

# Final Environmental Assessment

## Of a U.S. Fish and Wildlife Service Action to Issue a Migratory Bird Depredation Permit

### For the Take of Cormorants and Gulls on Lake Champlain Islands, Vermont

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May 1999

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U.S. FISH AND WILDLIFE SERVICE  
ENVIRONMENTAL ACTION MEMORANDUM

Within the spirit and intent of the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality's Regulations for Implementing NEPA, and other statutes, orders and policies that protect fish and wildlife resources, I have established the following administrative record and have determined that the action of:

issuing a migratory bird depredation permit to the Vermont Department of Fish and Wildlife for enhancing avian and plant diversity on Lake Champlain in 1999 by limiting the reproduction of double-crested cormorants and gulls via: (a) applying oil to the eggs in up to 3,000 cormorant nests on Young Island; (b) destroying up to 100 cormorant nests with eggs and 100 ring-billed gull nests with eggs on Mud Island, and 100 ring-billed gull nests with eggs on adjacent Rock Island; (c) destroying up to 200 ring-billed, herring and great black-backed gull nests with eggs, in any species combination, on Popasquash, Rock, Hen, Savage and Grammas Islands and Gull Rock; and (d) destroying up to 20 cormorant nests with eggs on Popasquash Island;

\_\_\_ is a categorical exclusion as provided by 516 DM 6, Appendix 1. No further documentation will be made.

X is found not to have significant environmental effects as determined by the attached Environmental Assessment and Finding of No Significant Impact.

\_\_\_ is found not to have special environmental conditions as described in the attached Environmental Assessment. The attached Finding of No Significant Impact will not be final nor will any actions be taken pending a 30-day period for public review (40 CFR 1501.4(d)(1)).

\_\_\_ is found to have significant environmental effects and a Notice of Intent to prepare an Environmental Impact Statement will be published in the Federal Register before the project is considered further.

\_\_\_ is environmentally unacceptable and/or contrary to Service policy on the issuance of migratory bird depredation permits and will not be implemented.

\_\_\_ is an emergency situation. Only those actions necessary to control the immediate impacts of the emergency will be taken. Other related actions remain subject to NEPA review.

1. \_\_\_\_\_  
Refuge Supervisor, North Date

2. \_\_\_\_\_  
PARD, Refuges and Wildlife Date

3. \_\_\_\_\_  
GARD, North Date

4. \_\_\_\_\_  
ES, REC Date

5. \_\_\_\_\_  
Regional Director Date

ENVIRONMENTAL ASSESSMENT OF A U.S. FISH AND WILDLIFE SERVICE ACTION  
TO ISSUE A MIGRATORY BIRD DEPREDATION PERMIT FOR THE TAKE OF CORMORANTS  
AND GULLS ON LAKE CHAMPLAIN ISLANDS, VERMONT

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Reviewed by: \_\_\_\_\_  
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Concurred by: \_\_\_\_\_

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Regional Environmental Coordinator

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Refuge Supervisor, North

Concurred by: \_\_\_\_\_

Anthony Leger Date

Assistant Regional Director, Refuges and Wildlife

Concurred by: \_\_\_\_\_

Sherry Morgan Date

Assistant Regional Director, North

Approved by: \_\_\_\_\_

Ronald Lambertson Date

Regional Director

**FINDING OF NO SIGNIFICANT IMPACT OF A U.S. FISH AND WILDLIFE SERVICE ACTION  
TO ISSUE A MIGRATORY BIRD DEPREDATION PERMIT FOR THE TAKE OF CORMORANTS AND  
GULLS  
ON LAKE CHAMPLAIN ISLANDS, VERMONT**

The U.S. Fish and Wildlife Service has proposed issuing an amendment to a migratory bird depredation permit to the Vermont Department of Fish and Wildlife for the purpose of enhancing avian and plant diversity on Lake Champlain, Vermont. The proposed amendment would authorize the VTFWD to limit the reproduction of double-crested cormorants and gulls on Lake Champlain, Vermont by: (a) applying oil to the eggs in up to 3,000 cormorant nests on Young Island, and (b) destroying up to 100 cormorant nests with eggs and 100 ring-billed gull nests with eggs on Mud Island, and 100 ring-billed gull nests with eggs on adjacent Rock Island. The current permit issued to the VTFWD authorizes: (a) the destruction of up to 200 ring-billed, herring and great black-backed gull nests with eggs, in any species combination, on Popasquash, Rock, Hen, Savage and Grammas Islands and Gull Rock; and (b) the destruction of up to 20 cormorant nests with eggs on Popasquash Island.

