

**Cyanotech Corporation Conservation Plan for
Hawaiian Stilt (*Himantopus mexicanus knudseni*)
Annual Report for 2004**



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Abstract

This annual report covers data collected September 2003 to August 2004 for the Conservation Plan for Hawaiian Stilt (*Himantopus mexicanus knudseni*) at Cyanotech Aquaculture Facility. Netting erected over the nesting habitat and Ducks Unlimited raceway in February 2003, continued to provide physical exclusion to these areas. Cleaning the *Spirulina* production raceways reduced the invertebrate food source. The total amount of Hawaiian Stilt incidental take at Cyanotech was 10. Cyanotech's current incidental take permit allows for up to 30 incidences of take per year. There were no nests or nesting attempts at the Cyanotech facility or in the lava field of Keahole International Airport.

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Management Actions

- Maintained the netting of the 0.69 hectare (ha) nesting habitat and former Ducks Unlimited (DU) raceway to exclude stilts from utilizing these areas to nest;
- Operated all raceways at 100% of capacity to prevent stilts from nesting in idle raceways;
- Continued to research and test means and methods of bird deterrents for the facility and reduce the food source attractant in the raceways;
- Maintained a hazing program utilizing laser, pyrotechnics, Mylar tape, driving roads of facility, and other means of deterrents to discourage stilts from frequenting the facility and nesting;
- Monitored the facility daily for nesting activity, take, and possible entanglement of birds in netting and Mylar tape deterrents;
- Maintained staffing needed to provide daily coverage of hazing and deterrent maintenance.

Summary for Cyanotech Conservation Plan in 2003

The nesting habitat for Hawaiian Stilt (*Himantopus mexicanus knudseni*) was managed from 1998 to 2002. The first year the habitat was not managed was 2003. The 0.69-ha nesting habitat and former DU raceway were netted to exclude stilts from utilizing these areas to nest. Cyanotech requested and received permission to utilize more aggressive non-lethal methods of hazing from the United States Fish and Wildlife Service (USFWS) and Hawaii State Division of Forestry and Wildlife (DOFAW), referred to hereafter as Wildlife Agencies. A laser and pyrotechnic gun were purchased and used in conjunction with driving the roads of the facility and Mylar tape as part of the hazing program initiated at Cyanotech in an effort to keep stilts from nesting and frequenting the facility. There were no nesting attempts at the Cyanotech facility or in the lava field of Keahole International Airport in 2003. The total amount of incidental take at Cyanotech for 2003 was two (September 2002- September 2003¹).

Facility Management

Nesting Habitat

Netting erected over the nesting habitat in February 2003 provided physical exclusion to the 0.69-ha man-made nesting habitat and was maintained through 2004 (Exhibit 1). Special emphasis was again put towards prevention of stilt entanglement in the netting. One half-meter strips of 30 millimeter (mm) Mylar tape were tied to the underside of the netting in a “zigzag” pattern of each 5.2-meter (m) section of netting, to provide a visual reference of the netting. Noting the stilts ability and willingness to move at night, three 90-watt floodlights were installed above the nesting habitat to illuminate the netting and Mylar tape strips in an effort to prevent any entanglement of birds. The floodlights were positioned on the North side of the habitat and operated by a photocell switch turning the lights on at sunset and off at sunrise. Mylar tape was also utilized on the grounds along the top of the nesting habitat to discourage any nesting attempts in these areas adjacent to

¹ A stilt recovered September 17, 2003 was reported in the 2003 annual report as one of two incidences of take for 2003. Therefore, that incident of take is not included in this annual report (September 2003-August 2004).

the habitat. Netting was monitored daily to check for entangled birds. To date, there have been no entangled birds in the netting. A series of severe windstorms damaged the netting and support structures; repairs were made each time only to have another windstorm damage them again. Repair to the net and support structures was time consuming and labor intensive. Noting that there were no holes in the net and that the net was only hanging lower to the ground (0.5 m), compared to the 2 m height when originally constructed, the decision was made to leave the netting in place and maintain it so that stilts could not gain access to the ground of the nesting habitat. There were no nesting attempts in or adjacent to the nesting habitat

Production Area

In 1998, a production raceway was converted into a stilt-nesting habitat and became known as the “DU raceway”. The raceway was managed for stilt nesting in 1998 and 1999, but management was discontinued in 2000 due to the inability of the habitat to maintain a self-sustaining invertebrate prey base for stilts. In 2001 and 2002, the raceway was used to test the effectiveness of Mylar tape as a deterrent. In 2003, the former DU raceway was netted as per recommendation of the 2002 annual report (Waddington 2002) (Exhibit 2). The netting at the DU raceway suffered similar damage from the windstorms, as did the netting at the nesting habitat. The netting was repaired several times. The netting was monitored daily to check for entangled birds. To date, there have been no entangled birds in the netting. There were no nesting attempts in or adjacent to the DU raceway or anywhere in the production areas of Cyanotech.

