

INCORPORATING DEPREDATION PERMITS INTO INTEGRATED DAMAGE MANAGEMENT PLANS FOR AQUACULTURE FACILITIES

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ABSTRACT: Increasing bird depredation at aquaculture facilities in Alabama, Arkansas, Louisiana, and Mississippi creates economic hardships for many fish farmers. Solutions to bird depredation at these facilities require the development of integrated damage management plans that will reduce damage levels while insuring minimal impacts to bird populations. Damage management plans developed for fish farmers by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Animal Damage Control (ADC) program always include non-lethal control recommendations. If non-lethal control is ineffective or only marginally effective in reducing damage, the management plans may also recommend the issuance of depredation permits by the U.S. Fish and Wildlife Service (USFWS). The purpose of the permits is to enhance the effectiveness of non-lethal control methods. Birds typically included on depredation permit requests include double-crested cormorants, great blue herons, and great egrets. Concern has been expressed that depredation permits have negative impacts on the populations of fish-eating birds. However, records from the USFWS indicate that from 1989 - 1993, only 35% - 66% of the birds which fish farmers were authorized to take were actually killed. Despite the fact that some birds are being killed, populations of cormorants, herons, and egrets are increasing.

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Aquaculture production continues to expand and diversify within the United States (USDA 1994). In addition to producing a variety of food products (Price and Nickum 1995), aquaculture facilities also serve as wetland complexes which often provide suitable habitat for a variety of shorebirds (Smith et al 1991) and waterfowl (Christopher et al 1987, Dubovsky and Kaminski 1987). They have also proven attractive to a host of wading and other fish-eating birds (Busroe 1985, Fleury 1993, Hoy et al 1989, Glahn and Stickley 1995, Ross 1994, Smith and Layher 1993, and Stickley et al 1995a).

Fish-eating birds, such as double-crested cormorants, great blue herons, and great egrets, not only consume fish in aquaculture ponds but also damage them during failed predation attempts. Bird activity at ponds may also alter the behavior of the fish to the extent that they stop feeding. As a result, operators of aquaculture facilities are concerned with the presence of fish-eating birds. Impacts of bird depredation have been documented at private, state, and federally owned fish hatcheries (Baird et al 1993, Parkhurst et al 1987, Parkhurst et al 1992,

Scanlon et al 1978). The greatest impacts have, however, been documented in the southern United States, specifically the four state area of Alabama, Arkansas, Louisiana, and Mississippi. This area contains the largest portion of aquaculture production in the U.S.: 92% of the nation's catfish ponds (USDA 1994) and 90% of all crawfish impoundments (Huner 1995). In addition, over 12,065 ha of baitfish ponds can also be found in Arkansas (Bo Collins, National Biol. Serv., Pers. Comm.). Losses have been documented at catfish farms in Alabama (Ross 1994) and Mississippi (Stickley and Andrews 1989), bait fish farms in Arkansas (Hoy et al 1989), and crawfish farms in Louisiana (Huner 1993).

Conflicts between fish eating birds and aquaculture interests are not new (Lagler 1938, 1939 and McAtee and Piper 1937). Concern about the resulting actions taken by aquaculture producers against depredating birds has also been expressed for several years (Pough 1940, 1941, 1949; Morrison 1975, Randall 1975). Recently, additional concerns have been raised about impacts to bird

populations as a result of the implementation of depredation permits as part of damage management strategies at aquaculture facilities (Fleury 1994, Snodgrass 1993, Williams 1992).

LEGAL STATUS OF FISH-EATING BIRDS

Birds typically associated with depredation at aquaculture facilities are protected by the Migratory Bird Treaty Act (MBTA). While authority for the conservation and management of all migratory birds rests with the U.S. Fish and Wildlife Service (Trapp et al 1995), the responsibility for addressing migratory bird depredation rests with the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Animal Damage Control (ADC) program (Acord 1995).

