Improving Detection of Pesticide Poisoning in Birds, Part II

by Pierre Mineau and Kelley R. Tucker

ABSTRACT: Pesticide effects on birds are multiple yet remain poorly understood. We know that birds are important sentinels of ecological health in every environment. Our knowledge of pesticide effects on birds and other wildlife is greatly improved when avian pesticide incidents are properly identified, reported, investigated, diagnosed, and recorded in accessible standardized formats. Properly informed and with resource support, the wildlife rehabilitation community can become a valuable source of information.

KEY WORDS: avian, pesticides, poisoning, organophosphorous, carbamate, anticoagulant, cholinesterase, neuro-toxicity, synapse, 2-PAM, atropine, clinical signs, measurement, monitoring, reporting

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Common Causes of Poisoning and Routes of Exposure

It is useful to review briefly the major causes of bird poisoning incidents. A good understanding by the rehabilitator of the types of pesticide exposure situations that frequently result in poisoning incidents may help him or her suggest a diagnosis for an individual that has been admitted.

The first category to consider is that of **abuse or deliberate misuse of a pesticide** (usually an insecticide but also rodenticides) to kill vertebrate wildlife considered to be pest species. Nontarget individuals, such as avian scavengers, are often killed incidentally. In the United States it is estimated that between 1985 and 1994 about half of all recorded incidents of raptor poisonings with organophosphorus (OP) and carbamate (CB) products were cases of abuse (Mineau et al. 1999). In Canada the proportion of cases resulting from abuse appears to be lower, but this tally is heavily biased toward one specific region where there is a problematic overlap between high wintering populations of bald eagles (*Haliaeetus leucocephalus*) and intensive agriculture. The presence of unusual food material (such as bread, meat of domestic animals, etc.) in intoxicated individuals is often the first indication that illegal baiting has taken place.

Granular insecticides come up time and time again as a source of wildlife pesticide mortality. Many cases have been reported in several countries. The high risk associated with pesticide granules is a result of (1) the high toxicity of several registered products, and (2) current agricultural machinery that cannot ensure that pesticide granules are completely buried below the soil surface or—worse—that deliberately place them on the surface. Poisoning cases can occur through direct exposure because several bird and small mammal species are attracted to granular formulations, especially those that make use of sand (silica) or dried granulated corn cob. The first are likely taken as grit, the latter as food because they resemble seed fragments. Exposure can also occur via invertebrates, especially earthworms or cutworms to which granules may adhere, or secondarily through predators and scavengers that eat their prey whole or ingest their gastrointestinal tract contents. In Canada and the U.S. there have been cases of poisoning of waterfowl foraging in puddles in fields more than six months after pesticide application. Out-of-season poisoning cases are therefore possible with these formulations.

Historically, **seed dressings** were one of the main sources of wildlife exposure to organochlorine or mercury compounds. Poisoning incidents with seed dressings are still relatively frequent, especially in Europe where there is a heavy use of cholinesterase-inhibiting pesticides for this purpose. Lindane (which is an organochlorine insecticide) is the main seed dressing chemical in North America, a situation that is about to change. It will be replaced with a number of products, some of which may be much more acutely toxic.

A group of birds at particularly high risk is grazers such as geese, some ducks, and coots. Grazing birds do not break down cellulose and therefore need to consume large quantities of foliage, which puts them at risk when feeding in sprayed forage crops, pastures, or turf. The use of diazinon on turf is a perfect example. More than 100 cases, some involving hundreds of birds, were recorded on turf before the pesticide was withdrawn from golf courses in the U.S. (Stone and Gradoni 1985, Stone 1987).

Wildlife species that specialize on agricultural pests such as grasshoppers, leatherjackets, grubs and others are at high risk of poisoning. Kills of these species are all the more tragic because such wildlife species are beneficial to agriculture, and they offer a valuable, if often unrecognized, service (Kirk et al. 1996). When highly toxic insecticides are used, especially against irruptive pest species (such as grasshoppers, cutworms, or leatherjackets [crane fly larvae]) opportunistic gorging can get a number of species, including some raptors, gulls, grouse, or songbirds, in trouble. In a recent case in Argentina, approximately 20,000 Swainson's hawks (*Buteo swainsoni*) were poisoned within the span of a few weeks after feeding on grasshoppers sprayed with monocrotophos (Hooper et al. 1999, 2002).