Reduction of Attractants and Hazing

Appendix IV of the Conservation Plan (Evans and Uyehara 2001) specifically outlines a three-year action plan for bird deterrent measures at Cyanotech. Some of the outlined research took place prior to the completion of the Conservation Plan and was reported in the Amendment to the Cyanotech Corporation Facility management for Hawaiian stilt (Jan.-Sept. 2002) (Waddington 2003).

During year three, the action plan calls for continued increase of road activity, continued research on bird repellent alternatives and cost, repellent trial if appropriate repellent is identified and feasible, research on alternative deterrent measures to augment or replace existing measures.

Reduction of Invertebrate Food Source

In years past the primary invertebrate food source has been the Brine fly (*Ephydra sp.*), this is no longer the case. In 2003, Water Boatman (*Trichocorixa sp.*) also became established in the *Spirulina* production raceways and provided a food source for the stilts. The Water Boatman is predatory and the subsequent effect was the reduction of the Brine fly densities present in the raceways. The Water Boatman has been observed at the facility in past years and has demonstrated seasonal changes in population densities.

Safflower Oiling

A program using Safflower oil and a backpack sprayer to spray and suffocate the Brine fly has been used in years past. This year experiments beginning in June were conducted to determine if the Safflower oil could be used as an effective means to reduce the Water Boatman population within the raceways. The Water Boatman is a strong swimmer with the ability to swim against the current generated by the raceway paddlewheels. After each *Spirulina* production raceway harvest seven and one half liters of oil were added by pouring into each raceway. The oil dispersed across the surface of the raceway and it is suspected that it then adheres to the Water Boatman's exoskeleton when it surfaces, giving it additional buoyancy. The Water Boatman then concentrates its energy on maintaining its position in the water column and not its position within the raceway. With the Water Boatman floating on the surface they are more easily removed utilizing mesh slant screens and seine nets positioned in the raceway. The slant screens are 1.22 x 1.52 m of 14-mesh stainless steel screen that are positioned in the raceways to catch the floating Water Boatman (Exhibit 3). Seine nets were also used in an effort to remove Water Boatman from the raceways. Sterling Net and Twine Company Inc. was contacted and custom seine nets were constructed to fit the raceways. The seine nets are 6.1 x 0.61 m and are constructed of 0.32 cm nylon netting (Exhibit 4). While the seine nets were effective at removing the insects and debris from the raceways, they are more fragile and labor intensive to maintain in comparison to the stainless steel slant screens. Both the slant screens and seine nets are cleaned four to five times daily. One slant screen or seine net was used per raceway and were moved between raceways as needed. In addition to removing debris and insects the use of slant screens and seine nets provides an additional opportunity to recover any dead or injured stilts. A total of 15 slant screens and two seine nets are in use at the time of writing. Safflower oil is used so the company can operate within their quality parameter that requires the use of non-genetically modified ingredients in the production of its products. The cost is \$16.55 per oil dose with an average of eight *Spirulina* production raceway oiled each day. An alternating schedule of oiling was implemented with oiling conducted each day for two weeks and then discontinued for two weeks. The alternating schedule of oiling is still being implemented at the time of writing.

Raceway Cleaning

The alternative method of removing the invertebrate food source was to drain the production raceways, allow them to dry, and sweep out the sediment and invertebrates. Draining and cleaning the raceways is part of the normal operation and maintenance of *Spirulina* Production. Raceways have been cleaned on average of once every 12 months. Cyanotech has implemented an on going cleaning schedule for the *Spirulina* production raceways that will have each raceway cleaned a minimum of twice per year. Raceway cleaning is based upon visual inspection of each raceway. Raceways with the most invertebrates are taken out of production for cleaning. The goal for this project is to clean one to two raceways per week.

Hazing

As in 2001 and 2002, a hazing program was implemented to increase the amount of activity in the production areas to make these areas less desirable for nesting. Methods included the driving of all the roads in the facility, the use of Mylar tape as a visual deterrent, and the production raceways being maintained at 100% of production capacity from February through the end of August. Driving the roads (six kilometers) via a golf cart has continued four to six times daily from the 2002-nesting season, in an effort to keep stilts from roosting and nesting in these areas. Mylar tape was again utilized through out the facility, during nesting season, to deter stilts from nesting in production areas.