The USFWS received an application for a permit amendment from the VTFWD on March 19, 1999. The application requested authority to: (a) oil the eggs in all cormorant nests on Young Island, (b) lethally take by asphyxiation any chicks that hatch on Young Island, (c) test two avian contraceptives DiazaCon and Nicarbazin on an unspecified number of cormorants on Young Island, and (d) destroy any cormorant or ring-billed gull nests, including eggs, and lethally take an unspecified number of adult cormorants by shooting on 10 State-owned islands. The USFWS has analyzed alternatives to the proposed action including authorizing all activities requested by the VTFWD, and denying the amendment request in its entirety.

The need for action stems from adverse impacts on other nesting birds and their habitat, and plant diversity, due to the high population of double-crested cormorants on Lake Champlain. Current numbers and distribution of cormorants in the Great Lakes population exceed historic levels; however, the lack of Federal or State protection until 1972, coupled with the damaging impacts of DDT until that same year and the overall degradation and loss of aquatic habitats, could have extensively reduced the range of cormorants before ornithologists kept records. Cormorant populations are now rebounding, due to government protection and the expansion of the catfish industry in the southern U.S. and ample fish stocks in the Great Lakes.

Cormorants first nested on Lake Champlain on Young Island in 1982, and in 1984, they expanded to the Four Brothers Islands, New York. These two colonies continue as the primary nesting sites for cormorants on the lake. In Vermont, in 1994, cormorants expanded to Mud Island, and in 1996 further expanded to three more sites. The total nest count in 1998 was approximately 4,138 nests on four islands, an increase of 43 percent from 1997.

Recent expansion of cormorant nesting to new islands in Lake Champlain could negatively impact habitat for other birds, and plant diversity on the nesting islands. Active management of the cormorant colony on Young Island would help to prevent the expansion of cormorants to other sites, and would maintain or slightly reduce the overall Lake Champlain cormorant population.

Reasons for selection of the proposed action:

- (1) The oiling of cormorant eggs on Young Island should reduce recruitment into the Lake Champlain population and slow the expansion of cormorants to new nesting sites. Tree-nesting herons and egrets at these sites, if any, would avoid displacement by cormorants. Vegetation at these sites would also avoid destruction by nesting cormorants.
- (2) Recruitment from Young Island to other established cormorant colonies should also subside due to egg-oiling, which could negate the need for the continued control of cormorants at these sites. On Popasquash Island, these reductions would reduce interspecific competition with common terns, a State-endangered species in Vermont.
- (3) The necessity of lethally taking cormorant chicks has not been adequately justified for reducing cormorant impacts to other birds and would not be authorized. The use of avian contraceptives on cormorants would not be authorized because these activities would be conducted by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services under experimental permits issued to that agency.
- (4) Authority would not be issued to oil ring-billed gull eggs on Young Island because the nesting population is unlikely to reach 8,000 pairs, which is the management objective of the VDFW.
- (5) The destruction of cormorant and ring-billed gull nests, including any eggs, would be authorized for Mud and adjacent Rock Island for the purpose of reducing damage to vegetation at these sites. Authority to lethally take adult cormorants on Mud Island would not be authorized because harassment in conjunction with egg-oiling is a less intrusive and effective technique. Similar authorities would not be issued for the other 8 State-owned islands because they do not have a history of use by these species.
- (6) Non-lethal management techniques on Young and Popasquash Islands would likely cause disruption to other nesting species, and the USFWS is therefore not requiring the VTFWD to use these as a precursor or supplement to egg-oiling and nest/egg destruction. Pyrotechnics in particular would frighten non-target species sharing islands with cormorants, and could result in abandonment by gulls and common terns. This could have significant impacts particularly to common terns, which nested only on Popasquash Island in 1998. Abandonment by cormorants from Young Island could also lead to their colonization of other islands. Exclusion and habitat alteration within current cormorant nesting areas could lower cormorant numbers on any of the nesting islands, but due to the similarity in habitat selection among the species, competition for any remaining space would be increased. Because cormorants return to their colonies before terns, this would negatively impact common terns more than cormorants.