Poisoning need not be through ingestion of contaminated foodstuffs. The **use of OPs in dormant oils** applied to California orchards has given rise to a large number of raptor intoxications (Hooper et al. 1989, Fry et al. 1998, Mineau et al. 1999, Hosea 2000). It is probable that other species such as goldfinches (*Carduelis tristis*), juncos (*Junco hyemalis*), killdeer (*Charadrius vociferous*), white crowned sparrows (*Zonotrichia leucophrys*), and yellow-rumped warblers (*Dendroica coronata*), present in high numbers (Michael Fry, U.C. Davis, pers. comm.), were also affected. In the case of raptors, however, exposure is thought to have come primarily from dermal contact with branches and other sprayed surfaces.

Finally, some poisoning cases result from the **use of organophosphorous pesticides for the treatment of ecto- and endoparasites in livestock.** The most interesting case is undoubtedly that of famphur as documented by Henny and colleagues (1984, 1985). Famphur was found to persist on the hair of cattle and cause poisoning of magpies (*Pica pica*) up to 100 days after treatment. Famphur remains one of the leading causes of eagle poisonings in the American Southwest. Author K. R. T. has detailed elsewhere pesticides that provide the greatest hazards to birds and remain registered for use in North America (Tucker 2000).

Identifying Pesticide Incidents

Our knowledge of pesticide effects on birds and other wildlife is dependent on the number and quality of incidents that are identified, reported, investigated, diagnosed—through necropsy, biochemical, and/or chemical testing—and recorded in an accessible and reliable format. Unfortunately, fully documented incidents are rare when considered against current estimates of lethal and sublethal pesticide effects on birds. A recent modeling exercise (Mineau 2002) suggests that bird kills are frequent and largely unavoidable with many pesticides registered currently. Kills have been recorded that implicate more than 50 pesticide active ingredients registered in the U.S. (USFWS unpublished). It is likely that documented cases represent only a small fraction of total pesticide mortality among birds (Vyas 1999). There are many reasons for this. Foremost is the difficulty of finding birds that have died or are inhibited by pesticides. Birds are small, many are cryptically colored and, once dead, they are often difficult to detect in open fields, park areas, or dense brush. Research shows that, on average, 77% of all carcasses are destroyed or removed by predators within 24 hours (ibid). Birds exposed to sublethal effects of pesticides may become disoriented or lethargic and may seek cover in dense brush or in cavities or holes of other species. The mobility of birds also adds to the difficulty of identifying incidents. Birds that receive lethal doses of pesticide can, in many cases, fly some distance—sometimes several miles—from a poisoning site prior to any significant impairment.

As noted in Part I of this paper (*J. Wildlife Rehab.* 25(2): 4–13), pesticide exposure that is not immediately lethal can impair a variety of avian functions and may lead to death or injury via predation, car strikes, starvation, or another such secondary event. In such instances, the recorded cause of death or the course of treatment often focuses on the secondary hazard, not the intoxication that created the bird's initial vulnerability. As reviewed earlier, efforts to measure cholinesterase levels or anticoagulant loads in injured and dead raptors at wildlife centers suggest that exposure to these pesticides may increase a bird's vulnerability to further injury via predation, accident, or other causes.

Rehabilitators and wildlife professionals are becoming increasingly aware of the effects of pesticides but are frustrated by the lack of access to testing, the shortage of federal and state resources to handle suspect cases, and the lack of a reliable centralized source for information and guidance on standard procedures and comparative references for diagnosing, treating, and reporting pesticide poisoning in birds.

The Avian Incident Monitoring System (AIMS) was developed to resolve many of these issues. AIMS is a comprehensive program, overseen by the American Bird Conservancy (ABC), to monitor, identify, diagnose, and report field effects of pesticides on birds in the U.S. and Canada. As originally designed, AIMS includes an electronic data system for sorting and sharing avian incidents nationally and internationally; incorporates historical data from paper and electronic files; and creates state/province-based programs that provide training, infrastructure development, and—when needed—outside resources to enhance monitoring, diagnostic, and reporting capacities (Tucker 2001).