Beginning in 2003, laser and pyrotechnics devices were also utilized to aid the hazing efforts. An "Avian Dissuader", a laser deterrent device, manufactured by Sea Technology Inc., was effectively used as a hazing aid (Exhibit 5). The laser is a pistol type design and operates on the "point and shoot" basis. The laser beam is aimed at the ground or embankments of raceways close to the stilts or the stilts' body and the red dot of light frightens the stilts and causes them to move from the area. The beam is adjustable from 3 to 30 cm and has a manufacturer's claimed effective range of 500 m. According to manufacturer's directions, the laser is most effective at sunrise and sunset. The laser was never directed at individuals, automobiles, boats, aircraft or the airport.

Pyrotechnics were also effectively utilized as a hazing aid (Exhibit 6). Two types of shells were used, "Screamer Sirens" and "Bird Bangers". The Screamer Siren shells, according to the manufacture, travel 50 to 75 m making a siren-like sound as it flies. The Bird Banger shells travel 35 to 50 m down range before exploding. The use pyrotechnics would cause the stilts to take flight, where the laser could be used to single out individuals to keep them from returning to the raceways.

Morning surveys of stilts on the facility were taken one half hour before sunrise and then hazing using the laser would begin if stilts were present at the facility (Figure 1). Morning surveys were conducted each day of the week with the exception of Sundays. A survey of stilts was also conducted one half hour before sunset and hazing would begin if stilts were present at the facility (Figure 2). Evening surveys were conducted every Tuesday and Friday. An ITT PVS-14, generation III, night vision monocular was used during the pre-sunrise and after the pre-sunset surveys and hazing activities to provide more accurate data and more effective hazing.

Hazing efforts have been successful in reducing the numbers of stilts frequenting the facility and also resulted in no nesting attempts at the facility. The stilts have become conditioned to the point that merely driving in their vicinity is enough to have them leave the facility with minimal if any use of either the laser or the pyrotechnics.

Property Outside of Cyanotech Boundaries (Lava Field of Keahole International Airport)

The lava field adjacent to the Cyanotech facility, where stilts had nested in previous years, was monitored weekly for nesting activity. Surveys were conducted every Saturday through the nesting season. A Nikon 20 x 60 Fieldscope and Zeiss 10 x 40 binoculars were used to survey the lava field. In addition to weekly surveys daily observations of stilt movements at and around the facility helped determine if stilts were frequenting the lava field. There were no instances of stilts being observed in the lava field.

Stilt Counts, Nesting, and Incidental Take

Stilt Counts

Stilt counts are conducted weekly through out the year (Figure 3). A mean of 8.58 (Standard Error = ± 3.31) adult stilts per weekly survey were observed at Cyanotech during 2004 nesting season (March-August), compared to 16.35 (Standard Error = ± 7.07) for the 2003 nesting season. A mean of 37.69 (Standard Error = ± 4.45) adult stilts were observed at Cyanotech during the non-nesting season weekly surveys (September 2003-February 2004) compared to 83.96 (Standard Error = ± 9.87) for September 2002-February 2003.

Nesting

There were no nests or nesting attempts at the Cyanotech facility or in the lava field of Keahole International Airport.

Incidental Take

As per the Conservation Plan, surveying for incidental take was conducted twice per week during the nesting season and once per week during non-nesting season. However, monitoring for injured or dead stilts was conducted daily as part of normal operations of the production raceways. Surveying the raceways for debris was conducted daily in an effort to protect the mechanical and harvest systems of the production raceways. Surveying the raceways visually first thing in the morning before the paddlewheels were turned on has proven to be the most effective method of identifying and recovering debris and stilts from the raceways. Visual observations were also made while the driving the production area to deter stilts from utilizing the facility to nest or roost.

There were 10 stilt mortalities recovered at Cyanotech this year (October 2003-August 2004). Six sets of remains recovered were recovered from *Spirulina* production raceways and four sets of remains were recovered from Astaxanthin raceways (Exhibit 7). Three sets of remains were in good enough condition for necropsy. The remains were sent to Dr. Thierry Work at the National Wildlife Health Centers Honolulu Field Station for examination (case numbers 17793,17803,17787). The cause of death was undetermined for two sets of remains and forced submergence was suspected for the third set of

remains. All remains were recovered between December 2003-February 2004 (a 12-week time span leading up to the 2004 nesting season). Intraspecific aggression, including forced submersion, was commonly observed especially during the months leading up to and through the nesting season. All remains when recovered were bagged, labeled, put in a freezer (or refrigerator if suitable for necropsy) and the Wildlife Agencies were notified. The total amount of incidental take at Cyanotech was 10. Cyanotech's current incidental take permit allows for up to 30 incidences of take per year.

Recommendations and Request

Continue to work cooperatively with Wildlife Agencies to secure an extension of one year to current conservation plan and permits. The year extension being requested would allow for more data collection and analysis as well as an opportunity to further modify and refine methods of reducing the invertebrate food source and deterring stilts from frequenting the facility.

