug therapy (Saving oiled seabirds, 1978).

The constant concern over aspergillosis motivated the IBRRC veterinary staff to investigate the use of antifungal drug therapy. By 1990 flucytosine (Ancobon, Roche Laboratories, Nutley, New Jersey) was being used prophylactically at 75-100 mg/kg twice daily in the rehabilitation clinic. Also by 1990 IBRRC had set its target release PCV at 40% for diving birds. This meant that birds were being held for longer periods of time to achieve the new release value.

When oiled birds began showing up along the San Mateo coastline Source Unknown oil spill (12/90), they were treated with flucytosine upon intake to the Berkeley facility. Of the 195 birds (more than 90% were common murre) 154 birds subsequently died, the vast majority showing symptoms of aspergillosis (IBRRC Source, Unknown 12/1990 unpublished data). These symptoms generally include weight loss, anorexia and severe respiratory compromise. It may take two or more weeks for these symptoms to become noticeable to the rehab staff. IBRRC began looking into other drugs to combat this disease.

By 1993 itraconazole (Sporonox, Janssen Pharmaceutica, Piscataway, NJ) was the drug being used to combat aspergillosis in

both the rehabilitation clinic as well as during oil spills. This drug appears to have some impact in the infection rate of common murre. In December of 97, Point Reyes oil spill (1997), 635 birds (mostly common murre) were found along the San Mateo coastline and treated with Sporonox® 20-25 mg/kg once daily. During this event some birds did develop aspergillosis but the release rate of 46% (IBRRC Source Unknown, 12/1997 unpublished data) compared with a 21% release rate from the spill eight years earlier implies that a smaller percentage had become infected with this disease. Unlike most oil spills these two were very similar, they happened at the same time of year in the same area, affected similar percentages of the same species and were cared for at the same facility by staff trained to use the same techniques.

IBRRC continues to use Sporonox® prophylactically for the prevention of aspergillosis in sensitive species. Although this drug seems to be effective in fighting aspergillosis in seabirds, it's no silver bullet. Birds still contract this disease and die from it despite IBRRC's best efforts. Further studies into the efficacy of this and other anti-fungal drugs, as they affect this disease in seabirds, are needed.

### **Warm Water Therapy Pools**

Chemical burns are commonly found on birds oiled by diesel and jet fuel spills but we also see it in bunker c and other fuel oils. Burns vary greatly in severity but always put the animal at high risk. The burns are a route for infection, fluid loss and more critically they present long term problems such as feather loss (this occurs when the skin sloughs off). Maintaining a bird in cold water with exposed skin from weeping burns or feather loss is next to impossible and usually results in hypothermia, as their insulative abilities are impaired.

Cold birds appear to be in great discomfort and try to get out of the water.

Birds that remain out of the water are likely to get keel lesions, hock sores and additional feather damage. In order for such problem birds to remain in water IBRRC staff has developed warm water therapy pools (WWTP). First used in a Source Unknown oil spill (2/1990) the staff experienced some success with common murre that were suffering from burns. The rehabilitation program began using WWTP to help birds regain their water proofing, for emaciated birds and for long-term cases that could not be placed into cold water. Success on the rehab level has led to the development of the current WWTP systems used by IBRRC (IBRRC, unpublished report).

WWTP are commonly used during spills where the birds are housed at one of the two centers the IBRRC manages in California. Using this specialized water system during spills in remote locations is challenging. However, WWTP were set up and utilized in the *Kure* oil spill (1997). There were many emaciated common murre (birds less than 700g) in this spill and they did not adjust well to the cold water and cold weather at the Oiled Wildlife Care Facility at Humboldt University. Giving these birds a few additional days to gain weight while being in warm water was the best way to avoid hock lesions.

### **Ventilation**

As mentioned, IBRRC had been concerned about aspergillosis (Tseng, 1993) in sea birds. Over crowding, stress, immunosuppression and ventilation are considered factors in the development and spread of this disease. During the *Tenyo Maru* oil spill (1991) the warm weather and insufficient ventilation were considered the main culprits in an aspergillosis outbreak that was responsible for the high (79%) mortality rate during that spill. The majority of the birds in-house were alcid species. Ventilation was the obvious culprit and this event highlighted the need for all facilities used in

treating oiled birds to have a minimum of 6 but preferably 15, air exchanges per hour. This rate of exchange can reduce the incidence of aspergillosis in seabirds (Tseng, 1993). It is difficult to find buildings meeting these specifications. That is why the need for state of the art oiled-bird rehabilitation centers was considered essential to achieve the best care possible for these birds. In California the Oiled Wildlife Care Network (OWCN) constructed two such centers, one in the city of Fairfield and the other in the city of San Pedro. IBRRC as part of the network manages these centers. When rehabilitation centers are established in remote locations meeting the ventilation needs is a priority.