As part of the wider AIMS project, a one-year methods validation and trial of a proposed national network is underway at the Patuxent Wildlife Research Center (PWRC) in Laurel, Maryland, with funding from the U.S. Environmental Protection Agency and critical support from PWRC staff, ABC, National Wildlife Health Center, and U.S. Fish & Wildlife Service. Several U.S. avian rehabilitation centers are participating as partners in the trial. If successful, and implemented at a regional or national level, the Avian Pesticide Incident Network (APIN) will provide permitted rehabilitators and wildlife professionals with access to screening and diagnostic resources so they can verify avian pesticide incidents that might otherwise go unrecorded because of cost or lack of resources. The APIN trial and proposed program expansion will provide additional information on clinical signs, diagnosis and treatment, observations on species- or chemical-specific responses, opportunities to verify and compare methods of detecting and measuring pesticides, and insight into how and when pesticides play a contributing role in addition to a direct role in mortality or impairment.

Why Incident Monitoring?

Pesticides are registered for use in a specific situation, for example on lawns or specific crops, in forestry, gardening, or the home. Federal environmental agencies responsible for evaluating the risk and efficacy of each registration require a battery of tests be performed on the principle or "active" ingredient. The vast majority of these tests are conducted in the laboratory, primarily to gauge potential human effects. Testing for effects on wildlife species and parts of the wider environment is limited. For example, only two bird species are required to be tested. Independent research has proven that there are vast differences in sensitivity from one bird species to another—and among individuals within species. Testing scenarios are highly controlled and do not account for variation between species, routes of exposure (e.g., dermal and inhalation in addition to the oral route), or differences in the health or general condition of animals that will be exposed in normal use patterns. The chemical behavior of pesticides can also be altered by local conditions, such as soil type and weather. Even if testing in controlled scenarios is extensive, unforeseen problems can arise once the product is released for registered commercial use. Specific species of birds not tested in the laboratory may show particular sensitivity to a compound in the field; the formulated product (the tested active ingredient plus other chemicals ingredients added for efficacy) may behave differently in a particular field scenario; or combinations of different formulated products, via sequential spraying or deliberate mixing of different compounds in the same area, may result in hazardous combinations not predicted in the laboratory. Scientists, policy analysts, and regulators are attempting to develop risk-assessment models that can take some of this variability and uncertainty into account. But without the dedication of resources to a greater number of preregistration field trials, ongoing scientific field research, or postregistration processes for assessing impacts in actual use scenarios, our understanding of pesticide effects on birds and other taxa will continue to be minimal.

Incident monitoring is one of the critical mechanisms by which unanticipated hazardous toxic effects resulting from registered, everyday use of pesticides can be recorded and reported—and in the end, mitigated or a specific use pattern cancelled. Effective incident monitoring requires trained and authorized personnel to search for, identify, and investigate wildlife incidents. In North America, at a national and international level, no formal avenues exist for reporting sightings of dead and injured birds that may be victims of pesticide exposure. The lack of formal or informal monitoring systems does not suggest that few problems exist, but ensures that much goes unobserved; that when incidents are observed they are not often reported, and that even when they are reported, they often remain uninvestigated due to a lack of resources, training, or readily available standards. The relatively small numbers of incidents that are reported, investigated, and diagnosed are the tip of the iceberg in terms of actual numbers poisoned.

In the Meantime: Guidelines for Rehabilitators

Until APIN is rolled out region-by-region, or a national monitoring system is up and running in each state and province, rehabilitators can contribute to the understanding of pesticide impacts and increase their accuracy of diagnosis and treatment by following standard procedures and documenting possible pesticide cases. The following guidelines should be considered a minimal procedural outline to be augmented by protocols or suggestions from state/province or federal authorities in an area or a particular diagnostic lab handling any collected samples. Rehabilitators in the U.S. and Canada should establish working relationships ahead of time with state/provincial and federal biologists and enforcement personnel in their area to ensure that any carcasses or site information collected can be easily incorporated into existing records and procedures. As is true with all care issues, the ongoing involvement of qualified veterinarians is critical to diagnostic capacity and the identification of resources for optimal response to pesticide incidents.