Continue to modify and improve current deterrent measures as well as identify and research new deterrent measures for the facility.

Continue to modify and improve methods of reducing the invertebrate food source in the production raceways.

The netting and netting support structures need to be inspected and reinforced where necessary to insure the integrity and effectiveness of the netting of both the nesting habitat and the former DU raceway.

It is recommended that Cyanotech operate at 100% of production capacity during the stilt nesting season (March-August). If this is not possible, idle raceways should be filled with seawater to prevent stilts from nesting in the idle raceways.

It is recommended that Cyanotech consider all reasonable measures to improve the ability to recover stilt carcasses in a condition suitable for necropsy and for the purpose of documenting incidental take.

Cyanotech requests that the Wildlife Agencies continue to work cooperatively with the Cyanotech staff to provide technical assistance on policy and conservation issues, as well as biological expertise (e.g., permit compliance, adaptive management, bird deterrents, etc.).

Literature Cited

Evans, K. and Uyehara, K. 2001. A Conservation Plan for Hawaiian Stilt at Cyanotech Aquaculture Facility Keahole Point, Hawaii. Ducks Unlimited Inc. 76 p.

Waddington, J.S. 2002. Cyanotech Corporation facility management for Hawaiian Stilt (*Himantopus mexicanus knudseni*) (Jan.-Sept. 2002). Cyanotech Corporation. 12 p.

Waddington, J.S. 2003. Amendment to the Cyanotech Corporation Facility management for Hawaiian stilt (*Himantopus mexicanus knudseni*) (Jan.-Sept 2002). Cyanotech Corporation. 3 p.

Waddington, J.S. 2003. Cyanotech Corporation Conservation Plan for Hawaiian Stilt (*Himantopus mexicanus knudseni*) Annual Report for 2003. October 28, 2003. Cyanotech Corporation. 15 p.

Acknowledgements

U.S. Fish and Wildlife Service
Hawaii State Division of Forestry and Wildlife
Natural Energy Laboratory of Hawaii Authority
Keahole International Airport Operations Department
Cyanotech Corporation