Provisions within the MBTA allow for the issuance of depredation permits for the legal killing of an otherwise protected bird when it has been determined that significant bird depredation has occurred. Permits are issued by the USFWS based upon the recommendations of ADC.

BIRD DAMAGE MANAGEMENT PLANS

ADC representatives respond to requests for assistance with bird depredation by conducting on-site visits to aquaculture facilities. During these visits, careful evaluations are made of the type of resource being damaged, the number and species of birds responsible for the damage, the economic losses resulting from the damage, and the control methods which have been used in an attempt to resolve the damage. Based on these evaluations, ADC personnel will develop integrated damage management plans for each aquaculture facility. These plans always include non-lethal control methods.

Non-lethal control methods which have been tried with variable results include frightening devices (Littauer 1990a, Stickley et al 1995b), overhead barriers (May and Bodenchuk 1992), perimeter fencing (Mott and Flynt 1995), and roost dispersal (Mott et al 1992). Aquaculture management strategies such as changes in stocking rates, altering

pond design, and using buffer prey have also been suggested but have yet to be fully evaluated (Mott and Boyd 1995).

If non-lethal control has proven ineffective or moderately effective in reducing damage, management plans may then include recommendations to the USFWS for the issuance of a depredation permit so that a limited number of birds may be removed. The removal of the birds is used to enhance the effectiveness of non-lethal control methods. When permits are issued to aquaculture producers, the USFWS places stipulations on the species and numbers of birds which can be killed, the geographic area where the killing may be conducted, the manner in which the birds may be killed, the manner in which bird carcasses must be disposed, the requirements for an annual report of the species and numbers of birds actually killed, and a time limit of not more than one year for which the permit is valid (Trapp et al 1995).

As a supplement to the damage management plans, ADC personnel often provide the aquaculture operators with leaflets which describe bird damage management techniques (Littauer 1990a, 1990b; Stickley 1990), instruct them on the use of control methods, provide a list of sources for the purchase of control tools, and may loan damage abatement equipment. ADC also provides formal training to catfish farm managers and employees to address areas such as bird identification and biology, proper use of control tools, and use of authorities granted under depredation permits.

NUMBERS OF BIRDS TAKEN UNDER AUTHORITY OF DEPREDAATION PERMITS

In 1989, Region 4 of the USFWS developed a database to track information related to the depredation permits issued by its office. Information collected includes the number of permits issued annually, the species of birds which could be taken, the number of birds authorized to be killed, and the number of birds which were reported killed by the permit holder.

In order to ascertain the number of birds actually killed by permit holders, data was obtained from the USFWS for permits which were issued to operators of aquaculture facilities in Alabama, Arkansas, Louisiana, and Mississippi from 1989 through 1993 (the most recent year of complete data). Information was obtained for the three bird species typically associated with depredation at aquaculture facilities: the great blue heron (Table 1), the great egret (Table 2), and the double-crested cormorant (Table 3). From 1989 through 1993, the percentage of birds actually killed by permit holders ranged from 35% to 68% of the authorized take.

HERON, EGRET, AND CORMORANT POPULATIONS

Data from Christmas Bird Counts (Annon. 1979-1993) in the four state area show increases in great blue heron, great egret, and double-crested cormorant populations. Increases in the wintering populations of cormorants are attributed to increases in their breeding populations. Analysis of band returns of cormorants which winter in the four state area indicate that these birds migrate from breeding grounds in Canada and the Great Lakes region (Dolbeer 1991). Birds from these regions represent 60% of the entire North American cormorant population, and in the past 20 years, the numbers of breeding pairs have increased to 220,000 (Hatch 1995).

DISCUSSION

Increases in the number of depredation permits issued, the number of birds authorized to be taken, and the number of birds actually killed by permit holders (Tables 1-3) reflect the increasing problem of bird depredation at aquaculture facilities. Despite the fact that the number of birds taken by permit holders has been increasing annually, the populations of great blue herons, great egrets, and double-crested cormorants are increasing. This indicates that the incorporation of depredation permits into damage management plans is not negatively impacting these bird populations.