Incidents in the field

If a wildlife rehabilitator or wildlife professional identifies an avian mortality incident, they may choose to retrieve carcasses and investigate the site. One motivating reason for doing so is the fact that, on average, carcasses are removed quickly and/or destroyed by scavengers, and time is of the essence for gathering meaningful data. Remember that, without appropriate storage conditions, carcasses become less useful for diagnostic purposes as time elapses. Please note that regulations covering these activities vary from country to country and you may be required to gain specific permissions. Consult the relevant government agency for details prior to conducting any such activities.

Once you take on the responsibility of investigating an incident, take the time to follow some basic procedures and document all observations. Any kill could become a formal investigation, and you may be the first or only person on the scene. The following generally applies to any incident.

- Be inquisitive, thorough, and safe.
- Do not assume that a pesticide is the cause; expect the unexpected—awareness of recent wildlife disease incidents in an area may affect your decision to collect.
- Assume that the incident may become evidence for a regulatory decision, focused monitoring efforts, or a legal case.
- Take common sense precautions, wear gloves, double bag all carcasses, be aware of fumes that might accumulate in the car or other enclosed space where carcasses are temporarily stored, and think twice about removing any bird from standing water—it may be difficult to avoid being exposed.
- Do not enter private land without landowner permission.
- Contact state/provincial and federal authorities immediately, whether you feel competent to collect and/or investigate, or not.
- Rehabilitators who carry emergency response kits may want to add the following items: several sizes of sturdy, self-sealing plastic bags; sturdy plastic disposable gloves; compass; camera; 3″x 5″ index cards; paper, pen, and pencil.

Documenting the site

The following elements are fundamental to a good site investigation. Observations on land use, proximity to water, weather, and other variables can be critical to identifying and verifying the reason for an incident. Record as much data as time and circumstances warrant. Include the following:

- **Description of the area:** specific location; land use immediately surrounding the carcass(es) and beyond; habitat. Draw a map with compass points that indicates tree stands, bodies of water, roads, and other physical features.
- **Environmental factors:** storms, precipitation, changes in temperature or other factors that might play a role in the condition of the bird or other physical evidence.

- **Chronology:** estimates of the order of events, including any known application of pesticide; arrival of birds in an area; onset and/or duration of clinical signs.
- **Organisms affected:** species, number of individuals per species (if an estimate, describe your method of estimation), age, sex, overall appearance.
- **Clinical signs:** any usual behavior or physical appearance (e.g., lethargy, fearlessness, drooping wing or neck, seizures, etc.).
- **Populations at risk or present:** species using, moving through, or known to regularly inhabit the area.
- **Take photographs** of the site and of carcasses when possible.

Collection, transport, and storage

Established relationships with wildlife laboratories, local authorities, veterinarians, or other organizations with experience working with pesticides and birds may affect decisions regarding whether, when, and how to collect and store evidence from incidents that might be identified. As a general rule, when the incident is limited to one or only a very few known carcasses, it is best to collect all of them if supplies are available. Remember that the longer a carcass decays or is subject to scavenging or exposure to heat and other elements, the less use it will be in the diagnostic process. Carcasses should be handled minimally and with disposable gloves. After scanning a site and noting some of the information above, document the site with photographs, including the wider site in which the carcass(es) are present and closer shots detailing the position of the carcass(es). Before collecting, prepare an identification tag to be attached to the bird by string or wire or inserted into the interior self-sealing plastic bag. Information on the tag should include your name, address, phone number or other contact information (these could be preprinted), collection site, date, and species. Note whether the bird was found dead or any clinical signs apparent prior to death. After sealing bag with the tag inside, place this bag into a second self-sealing bag. Double-labeling, placing a duplicate second card in the outside bag, is often worth the extra time. Use a soft lead pencil or permanent ink pen.