Should the VTFWD apply for permit renewal in 2000 and beyond, the continued oiling of cormorant eggs on Young Island through at least 2001 could lead to slight declines in the Lake Champlain population through 2004. The number of new colonies in the area would also likely subside. In 1998, approximately 64 percent of cormorants nesting on islands in Lake Champlain occurred on the islands proposed for control under this EA. Assuming a lakewide increase of 21 to 43 percent, based on 1998 nest counts (4,138) the total number of active nests on Lake Champlain is expected to be 5,000 to 6,000 in 1999. Therefore, approximately 2,000 pairs would be expected to produce young in 1999. Given that productivity averages about 2.5 young per pair, approximately 5,000 cormorant chicks could fledge from the lake in 1999 under this proposed action. This take would not have a significant environmental effect because the total Lake Champlain cormorant population size would decline only slightly. The effects to the Great Lakes population are insignificant.

Based on a review and evaluation of the attached Environmental Assessment entitled A U.S. Fish and Wildlife Service Action to Issue a Migratory Bird Depredation Permit for the Take of Cormorants and Gulls on Lake Champlain Islands, Vermont, I have determined that the oiling or destruction of cormorant eggs on three islands and the destruction of ring-billed gull eggs on two islands does not constitute a major Federal Action which would significantly affect the quality of the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. Therefore, the preparation of an Environmental Impact Statement is not required.

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Regional Director Date  
U.S. Fish and Wildlife Service  
Hadley, Massachusetts

## PREFACE TO THE FINAL ENVIRONMENTAL ASSESSMENT

This preface is intended to facilitate public review of the final EA. The preface contains a description of significant changes incorporated in the final document and a summary of the proposed action.

### Changes from the Draft Environmental Assessment

Since the close of the public comment period on the draft EA, which extended from April 14, 1999 to April 29, 1999, the U.S. Fish and Wildlife Service has re-evaluated its proposed action in light of public comments received. (See Appendices E and F for a summary of public comments and USFWS responses.) Changes reflected in this document include:

Clarification of the permit expiration date, February 29, 2000.

Clarification of monitoring requirements of the impacts of oiling cormorant eggs on Young Island to cormorants and gulls.

Addition of information on the expected impacts of the oiling of cormorant eggs on Young Island to nesting cormorants and ring-billed gulls.

Addition of information on the impacts of each alternative to aesthetics and to person most likely affected by the proposed action landowners, birdwatchers, anglers, and those concerned with animal welfare.

### Summary of the Proposed Action

The proposed action is to issue a depredation permit to the VDFW for the oiling of eggs in up to 3,000 cormorant nests on Young Island in 1999, using mineral or vegetable oil. Oiling could be done as often as necessary from early May through late July to prevent the hatching of chicks.

Activities that would not be authorized include the euthanization of chicks, because insufficient information was provided supporting this request. In particular, the projected number of chicks expected to hatch is not specified, and the damage imposed by this unspecified number of chicks to avian and plant diversity is not quantified, other than identifying that these birds would recruit into the lakewide population. Further, the USFWS authorizes the take of migratory bird chicks only for emergency safety purposes, and often requires that these chicks must be transferred to permitted Federal avian rehabilitators for rearing and subsequent release to the wild.

The requested activity to use reproductive inhibitors would not be authorized by the permit. Neither DiazCon nor Nicarbazin is registered for use on cormorants. The compounds could, however, be tested in the future by the USDA/WS with proper experimental permits (USDA

1999). Because these experimental permits would be sought by the USDA/WS, and the compounds would be administered by personnel from that agency, the activities would be done under that agency's jurisdiction, and would not need USFWS permit approval.