Exhibit 1 Netted Nesting Habitat



Exhibit 2 Netted Ducks Unlimited Raceway



Exhibit 3 Seine Net for Insect Removal

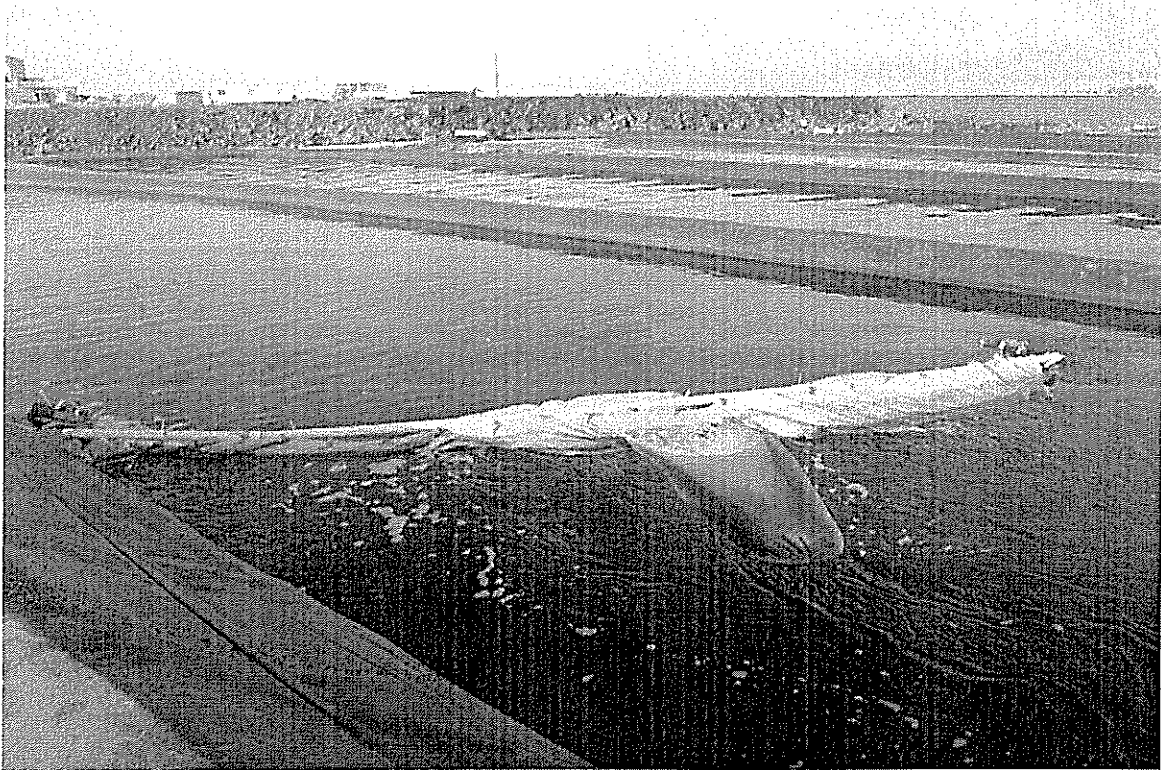