Transport carcasses quickly to an appropriate prearranged storage facility. Consider the possibility of fumes, keeping carcasses in a well-ventilated area during transport. Rehabilitators are already aware of the various reasons for separate cooling and freezing units in their work. At minimum, clearly labeled, limited access, partitioned areas in units set aside for double-bagged carcasses only, should be maintained for any potential pesticide incident storage. If the storage site for carcasses is owned or managed by another individual or agency, have the transferee fill out another 3″x 5″ card with their name and contact information and the date of transfer, and insert this into the outside bag of all carcasses involved. Keep a record of this transfer in your notes for the incident.

Deciding how to store carcasses requires consideration of the contradictory demands of necropsy versus chemical and biochemical analysis noted above. For the former, the bird should be keep cool but not frozen; in the best case scenario for chemical and biochemical analysis, the carcass should be frozen immediately, preferably in a stable ultralow freezer. Ultralow storage allows rapid freezing of carcasses and maintains a stable low temperature. Once frozen, any thawing or refreezing—including the natural defrosting process in most home units—will compromise chemical or biochemical analysis. Again, rehabilitators working with experienced partner laboratories or agencies can receive some guidance in making these decisions. If multiple carcasses in good condition are available from one site, split them up, freezing some for analysis and keeping others cool for necropsy. While chemical and biochemical analyses are often key to diagnosing OP and CB pesticides, a carefully conducted necropsy may reveal important information about the incident, including evidence of other pesticides such as rodenticides.

This bald eagle was located just after death by a USFWS agent, marked, and purposefully left in the field. Twenty-four hours later, at the time of this photo, its scavenged carcass is difficult to locate, identify, and leaves little, if any, evidence for pursuing pesticide analysis.

Necropsy, biochemical, and chemical analysis

This paper will not address specific protocols for necropsy and biochemical and chemical analysis. Numerous valid procedures exist for any one of these protocols, but standards for ensuring comparability and consistency in data collection are lacking. The APIN trial described above will validate protocols for diagnostic processes agreed on by a working group, including scientists from numerous federal agencies, academia, nonprofit science, and conservation groups and industry. Once validated, these protocols will be made available to practitioners through publications and other fora.

If your reporting does not result in federal or state/province involvement in the case, you may choose to necropsy or have the bird necropsied and submit samples to a laboratory. In addition to common necropsy procedures, other aspects germane to pesticide investigations include using sagittal sections if dividing the brain; removing upper GI tract (stomach and crop contents and stomach, esophagus/crop), bagging or placing these in a glass jar (preferably chemically cleaned and sterile), and freezing as quickly as possible (preferably in an ultralow freezer); and making careful notes on crop or stomach contents identifying and describing seeds, granules, foreign substances, dyes, insects, and other notable material.

If you choose to pursue necropsy, biochemical, or chemical analysis, contact APIN trial staff or the National Wildlife Health Center in the U.S. or the Canadian Cooperative Wildlife Health Center in Canada for further information.

Live birds

Part I of this paper addressed the treatment of birds intoxicated by OP and CB pesticides or by anticoagulant rodenticides. Birds found alive but incapacitated on a site where pesticide poisoning may be implicated or that exhibit clinical signs of OP/CB poisoning on admission can also be tested for ChE inhibition. A sufficient amount of blood must be collected to allow repeat analyses: initial, spontaneous reactivation, 2-PAM reactivation, etc. Once the bird is stable, or as part of the intake exam, draw enough blood to fill at least two (and ideally four) 80–100 microliter tubes. On larger birds the maximum amount of blood necessary will be 1.0 milliliter. For birds under 30 g the assay will require the maximum amount of blood that can be drawn—10% of blood volume or 1% of the bird's body weight. It is ideal to use 80–100 microliter tubes because a single one is sufficient for an analysis, allowing the other(s) to be kept frozen until analyzed. Centrifuge and chill these at –34.44° C (–30° F) or below. These tubes can be submitted for ChE testing to a laboratory with experience in testing avian samples. See the National Wildlife Health Center guidelines for shipping or contact APIN trial staff for details. Consider repeating this blood draw procedure twice more at three- to four-day intervals if the condition and stress level to the bird allows. Also, repeat the blood draw procedure just before release. As noted above, serial sampling of blood can be invaluable to gain more knowledge of the behavior of OPs and CBs in specific species and individuals.