The request to oil ring-billed gull eggs on Young Island would not be approved under the proposed action. Insufficient information exists documenting that the number of ring-billed gull nests exceeds or is likely to exceed 8,000, which is the VDFW's objective for the island. The VDFW may submit an amendment request for this activity once the nesting population has been verified to be over 8,000 pairs in 1999, and subsequent permit decisions would be expedited and based on this EA.

Likewise, authorities to destroy cormorant and ring-billed gull nests, including any eggs, on Burton, Button, Knight, Mosquito, Shin, Sloop, and Woods Islands and the Lamoille River Delta would not be granted at this time, because neither species has historically nested on these islands, and the likelihood of colonization appears minimal. Further, threats to avian and plant diversity have not been identified for these islands in the VDFW permit application. The VDFW may submit an amendment request to take cormorant and ring-billed gull nests once the species have been documented as loafing or nesting on these islands, and that harassment during the pair-bonding and nest-building stages has largely failed.

The lethal removal of adult cormorants by shooting would not be authorized for these islands. Harassment, in combination with nest destruction, has been shown to be a successful deterrent to cormorant colonization on Lake Champlain and elsewhere and, if used, would likely eliminate any need for lethal removal.

Authority to destroy cormorant and ring-billed gull nests and eggs would, however, be granted on islands with a known history of nesting by these species. On Mud Island, the permit would authorize the destruction of up to 100 cormorant and 100 ring-billed gull nests, and the destruction of up to 100 ring-billed gull nests on adjacent Rock Island. These numbers would include any renests. Given that threats to avian and plant diversity are not identified for these two islands, the VDFW's primary concern is to maintain the islands free from cormorants and gulls to limit the further expansion of their lakewide populations. This authority would be conditioned that harassment must be used during the pair-bonding and nest-building stages. The lethal removal of adult cormorants would not be authorized for Mud Island because harassment and nest or egg destruction should be sufficient.

The permit would require a report of the following: (a) an estimate of the number of breeding pairs in 1999 for each colonial waterbird species on the 17 islands covered by this EA; (b) the number of cormorant, ring-billed, herring or great black-backed gull nests either destroyed or treated by egg-oiling for each island, by date of treatment, including any taken by USDA/WS; (c) an estimate of the number of cormorant chicks that hatch on Young Island; (d) a description of the non-lethal management techniques used on these islands, and the efficacy of each; and (e) information on the movement of colonial waterbirds to any new sites within Lake Champlain, Vermont.

In addition, a detailed description of the impacts to target and non-target species resulting from the presence of persons treating eggs on Young Island, for each visit must be reported. This would include: (a) a description of the behavioral response of cormorants and ring-billed gulls to each visit on each island, including an estimate of the number of birds flushed, the distance at which they flushed, and the average time elapsed before the birds return to their nest sites; and (b) an estimate of the number of eggs or chicks by species that are pirated on Young Island by ring-billed gulls, and an estimate of productivity for this species. All reporting would be due by the permit expiration date, February 29, 2000.

For permit renewal, the VDFW must provide a status assessment of colonial waterbirds on Lake Champlain, Vermont, including management objectives for these species. The VDFW must also submit a status assessment of waterfowl on Lake Champlain, Vermont, including management objectives for these species, if their permit request again incorporates objectives for waterfowl.

## I. INTRODUCTION

This Environmental Assessment (EA) was prepared by the U.S. Department of the Interior, Fish and Wildlife Service (USFWS) in accordance with the National Environmental Policy Act of 1969 (NEPA). This EA considers the environmental consequences of the issuance of a migratory bird depredation permit requested by the State of Vermont, Department of Fish and Wildlife (VDFW) to protect avian and plant communities on islands in Lake Champlain from impacts due to double-crested cormorants (*Phalacrocorax auritus*) and ring-billed gulls (*Larus delawarensis*).