Exhibit 4 Slant Screen for Insect Removal

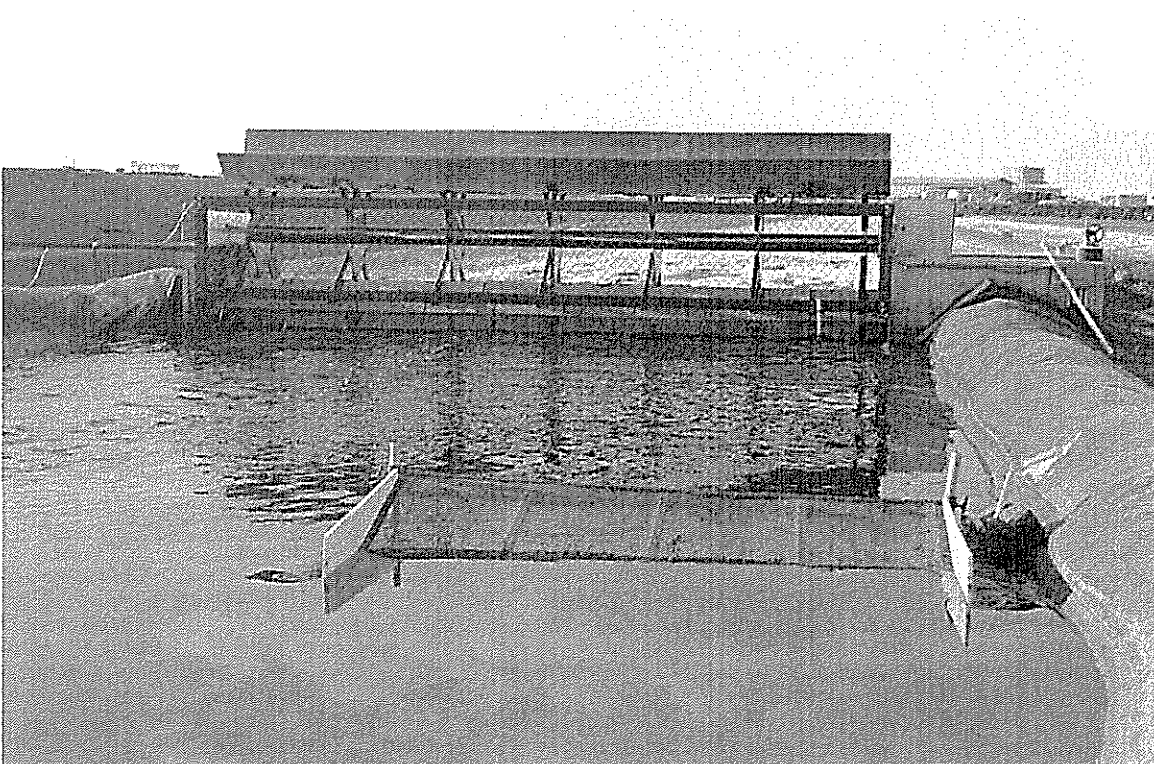


Exhibit 5 Avian Dissuader Laser

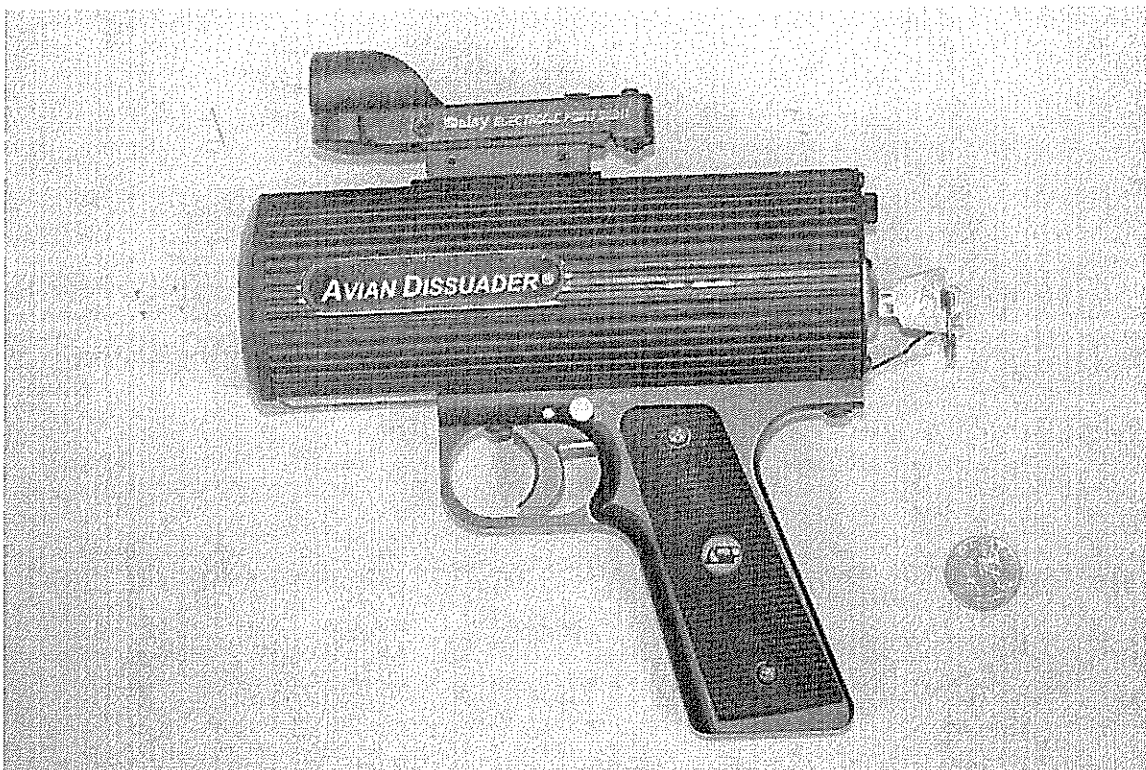
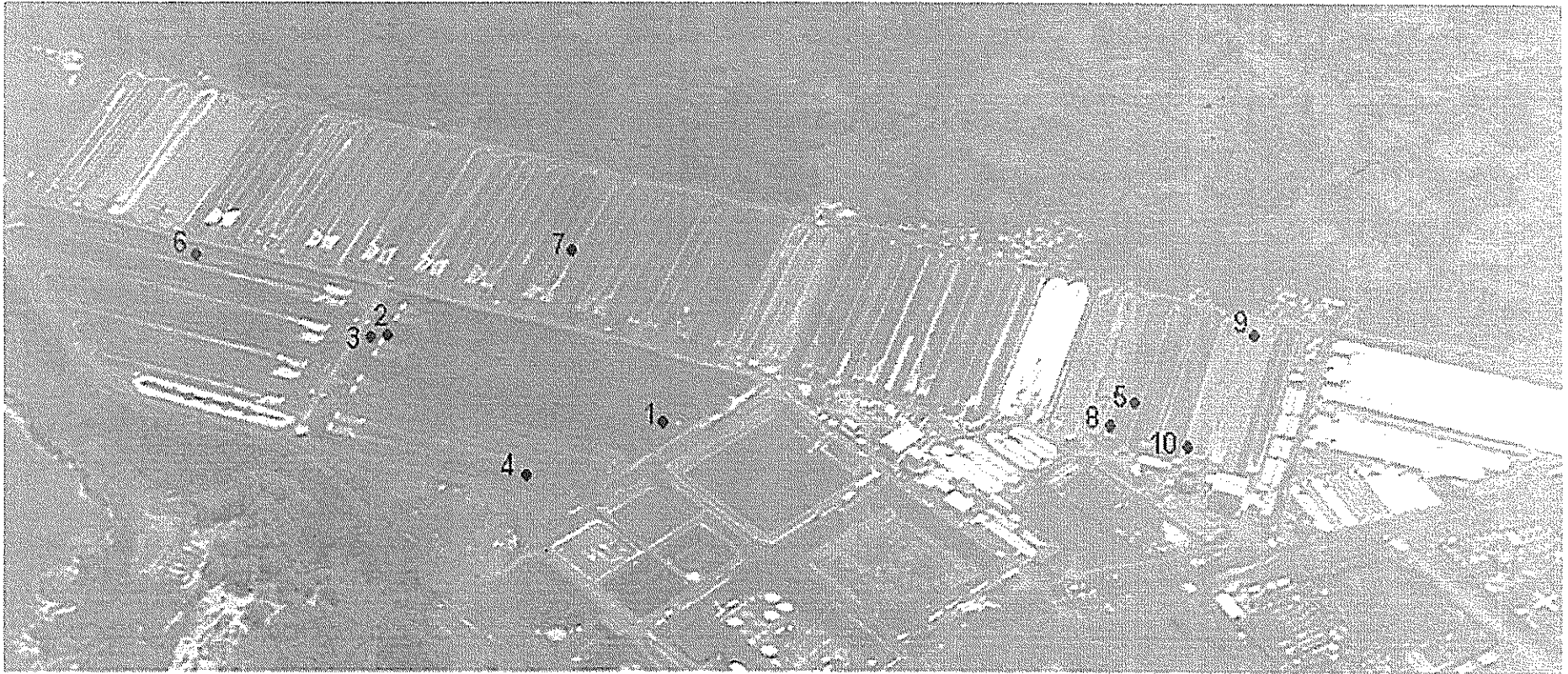