If crop contents on larger species can be removed with minimal stress, remove, double-bag (or use a chemically cleaned and sterile glass jar), and freeze contents following the same relevant safety and temperature protocols as for carcasses. Analyzing crop contents for signs of dye, pesticide granules, or potentially contaminated food sources and pesticide residue can provide compelling evidence of pesticide exposure. Make written notes about the contents when removed and add these to any observations of the site. As noted above, removal of crop contents may also alleviate a source of ongoing intoxication in live birds.

Ethanol foot washes of birds exposed to pesticides can also provide samples for residue testing. Blood, crop contents, and foot wash protocols have been developed for use in the APIN trial and, once validated, will be made widely available.

Shipping

In the majority of cases, rehabilitators will be asked to ship samples (carcasses, blood, etc.) as soon as possible to the laboratory of the agency or organization with which they are cooperating. Remember to always coordinate the shipper, rate, and arrival time with the laboratory staff, as timing is critical to receiving samples of the highest quality. In cases where necropsy is a next step, the use of blue ice (chemical ice packs) is recommended as a refrigerant since they are less likely to leak once thawed. Carcasses must be kept dry and equally cold during shipment. Dry ice will freeze samples so is inappropriate except where freezing is desired. Again, discuss refrigerants with the laboratory with which you are working. Packaging and shipping protocols are available from APIN trial staff and from the National Wildlife Health Center.

Reporting and recording

While appropriate response techniques are critical to the quality of investigative and diagnostic results, they will be in vain unless each rehabilitator keeps detailed records of any incident to which they respond. Even when a rehabilitator is working with qualified personnel from other agencies, their observations in the field or, more likely, of an avian victim may be of great assistance in an investigation. Notes should be kept throughout the incident and recorded as much as possible during the investigation while observations are fresh in the mind and unaffected by later assumptions or findings from the incident. Guidelines and forms for recording information have been compiled by numerous agencies and APIN trial staff.

As soon as circumstances allow, rehabilitators should report incidents to relevant authorities. A listing of federal agencies and resources can be found in the Appendix at the end of this paper. Again, establish a working relationship with state and federal conservation, fish and game, and/or law enforcement authorities in your area. See the sidebar for telephone contact information.

Conclusions

An incident monitoring program requires a network of trained individuals capable of carrying out investigations in the field and collecting and properly identifying and storing samples; access to laboratories equipped for biochemical and chemical analysis and familiar with relevant wildlife protocols; and, in the end, a system for storing and providing access to gathered information. Monitoring can be passive or voluntary, active and highly systematized (thus requiring significant time and a specific geographical focus), or lie somewhere in between, but each system requires that investigative and diagnostic tools and resources are available when an incident is identified and reported. Partnerships among agencies and organizations that are concerned with avian mortality and/or with pesticide effects can bring the maximum available resources to bear on incidents. Coordination of collection activities, investigative and diagnostic procedures, and agreement on a range of procedural standards is essential to produce and maintain a body of high-quality, scientific data that can influence pesticide practice and regulation. Wildlife rehabilitators are well placed to assist in these efforts, and programs are being developed that will provide guidance and resources for those who choose to contribute the additional time and energy required to pursue pesticide diagnoses.

Carefully developed and implemented, the usefulness of an incident monitoring system will increase as the quality, coverage, and reliability of the reports increases. The benefits of such systems are obvious for individual birds, scientists concerned about specific species, and advocates seeking additional information on a particular pesticide. They extend as well to farmers, state officials, regulators, pesticide applicators, land managers, and pesticide manufacturers. All are invested in, can be informed by, and respond constructively to well-documented effects of pesticides in the field. Monitoring systems such as AIMS seek to share information broadly in order to effect informed decision making. Incident data can be used to validate assessments made in registration; trigger review of a particular pesticide use; improve label directions; focus more systematic field monitoring to further isolate and, hopefully, solve problems.