### **Euthanasia Criteria**

The IBRRC has always used triage as a way to manage the huge numbers of birds presented at a spill. Euthanizing birds is always unpleasant but in cases where the animal has external wounds, fractures, or contagious diseases (aspergillosis) it is used as a way to end suffering, protect non infectious birds and put resources towards the birds with the most reasonable chance for survival. Before blood analysis became routine, most of our euthanasia criteria were based on signs and symptoms such as malnutrition, injuries, failure to thrive and disease.

As blood analysis became a standard procedure from intake to release, the staff began to see correlations between bird mortalities and certain weights and blood values. Birds that were severely anemic, hypoproteinemic and emaciated almost always died no matter what treatments were tried on them. As our medical procedures were improved and standardized (IBRRC, OWCN unpublished data), it became clear that within most seabird species those with very low PCV's and total proteins (TP) combined with a severely emaciated admission weight were doomed to die prior

to release (OWCN, unpublished data). Euthanasia criteria were expanded and implemented to help relieve the suffering of birds that fall within this category.

### **Penguin Feeding Box**

When the IBRRC's response team first traveled to South Africa it was to assist SANCCOB during the Apollo Sea oil spill (1994). During this response team members found it difficult to be sure all the African penguins (*Spheniscus demersus*) were eating properly. As some birds were dropping weight and needed medical attention, making sure they all ate was a priority. This spill involved 10,000 birds that could not all be housed at the main center. In a satellite facility called Wing field, a feeding box was developed to solve this problem. The box had two sliding panels at opposing ends, one end was opened, after four to eight birds were ushered in the panel was slid closed behind them. These birds were first given one fish each, this fish was loaded with vitamins, they were then fed as much fish as they wanted with a minimum of three fish per bird. When they were finished the other panel was opened and they were ushered out of the box to a new pen. Birds were fed twice daily in this fashion. By using this box, personnel could observe each bird twice daily. Any birds not eating could be force-fed until they caught on. If they were very thin they could be taken to vet unit for treatment

Unfortunately, during *Apollo Sea*, the feeding box did not catch on at the main center until many of the birds had already been released. The feeding box has been used on every other large spill since the *Apollo Sea*. During the *Treasure* oil spill (2000) it took a lot of convincing by senior management to get the box implemented, concerns over stress confinement and animal wrangling were all discussed. After a few days (much to the amazement of the volunteers) the penguins were queuing up

for their twice-daily feeds. The feeding box helps to minimize the animals stress (once they become accustomed to it) over the duration of their stay. It also ensures that even with 15 thousand birds that all look the same individuals with special concerns are not neglected. This feeding method was a wonderful innovation that has greatly assisted with the process of feeding large numbers of penguins.

### **The “Donut”**

Sea birds, particularly loons, grebes and sea ducks have developed unique physiological adaptations as a result of spending the vast majority of their time in the water. Their legs and wings are set rather far back on their bodies and therefore they are unequipped to remain for long periods of time on land. When in captivity their weight rests primarily on the keel. Circulation loss and trauma to the skin occurs along the keel resulting in the bruising of these thin soft tissues covering this bone. This is followed shortly by tissue necrosis along the keel. The necrotic tissue splits open creating a lesion along the keel. Blood and serum drain from the lesion and contaminate the feathers along the belly of the bird. Keel sores do not respond well to sutures and will not heal by themselves in cold water. The weeping serum sticks to the feathers and is very difficult to clean off.

The birds are unable to maintain water proofing and become hypothermic. These wounds are difficult to treat and have an extremely poor prognosis that in a spill situation such treatments are unrealistic. Even on net bottom caging these lesions can begin in as few as five days (IBRRC unpublished data). In an oil spill setting getting these species cleaned and back into water is their only salvation from this problem.