On March 19, 1999, the VDFW submitted an application for a migratory bird depredation permit to take a combination of double-crested cormorant and ring-billed gull nests, eggs, and individuals (Appendix A). Since 1990, the VDFW has submitted applications for a depredation permit to take gull and cormorant nests with eggs on Lake Champlain, Vermont, and the USFWS has issued an annual permit (MB-751275). (See Appendix B for permit history.) These permits were issued in compliance with NEPA as categorical exclusions in accordance with USFWS 516 DM 6, Appendix 1, Section 1.4(c)(1), after we had determined that these annual permits caused no, or negligible, environmental disturbances.

In addition to the permit issued to VDFW, one other permit has been issued to the private landowner of an island in Lake Champlain for the take of cormorant nests, eggs, and individuals. Also, until 1997, the U.S. Department of Agriculture/Animal and Plant Health Inspection Service/Wildlife Services (USDA/WS, formerly Animal Damage Control) held a permit in every State, including Vermont, authorizing the unlimited take of nongame migratory birds, including cormorants and gulls, for the purpose of resolving a variety of damages. However, since 1997, under a decision from the U.S. Department of Justice, Federal agencies are no longer required to obtain permits from the USFWS under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), for activities performed as part of their official duties.

We have determined that the application received on March 19, 1999, may result in environmental impacts and that the preparation of an EA is warranted. Because this application is an expansion of activities pertaining to ongoing cormorant and gull management on Lake Champlain by the VDFW, we are treating this request as an amendment to their current permit, issued on March 22, 1999, which was categorically excluded due to insignificant impacts. However, because the amendment request will cumulatively add to the original, categorically excluded authorities, this EA will address both the original permit request, received on March 5, 1999, and the amendment request received on March 19, 1999.

The USDA/WS has also prepared an EA regarding their proposed actions to implement cormorant and gull population control on Lake Champlain (USDA 1999). These proposed actions are reflected in part in the application submitted by the VDFW, but the USDA/WS also proposes to conduct management activities under their own jurisdiction on some privately owned islands, which is outside the scope of USFWS action and this EA. The VDFW assisted the USDA/WS in writing their EA, and used it as a public outreach document by direct mail to a variety of Vermont organizations and agencies, during a series of public meetings, and by making it available at public libraries and on the Internet. Written comments were sought through all venues.

Because the USFWS is a cooperating agency in these proposed actions through our issuance of a Federal permit, we can adopt all or a portion of the USDA/WS EA for USFWS actions. This EA incorporates the analyses in the USDA/WS EA, including the considerable amount of public comment that has been gathered, analyzed and responded to through the USDA/WS EA process.

The USFWS has Federal responsibility for the administration of the Migratory Bird Treaty Act. The MBTA protects all species of migratory birds by prohibiting the take and subsequent use of birds, including parts, nests, and eggs, except as allowed under regulation. Section 704 of the Act provides for the Secretary of the Interior to adopt regulations permitting the take of migratory birds, or any part, nest, or egg thereof, for purposes and means that are compatible with the terms of the Act's four underlying conventions. These conventions are between the U.S. and Great Britain (on behalf of Canada) in 1916; the U.S. and the United Mexican States in 1936, as amended in 1972; the U.S. and the Government of Japan in 1972; and the U.S. and the Union of

Soviet Socialist Republics in 1976. Ring-billed gulls first came under Federal protection in 1916 via the convention with Great Britain, and double-crested cormorants in 1972 via the amendment to the convention with the United Mexican States.

Under Title 50, Code of Federal Regulations, Section 21.41, the USFWS may issue permits to take migratory birds, nests, or eggs for depredation control purposes. Such permits are issued by the Regional Director responsible for the affected area. The specifics of Section 21.41 are:

(a) Permit requirements. Except as provided in 21.42 through 21.46, a depredation permit is required before any person may take, possess, or transport migratory birds for depredation control purposes. No permit is required merely to scare or herd depredating migratory birds other than endangered or threatened species or bald or golden eagles.