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APPENDIX A. FEDERAL AGENCY CONTACTS

Staff at many of these agencies may be able to assist rehabilitators in investigating or diagnosing an avian pesticide poisoning incident. Be aware that agency funding is limited, and certain species, geographic locations, or circumstances may have priority. In the U.S. rehabilitators are required to report suspected pesticide poisoning to their regional U.S. Fish and Wildlife Service (USFWS) permit examiner. In a case involving possible criminal activity (i.e., intentional misuse of a pesticide), endangered species, or a repeating pattern of abuse, contact the USFWS law enforcement office closest to you and in your USFWS region. Remember that state and federal law enforcement officers may choose to investigate any poisoning incident, and well-documented rehabilitation records and observations can be invaluable to an investigation. Other possible sources of diagnostic support include the National Wildlife Health Center and the regional USFWS Contaminants program office. These agencies deal with a wide variety of contaminants-related issues, but may have a particular interest or program that will allow them to pursue a situation reported by a rehabilitator. In Canada, the Canadian Cooperative Wildlife Center maintains a hotline and has three regional offices that may be able to provide varying levels of support to rehabilitators. These are only federal contacts; many states have excellent contaminants personnel who can provide information and support on these and related issues.

United States Fish & Wildlife Service

Division of Migratory Bird Management, Regional Contacts (Permit Examiners)

Region 1 (WA, OR, ID, NV, CA, HI, GU, Pacific Islands)	503/872-2715
Region 2 (NM, TX, AZ, OK)	505/248-7882
Region 3 (MN, WI, MI, MO, IL, IN, OH)	612/713-5436
Region 4 (NC, SC, GA, FL, TN, AR, LA, AL, PR)	404/679-7070
Region 5 (ME, VT, NH, MA, NY, NJ, DE, MD, WV, VA)	413/253-8641
Region 6 (CO, UT, KS, NE, WY, MT, ND, SD)	303/236-8171
Region 7 (AK)	907/786-3693

Division of Law Enforcement, Senior Resident Agent Offices
Contact the office in your USFWS region closest to location where bird was found.

Mesa, AZ	480/835-8289
Torrance, CA	310/329-6399
Sacramento, CA	916/414-6660
St. Petersburg, FL	727/570-5398
Miami, FL	305/526-2610
Atlanta, GA	404/763-7959
Honolulu, HI	808/541-2681
Boise, ID	208/334-1684
Derby, KS	316/788-4474
Slidell, LA	504/641-6209
Baltimore, MD	410/962-7980
Charlestown, MA	617/424-5750
Ann Arbor, MI	734/971-9755
St. Paul, MN	651/778-8360
Jefferson City, MO	573/636-7815
Jackson, MS	601/965-4699

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Billings, MT	406/247-7355
Newark, NJ	973/645-5910
Albuquerque, NM	505/346-7828
Valley Stream, NY	516/825-3950
Raleigh, NC	919/856-4786
Oklahoma City, OK	405/608-5251
Wilsonville, OR	503/682-6131
Pierre, SD	605/224-1001
Houston, TX	281/442-4066
San Antonio, TX	210/681-8419
Ogden, UT	801/625-5570
Richmond, VA	804/771-2883
Redmond, WA	425/883-8122
Casper, WY	307/261-6365

Division of Environmental Quality, Contaminants Program

Region 1 (WA, OR, ID, NV, CA, HI, GU, Pacific Islands)	503/231-6172
Region 2 (NM, TX, AZ, OK)	505/766-2914
Region 3 (MN, WI, MI, MO, IL, IN, OH)	612/713-5426
Region 4 (NC, SC, GA, FL, TN, AR, LA, AL, PR)	404/679-7127
Region 5 (ME, VT, NH, MA, NY, NJ, DE, MD, WV, VA)	413/253-8659
Region 6 (CO, UT, KS, NE, WY, MT, ND, SD)	785/539-3474
Region 7 (AK)	907/786-3483

United States Geological Survey, Biological Resources Division
National Wildlife Health Center

Wildlife Disease Specialists

Grace McLaughlin	608/270-2446
Kim Miller	608/270-2448

Canadian Cooperative Wildlife Health Center

Headquarters: Saskatoon, Hotline 800/567-2033

Regional Offices

Guelph	519/823-8800, ext. 4556 or 4557
Quebec	450/773-8521, ext. 8346
Prince Edward Island	902/566-0667 or 902/566-0959

APIN Trial Contact

APIN Trial Coordinator

Shannon Borges	301/497-5732