When these species are admitted to the rehabilitation program at IBRRC they are often in no condition to go into a pool right

away. They often need more time in the clinic to address their medical concerns. In 1995 the rehabilitation staff developed the use of a U shaped donut to relieve the pressure from resting on the keel. The design allows the donut to rest on the pectoral muscles and distributes the birds weight more evenly over a larger area. The donut is strapped to the bird using a figure 8 configuration, crossing over the back while allowing the neck, wings, and legs movement.

The donut has mostly been restricted to use in the rehabilitation program as the apparatus requires skill to put on and is labor intensive. However by having pre-made materials and skilled personnel during the *Leuchenbauch* Oil Spill (2002) the staff was able to apply donuts to most of the birds requiring them (predominantly western grebes, (*Aechmophorus occidentalis*). IBRRC staff has observed an additional benefit of the donut. These same species when resting on their keels have their legs in a hyperflexed state. The angle of the bent hock joint reduces circulation and these joints commonly become swollen and infected. As the donut elevates the bird it also allows the birds legs to rest in more normal position reducing the chances of swelling and infection of the hocks. Even though donuts have reduced the development of keel sores in these species, birds cannot remain on them for long periods time without developing some bruising. This innovation has the potential to greatly impact these species survival rates if they can be applied in every spill.

### **Shore Bird Rehabilitation**

It was a common generalization among the IBRCC team that oiled birds with smaller mass 100g or less suffered higher mortalities during oil spills. This assumption was based on the toxic effects of oil (smaller birds have a lower threshold of tolerance), effects of hypothermia and

captive stress. As long as search and collection was passive or relied on the public to bring in birds these assumptions were validated. Being smaller and more secretive many shore birds are more difficult to find or are often overlooked by unskilled persons. The few birds that did end up at a rehabilitation center were usually showing advanced stages of hypothermia, dehydration and emaciation. Consequently few of these small birds survived.

As the IBRRC team became more skilled in search and collection, they employed a variety of techniques that targeted smaller birds specifically. This enabled IBRRC to work with oiled shorebirds that were not mortally debilitated when collected. We soon learned that these birds responded surprisingly well to the rehabilitation process and captive care. The first experience with such small birds was in 1994 when 23 Virginia and sora rails were captured. They had been overlooked initially but once they were identified as oiled a concerted effort was made to find and trap them. Setting up mist nets in short dense water plants was not practical so the birds were captured using long handled dip nets. The birds were flushed and netted by people working in teams.

Once in captivity these birds did very well, they began to eat almost immediately on their own. The rails proved to be very territorial and had to be housed individually while indoors. One of the most stressful procedures for the birds during rehabilitation is the washing process. The rails did very well through this process and showed no serious problems with handling the stress. After the wash the rails were placed in 8x8 (ft) conditioning pens with no more than 4 birds to a pen. They were soon ready for release much to the surprise of the Team. The resiliency of these birds was remarkable 78% were released back to the wild. This experience challenged the assumptions

IBRRC held regarding the rehabilitation of smaller bird species.

It wasn't until the *Kure* Spill (1997) that IBRRC was able to work again with small shorebirds in large numbers. The search and collection team identified and captured 41 dunlins using long handled dip nets. Many of these birds were cold from exposure and easy to catch. Like the rails, these birds responded very well to captive care. The dunlins showed no signs of being territorial so they were housed in groups in a couple large containers. They tolerated the stress of the rehabilitation process very well with 97% being successfully released.

The IBRRC Team is always excited to learn how to successfully care for species of birds that were considered difficult. It is IBRRC's experience that techniques learned and perfected for common species may at some time be used or adapted to use for a species or population that is threatened or endangered. When the *New Carrissa* ran aground off the Oregon coast in 1999 the oil threatened a breeding population of endangered snowy plover. Using noose traps, 16 oiled snowy plovers were collected along with 35 sanderlings (*Calidris alba*).

Both these species did very well in captivity, the snowy plovers showed some intra specific aggression so multiple feeding stations were established to compensate for this behavior. 100% of the snowy plovers and the sanderlings were released. As this population of snowy plovers is continually observed, a long-term post release study is being conducted.

Later in 1999 all the birds captured during the *Four Bayou* spill were shore birds, 13 sanderlings, 1 endangered piping plover (*Charadrius melodus*) and 1 red knot (*Calidris canutus*). These birds were all captured by using noose mats. By now IBRRC had gathered enough skill and knowledge to assume that these birds would also do reasonably well. As predicted, they

did astonishingly well with a 100% release rate.