(b) Applicant procedures. Applications for depredation permits shall be submitted to the appropriate Special Agent in Charge (see 13.11(b) of this subchapter). Each such application must contain the general information and certification required by 13.12(a) of this subchapter plus the following additional information:

- (1) A description of the area where depredations are occurring;
- (2) The nature of the crops or other interests being injured;
- (3) The extent of such injury; and
- (4) The particular species of migratory birds committing the injury.

(c) Additional permit conditions. In addition to the general conditions set forth in part 13 of this subchapter B, depredation permits shall be subject to requirements in this section:

- (1) Permittees may not kill migratory birds unless specifically authorized on the permit.
- (2) Unless otherwise specifically authorized, when permittees are authorized to kill migratory birds they may do so only with a shotgun not larger than No. 10 gauge fired from the shoulder, and only on or over the threatened area or areas described on the permit.
- (3) Permittees may not use blinds, pits, or other means of concealment, decoys, duck calls, or other devices to lure or entice birds within gun range.
- (4) All migratory birds killed shall be retrieved by the permittee and turned over to a Bureau representative or his designee for disposition to charitable or other worthy institutions for use as food, or otherwise disposed of as provided by law.
- (5) Only persons named on the permit are authorized to act as agents of the permittee under authority of the permit.

(d) Tenure of permits. The tenure of depredation permits shall be limited to the dates which appear on its face, but in no case shall be longer than one year.

Under the migratory bird depredation regulation, the USFWS issues permits to resolve documented and justified needs for the lethal removal of migratory birds, including nests and eggs. Upon receipt of an application for a depredation permit, our administrative procedure is to determine: (a) if the identified need is documented, (b) whether USFWS policy supports the issuance of permits for these needs, (c) if adequate non-lethal management methods have been attempted, (d) if the request for take is supported by a recommendation from the USDA/WS, and (e) whether the proposed take has a reasonable chance of resolving the need immediately or within a few years.

When migratory birds compete or otherwise cause damage to other wildlife, we authorize the

lethal take of birds, including nests and eggs, only when endangered, threatened, or species of conservation concern are impacted. Game species also may be considered if they are currently listed as endangered or threatened, or are the subject of a comprehensive restoration effort or recovery plan (USFWS 1999). However, wildlife managers can use any form of non-lethal harassment or habitat management to reduce impacts to any wildlife species without a permit from the USFWS in accordance with 50 CFR 21.41(a) as the first means to help prevent declines of other species.

On March 22 and April 8, 1999, the USDA/WS submitted ADC Forms 37 outlining the recommended authorities for the VDFW's requested permit for expanded cormorant and gull management on Lake Champlain, Vermont (Appendix C). This Federal form is submitted by the USDA/WS to the USFWS as a supplement to each permit application, as agreed in the Final Report of the USDA/WS and USFWS Joint Migratory Bird Working Group in 1990 (USDA and USFWS 1990). In addition to recommending permit authorities, the USDA/WS may assist the VDFW with these activities by conducting part or all of the work. Although the USDA/WS could conduct any activity involving the take of a migratory bird under their own authorities, and without a permit from the USFWS, the VDFW submitted a permit application so that they would have the authority to conduct all or part of the work in addition to USDA/WS. Through its responsibilities under the MBTA, the USFWS must determine whether to issue a depredation permit for the VDFW's proposed activities and, if so, with what terms and conditions.

## II. PURPOSE AND NEED FOR ACTION

### A. Description of Requested Action by the State of Vermont

The VDFW seeks an amendment to their current USFWS permit that would authorize the take of double-crested cormorants and ring-billed gulls (birds, eggs, and/or nests) for the purpose of enhancing and maintaining avian and plant diversity on State-owned islands in Lake Champlain. Populations of cormorants and ring-billed gulls have increased significantly in recent years on Lake Champlain from their original colonization of the Four Brothers Islands, New York, and Young Island (also known as South Sister Island), Vermont (Figure 1).