The fact that in any single year the percentage of birds actually killed never exceeded 68% of the authorized take illustrates the frightening effect lethal control has on bird behavior. This was best exhibited in a recent study where catfish farmers at three complexes in Mississippi were given the authority under a USFWS permit to remove as many as 2,500 double-crested cormorants in a 19 week period. During the course of the study, the participants were supplied ammunition and encouraged to kill as many cormorants as allowed by the permit. At the conclusion of the project only 290 birds had been killed. This low rate of kill was attributed to a learned behavior by the birds to avoid being shot (Hess 1994), similar to behavior exhibited by waterfowl during hunting seasons (Owens 1977).

The limited removal of birds responsible for depredations at aquaculture facilities is not without controversy. Responsible damage management plans always stress non-lethal control methods as the first step in reducing damage. If non-lethal control methods are ineffective or marginally effective, depredation permits are incorporated into management plans to remove a limited number of depredating birds. ADC personnel may also recommend the issuance of permits to enhance the effectiveness of non-lethal control methods. The intent of depredation permits is to remove the minimum number of birds as necessary in order to resolve damage while ensuring that the overall bird populations are not negatively impacted.

LITERATURE CITED

- Acord, B.R. 1995. Cormorant management and responsibilities: United States Department of Agriculture. Pages 231-233 *in* The Double-crested Cormorant: biology, conservation and management (D.N. Nettleship and D.C. Duffy, Eds.). Colonial Waterbirds 18 (Special Publication 1).
- Annon. 1979-1993. Christmas Bird Counts. American Birds Vols. 33-47.

- Baird, M.L., T.I.J. Smith, and W.E. Jenkins. 1993. Evaluation of control techniques for avian predators of pond-reared fishes. Proc. Annu. Conf. Southeast. Assoc. Fish & Wildlif. Agencies. (In Press).
- Busroe, F.M. 1985. Avian species attracted to and utilizing the Minor E. Clark Fish Hatchery. *Ky Warbler* 61:23-27.
- Christopher, M.W., E.P. Hill, and D.E. Steffen. 1987. Use of catfish ponds by waterfowl wintering in Mississippi. Pages 413-418 in (M.W. Weller, Ed.). Proc. Symp. Waterfowl in winter. Univ. Minn. Press, Minneapolis. 624pp.
- Dolbeer, R.A. 1991. Migration patterns of double-crested cormorants east of the Rocky Mountains. *J. Field Ornithol.* 62:83-93.
- Dubovsky, J.A. and R.M. Kaminski. 1987. Estimates and chronology of waterfowl use of Mississippi catfish ponds. Proc. Annu. Conf. Southeast. Assoc. Fish & Wildl. Agencies. 41:257-265.
- Fleury, B.E. 1993. Population trends in Louisiana herons, egrets, and ibises from 1949 to 1989. Page 35 in (J.V. Huner, Ed.). Management of Fish-eating Birds on Fish Farms: A Symposium. National Aquaculture Association/National Audubon Society. 51pp.
- _____. 1994. Crisis in the crawfish ponds. *Living Bird* 13:28-34.
- Glahn, J.F. and A.R. Stickley, Jr. 1995. Wintering double-crested cormorants in the delta Region of Mississippi: population levels and their impacts on the catfish industry. Pages 137-142 in *The Double-crested Cormorant: biology, conservation and management.* (D.N. Nettleship and D.C. Duffy, Eds.). Colonial Waterbirds 18 (Special Publication 1).
- Hatch, J.J. 1995. Changing populations of double-crested cormorants. Pages 8-24 in *The Double-crested Cormorant: biology, conservation and management.* (D.N. Nettleship and D.C. Duffy, Eds.). Colonial Waterbirds 18 (Special Publication 1).
- Hess, K.D. 1994. Effectiveness of shooting double-crested cormorants on catfish ponds and harassment of roosts to protect farm-raised catfish. M.S. Thesis, Mississippi St. Univ., Miss. State. 59pp.
- Hoy, M.D., J. Jones, and A. Bivings. 1989. Economic impact and control of wading birds at Arkansas minnow ponds. Proc. East. Wildl. Damage Control Conf. 4:109-112.
- Huner, J.V. 1993. Estimation of the impact of wading birds on production in Louisiana crawfish ponds. Pages 39-40 in (J.V. Huner, Ed.). Management of Fish-eating Birds on Fish Farms: A Symposium. National Aquaculture Association/National Audubon Society. 51pp.
- _____. 1995. How crawfish impoundments sustain wetland vertebrates in the south. *Presented at National Agricultural Ecosystems Management Meeting, New Orleans, LA.*
- Lager, K.F. 1938. Fish predation investigation. *Prog. Fish-Cult.* 39:47-48.
- _____. 1939. The control of fish predators at hatcheries and fish rearing stations. *J. Wildl. Manage.* 3:169-179.
- Littauer, G.A. 1990a. Avian predators: frightening techniques for reducing bird damage at aquaculture facilities. U.S. Dept. Agric., Coop. Ext. Serv., Southern Reg. Aquacult. Center Publ. No. 401. 4pp.