Exhibit 6 Pyrotechnic System



Exhibit 7

Stilt Mortality Recovery Map



1. 12-02-03 *Spirulina* Production Raceway 67
2. 12-02-03 *Spirulina* Production Raceway 68
3. 12-03-03 *Spirulina* Production Raceway 68
4. 12-07-03 *Spirulina* Production Raceway 63
5. 12-23-03 Astaxanthin Raceway 14
6. 01-07-04 *Spirulina* Production Raceway 55
7. 01-28-04 *Spirulina* Production Raceway 25
8. 02-04-04 Astaxanthin Raceway 14
9. 02-21-04 Astaxanthin Raceway 10
10. 02-24-04 Astaxanthin Raceway 11

Figure 1

Cyanotech Pre-Dawn Hawaiian Stilt Counts Comparison Mar.-Aug.2003 to Sept. 2003-Aug. 2004

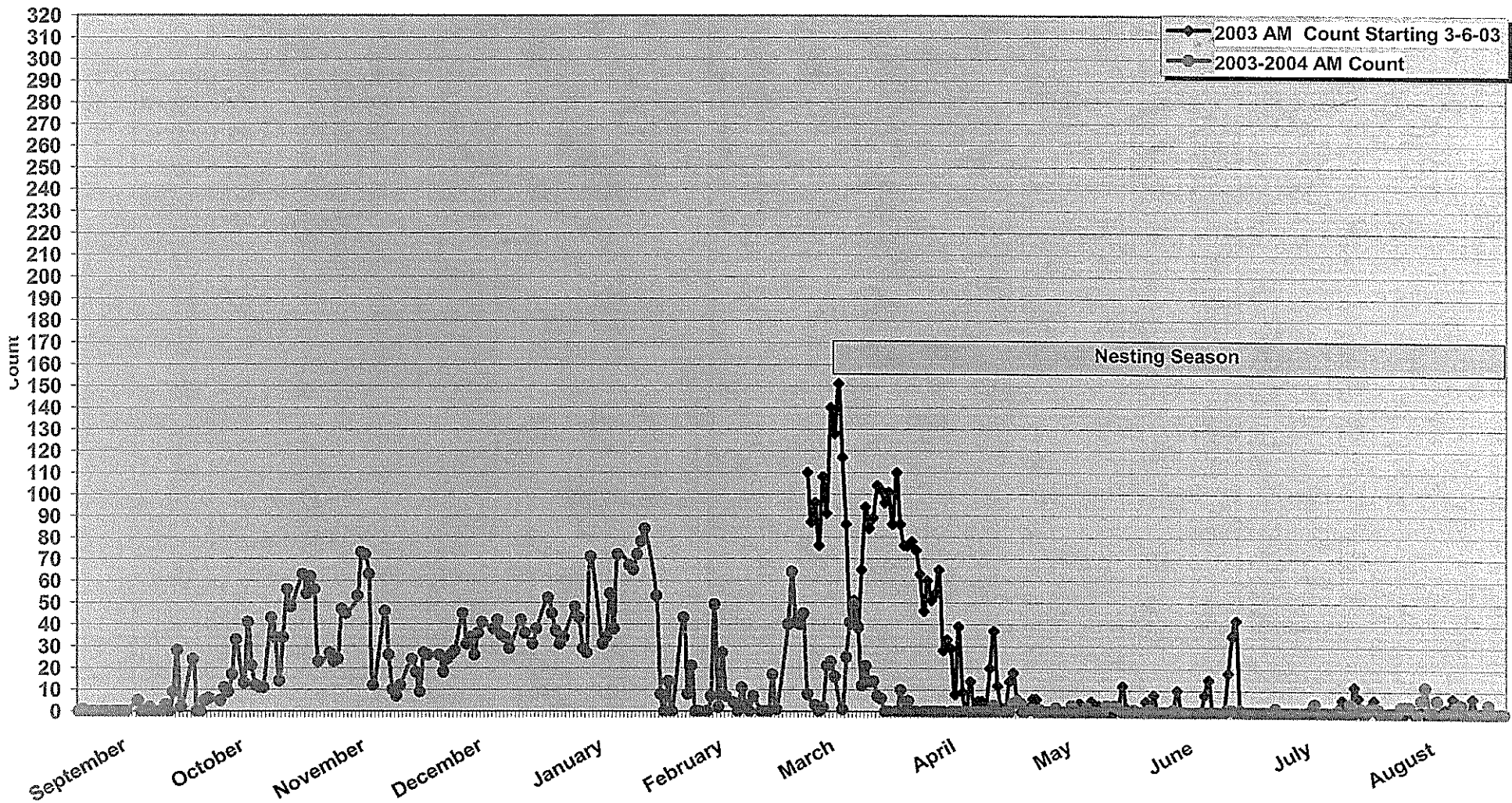


Figure 2

Cyanotech Pre-Sunset Hawaiian Stilt Counts Comparison Mar.-Aug.2003 to Sept. 2003-Aug. 2004