Depredation permits issued to the VDFW since 1990 have authorized the limited take of nests and eggs of both species as they have expanded to other Vermont islands from these original colonies, for the purpose of reducing competition for nesting space with common terns (*Sterna hirundo*) (Appendix B). Common terns are listed as endangered by the State of Vermont, and are a migratory nongame species of management concern in the U.S. (French and Pence 1996, USFWS 1995). The suppression of gull and cormorant nests on islands with active tern colonies is listed as a strategy for achieving the State's common tern recovery plan goals (LaBarr 1996). Common terns have nested on up to six islands in Lake Champlain in recent years, all in Vermont, and we have authorized the take of gull nests on Popasquash, Rock, and Hen Islands and Gull Rock since 1990, and on Savage and Grammas Islands since 1995 (Figure 1). The location for taking cormorant nests has been authorized for Popasquash Island since 1996. Since 1994, a limited taking of herring gull (*Larus argentatus*) and great black-backed gull (*L. marinus*) nests have also been authorized; the number taken each year has been limited to a maximum 200 nests of all gull species combined.

The VDFW is currently seeking additional authorities to limit cormorant and ring-billed gull nesting at the primary Vermont colony on Young Island, in order to (1) enhance avian and plant diversity on this island, and (2) limit the number of cormorants and gulls that are recruited into the lakewide population through successful reproduction. The VDFW intends to manage Young Island as a waterbird nesting colony for additional species such as common terns and waterfowl. Specifically, the VDFW seeks to oil the eggs in all cormorant nests, which numbered 2,597 in 1998. The spraying of mineral or vegetable oil prevents gaseous exchanges across the shell, resulting in the death of embryos by asphyxiation. As a result, the adults continue to incubate the eggs and do not recycle and lay new clutches. They also do not typically abandon the colony and attempt to nest elsewhere.

The VDFW also seeks to lethally take by asphyxiation (with carbon dioxide canisters) any chicks that hatch to prevent their recruitment into the population. The VDFW also wants to test two

avian contraceptives DiazaCon and Nicarbazin on an unspecified number of cormorants. Proposed actions that do not require Federal permit approval include placing exclusion devices, in accordance with 50 CFR 21.41(a).

The VDFW is also seeking authority to destroy cormorant and ring-billed gull nests and eggs if the birds colonize any additional State-owned islands, and to lethally take an unspecified number of adult cormorants on these islands by shooting. The requested locations for these additional activities in Vermont are Burton, Button, Knight, Mosquito, Mud, Rock, Shin, Sloop, and Woods Islands, and the Lamoille River Delta (Figure 1). Proposed actions on these islands that do not require Federal permit approval include harassment.

The ADC Forms 37 submitted by the USDA/WS support the activities requested by the VDFW (Appendix C). However, the USDA/WS is not planning to use avian contraceptives in 1999, and because experimental permits could be issued only to that agency, the VDFW cannot implement this activity in 1999.

## B. Double-crested Cormorant Population Status

(1) General Biology. Double-crested cormorants are a long-lived species (maximum 15+ years) with a relatively high reproductive rate compared to other colonial waterbirds (Duffy 1995). By age 2 or 3, they return to breed at or near their natal colony, unless nesting space is unavailable, and continue to use that site in successive years. Double-crested cormorants typically lay 3 to 4 eggs (range 2 to 7) and fledge 2 to 3 chicks per pair. Cormorants are opportunistic feeders on fish, catching their prey by underwater diving, and generally take those that are most readily available without regard to species. Because of their diet, cormorants have a long history of conflict with fishermen, who have anecdotally blamed cormorants for declines in fish stocks. Despite their ability to readily adapt to different habitats and foods, they are among the colonial waterbirds more sensitive to human disturbance during breeding.

(2) North American Population. The North American breeding population of double-crested cormorants was recently estimated at 360,000 pairs (Hatch 1995). Using values derived from the published literature of 1 to 4 nonbreeding birds for each breeding pair yields an estimated total population of about 1 to 2 million birds (Hatch 1995).