- _____. 1990b. Control of bird predation at aquaculture facilities: strategies and cost estimates. U.S. Dept. Agric., Coop. Ext. Serv., Southern Reg. Aquacult. Center Publ. No. 402. 4pp.
- May, A.J. and M.J. Bodenchuk. 1992. "Wire" grid excludes cormorants from commercial catfish ponds. *The Probe* 125:4.
- McAtee, W.L. and S.E. Piper. 1937. Excluding birds from reservoirs and fish ponds. U.S. Dept. of Agric. Leaflet No. 120. 6pp.
- Morrison, K. 1975. War on birds. *Def. Wildl.* 50:17-19.
- Mott, D.F., K.J. Andrews, and G.A. Littauer. 1992. An evaluation of roost dispersal for reducing cormorant activity on catfish ponds. *Proc. East. Wildl. Damage Control Conf.* 5:205-211.
- _____. and F. L. Boyd. 1995. A review of techniques for preventing cormorant depredations at aquaculture facilities in the southeastern United States. Pages 176-180 *in* *The Double-crested Cormorant: biology, conservation and management* (D.N. Nettleship and D.C. Duffy, Eds.). *Colonial Waterbirds* 18 (Special Publication 1).
- _____. and R.D. Flynt. 1995. Evaluation of an electric fence system for excluding wading birds at catfish ponds. *Prog. Fish-Cult.* 57:88-90.
- Owens, N.W. 1977. Responses of wintering brant geese to human disturbances. *Wildfowl* 28:5-14.
- Parkhurst, J.A., R.P. Brooks, and D.E. Arnold. 1987. A survey of wildlife depredation and control techniques at fish-rearing facilities. *Wildl. Soc. Bull.* 15:386-394.
- _____, R.P. Brooks, and D.E. Arnold. 1992. Assessment of predation at trout hatcheries in central Pennsylvania. *Wildl. Soc. Bull.* 20:411-419.
- Pough, R.H. 1940. Blue herons can't read. *Bird Lore* 42:507-516.
- _____. 1941. The fish-eating bird problem at fish hatcheries of the northeast. *Trans. N. Am. Wildl. Conf.* 4:203-206.
- _____. 1949. Whose fish is it? *Audubon* 51:90-96.
- Price, I.M. and J.G. Nickum. 1995. Aquaculture and birds: the context for controversy. Pages 33-45 *in* *The Double-crested Cormorant: biology, conservation and management* (D.N. Nettleship and D.C. Duffy, Eds.). *Colonial Waterbirds* 18 (Special Publication 1).
- Randall, R. 1975. Deathtraps for birds. *Def. Wildl.* 50:35-38.
- Ross, P.G. 1994. Foraging ecology of wading birds at commercial aquaculture facilities in Alabama. M.S. Thesis, Auburn Univ., Auburn. 65pp.
- Scanlon, P.F., L.A. Helfrich, and R.E. Stultz. 1978. Extent and severity of avian predation at federal fish hatcheries in the United States. *Proc. Annu. Southeast. Assoc. Fish & Wildl. Agencies.* 32:470-473.
- Smith, K.G., J.C. Neal, and M.A. Mlodinow. 1991. Shorebird migration at artificial fish ponds in the prairie-forest ecotone of northwest Arkansas. *Southwest. Nat.* 36:107-113.