IBRRC was able to achieve its new expertise in oiled shore bird rehabilitation by first mounting an aggressive search and collection program. Successfully caring for these birds was completely unexpected and enlightening for the team. Learned techniques on common species were successfully applied to the endangered snowy plover within just five years of working with small shore birds.

## CONCLUSIONS

The IBRRC has been working diligently to provide the best care possible for oil-affected birds. In keeping with this commitment IBRRC has continuously come up with new ideas, products, procedures and innovations to improve the care of oiled wildlife. Each innovation, while moving the field forward, has created scenarios and outcomes that did not exist previously. With the adoption of blood parameters fewer birds died in the wash but the birds that may have died from stress now faced increased risks for developing pressure sores from their caging.

Likewise, birds held longer to meet release criteria were more likely to show signs of chronic disease than when birds were allowed to just fly off without the benefit of blood analysis. This could imply that birds released prior to 1991 were not as fit as was thought or that birds held longer are at higher risk for contracting diseases. As the field progresses, things change and changes, combined with the many variables impacting each spill, make it very hard if not impossible to compare or predict future outcomes.

Bird species have been evolving on unique evolutionary paths for many millions of years adapting uniquely to their different environments and the stressors within those environments. Therefore, it follows that each species will have a different response

to being oiled, captured, and rehabilitated. This variable response at the species level precludes any extrapolation about post-release survival between species. When Brian E. Sharp, conducted a review of band returns from 13 species from various oil spills based on 127 band returns between 1969 and the early 1990's, he considered just seven variables from only three vastly different spills (Sharp, 1996).

Sharp concludes that "Oil spill response planning and resources should be redirected to the prevention of damage, rather than focusing on ineffective attempts at rehabilitation after the damage has occurred." Yet his data is not the result of an intense study done on any one species following post release movements over time. Instead his returns are anecdotal and represent only 13 species.

Sharp's conclusion is at minimum premature while his call to reexamine seabird rehabilitation in general presumes his own analysis to be far more conclusive than it is. There have been only a few species-specific studies that have attempted to answer the post-release survivability question. The South African study on African penguins continues to support high long-term survival of post release oiled birds (Wolfaardt and Nel, 2003). Studies by other investigators are more limited in scope and offer varying results that seem to be species dependant. A radio telemetry study of brown pelicans (Anderson et al., 1996) demonstrated a higher mortality in oiled versus non-oiled birds. Another post release survival study on American coots (*Fulica americana*) also indicates a lower survival of oiled birds (Anderson et al., 2000. and Newman et al., 2000). Two recent studies show more positive results. No difference in survivability of oiled versus non-oiled was observed while studying western gulls (*Larus occidentalis*) over several months (Golightly et al., 2002). A study on post

release oiled versus non-oiled common murrelets (*Uria lomvia*) has demonstrated similar survival rates (Newman et al., 2001). Yet another study on snowy plovers remains unpublished.

It is obvious that more long-term studies involving more species are needed before any generalizations can be made about a particular species post-release success. Because of the rapid medical and rehabilitation advances being made in oiled bird care, those reviewing its efficacy must keep abreast of them and understand the limitations when reviewing data on animals cared for under outdated protocols.

Throughout its 32 years of oil spill response IBRRC has continued to lead the field in oiled bird rehabilitation. The many advances that it has made during this time have helped other organizations learn about rehabilitating oiled sea birds without having to making the same mistakes. The IBRRC's commitment to reaching out and trying to help other groups that work with oiled wildlife is evidenced by the three volumes of protocols it has contributed to over the years.

The IBRRC team has been actively responding to global emergencies wherever it can, meeting new challenges and learning valuable skills. These global responses have brought IBRRC into close contact with other organizations that share the same goals. By working with these organizations not only has an international response team been created, but also IBRRC is able to assist other nations in giving their oiled wildlife the best achievable care. In the process IBRRC is attempting to raise global awareness about the possibilities this work presents for conserving wildlife. Advances in care and monitoring techniques are allowing interested professionals to obtain an increasingly accurate look into post release survivability of oil-affected birds. The IBRRC's goal of releasing birds that are

healthy and can survive long term in the wild is gradually being realized.

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