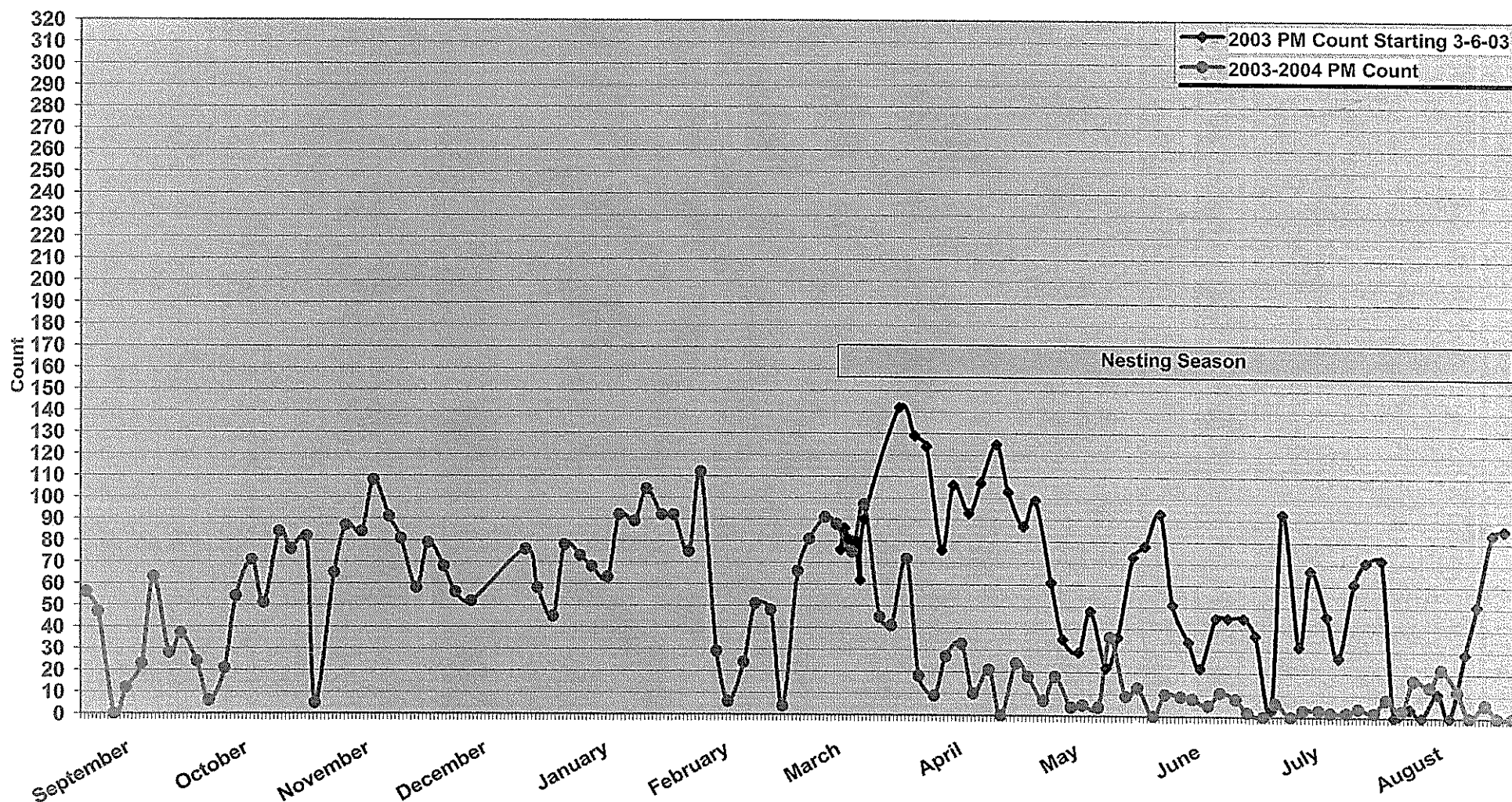


Figure 3

Cyanotech Weekly Hawaiian Stilt Counts Comparison Sept. 2002-Aug.2003 to Sept. 2003-Aug. 2004