- Smith, P.L. and W.G. Layher. 1993. Utilization of sportfish hatcheries in Arkansas by piscivorous birds during summer and fall of 1992. Page 40 *in* (J.V. Huner, Ed.). Management of Fish-eating Birds on Fish Farms: A Symposium. National Aquaculture Association/National Audubon Society. 51pp.
- Snodgrass, R.D. 1993. Solutions and recommendations: A panel discussion. Pages 26-29 *in* (J.V. Huner, Ed.). Management of Fish-eating Birds on Fish Farms: A Symposium. National Aquaculture Association/National Audubon Society. 51pp.
- Stickley, A.R., Jr. 1990. Avian predators on southern aquaculture. U.S. Dept. Agric., Coop. Ext. Serv., Southern Reg. Aquacult. Center Publ. No. 400. 8pp.
- _____. and K.J. Andrews. 1989. Survey of Mississippi catfish farmers on means, effort, and costs to repel fish-eating birds from ponds. Proc. East. Wildl. Damage Control Conf. 4:105-108.
- _____, J.F. Glahn, J.O. King, and D.T. King. 1995a. Impact of great blue herons on channel catfish farms. J. World Aquaculture Soc. 26: 194-199. 1995.
- _____, D.F. Mott, and J.O. King. 1995b. Short-term effects of an inflatable effigy on cormorants at catfish farms. Wildl. Soc. Bull. 23:73-77.
- Trapp, J.L., T.J. Dwyer, J.J. Doggett, and J.G. Nickum. 1995. Management responsibilities and policies for cormorants: United States Fish and Wildlife Service. Pages 226-230 *in* The Double-crested Cormorant: biology, conservation and management (D.N. Nettleship and D.C. Duffy, Eds.). Colonial Waterbirds 18 (Special Publication 1).
- U.S. Department of Agriculture (USDA). 1994. Aquaculture situation and outlook. Commodity Economics Division, Economic Research Service, AQS-13, Washington, D.C. 48pp.
- Williams, T. 1992. Killer fish farms. Audubon 94:14,16,18-22.

Table 1. Depredation permits issued for the take of great blue herons in Alabama, Arkansas, Louisiana, and Mississippi; 1989 - 1993.

Year	Number of Permits Issued	Number of Birds Authorized to be Taken	Number of Birds Taken	% of Authorized Take
1989	42	1321	763	58
1990	73	2241	1358	61
1991	86	2663	1561	59
1992	86	2502	1648	66
1993	95	2732	1811	66
Total	382	11459	7141	62

Table 2. Depredation permits issued for the take of great egrets in Alabama, Arkansas, Louisiana, and Mississippi; 1989 - 1993.

Year	Number of Permits Issued	Number of Birds Authorized to be Taken	Number of Birds Taken	% of Authorized Take
1989	38	1235	433	35
1990	56	1670	739	44
1991	71	2085	989	47
1992	67	1879	956	51
1993	70	1929	1105	57
Total	302	8798	4222	48

Table 3. Depredation permits issued for the take of double-crested cormorants in Alabama, Arkansas, Louisiana, and Mississippi; 1989 - 1993.

Year	Number of Permits Issued	Number of Birds Authorized to be Taken	Number of Birds Taken	% of Authorized Take
1989	49	3093	1781	58
1990	85	6158	4189	68
1991	101	6883	3976	58
1992	102	6673	4437	66
1993	112	7753	4877	63
Total	449	30560	19260	63