The double-crested cormorant breeds widely throughout much of coastal and interior North America, and is one of six cormorant species breeding on the continent. As of 1992, it had been found breeding in 40 States in the U.S., all 10 Canadian Provinces, and in Mexico, Cuba, and the Bahamas (Hatch 1995). However, the species is not uniformly distributed across this broad area and breeds in six relatively discrete populations comprising four subspecies. Sixty-one percent of the breeding birds belong to the Interior population, while another 26 percent belong to the Northeast Atlantic Coast population, both comprised in the subspecies *auritus*. Two major areas of concentration are apparent in the vast range of the Interior population: (1) the prairie lakes of Alberta, Manitoba, and Saskatchewan (which account for 69 percent of the Interior population); and (2) the U.S. and Canadian Great Lakes (accounting for another 12 percent). The large Interior and Northeast Atlantic populations overlap extensively in their winter range from coastal Texas to North Carolina.

The double-crested cormorant has always been widely distributed as a breeding species. During the 20th century, the species expanded into the U.S. and Canadian Great Lakes from the Canadian prairies, beginning with Lake Superior about 1913 and ending with Lakes Erie and Ontario in the late 1930's (Weseloh, et al. 1995). Cormorants were first sighted on Lake Champlain in 1933 (Kibbe and Laughlin 1985), thereby suggesting that this population continued to expand its range eastward. It is possible that these range expansions represent recolonization of former (but previously undocumented) breeding localities from which the species was extirpated before 1912.

Our knowledge of double-crested cormorant population trends before 1959 is based on fragmented and largely anecdotal accounts from scattered portions of the range. Syntheses of much of this information (Hatch 1995, Weseloh, et al. 1995, and Jackson and Jackson 1995) reveal the following general patterns: (a) by 1900, cormorant numbers had been reduced, and

their range possibly restricted, by human persecution and the extensive drainage and degradation of natural wetlands; (b) the widespread construction of reservoirs and impoundments (beginning in the 1920's), in concert with sport fish stocking programs and the creation of refuges and other conservation lands (beginning in the 1930's), had beneficial effects on cormorant numbers; (c) the widespread use of DDT and other pesticides (beginning in the 1940's) had devastating effects on cormorant reproductive success, with the result that populations reached their lowest point in the mid-1970's; and (d) the ban on DDT in 1972 in the U.S. and the general decrease in levels of environmental contaminants, in concert with Federal protection under the MBTA and development of the channel catfish (*Ictalurus punctatus*) industry in the southern U.S. in the mid-1970's, created a favorable environment for the growth of cormorant populations.

Quantitative information on double-crested cormorant population trends is available from three sources: (a) Breeding Bird Survey data (1966-1996), (b) Christmas Bird Count data (1959-1988), and (c) published accounts of censuses of breeding colonies. Trends from these sources generally parallel each other, and are discussed in the following paragraphs:

(a) Between 1966 and 1994, the continental breeding population increased at an estimated rate of 6.1 percent/year (Sauer, et al. 1996a). The very high rate of growth in the early years (13.0 percent/year), and to a lesser extent for the entire period, is partly an artifact of the extremely small population in the early years of the survey period (late 1960's and early 1970's). Compared to the earlier (1966-1979) time period, the growth of the continental and Canadian populations appears to have slowed appreciably in the later (1980-1994) period; however, the U.S. population has continued to show a significant rate of increase in the 1980's and 1990's, apparently due primarily to the continued rapid growth of populations in the Mountains and Plains States. The only significant declines noted were in the west coast region (1966-1994) and in North Dakota (1980-1994), although the west coast trend appears to be contradicted by rather dramatic site-specific increases in British Columbia, Washington, and California (Carter, et al. 1995). Most of the recent increases in numbers have occurred within the known historical breeding range (Hatch 1995).

(b) Between 1959 and 1988, the continental wintering population increased at an average rate of 7.3 percent/year (Sauer, et al. 1996b); significant increases were registered for 17 of the 20 States or Provinces for which data were available. Trends are available for 9 of the primary catfish-producing States; six of these (Alabama, Louisiana, Mississippi, Oklahoma, Texas and Virginia) have trends (median 16 percent, range 12 to 19 percent) that are well above the continental average. Most of the localities in the mid-South for which information is available show dramatic population increases between the mid-1970's and the early 1990's, with the trends paralleling a similar magnitude of growth in the area of catfish ponds in the region during the same period (Jackson and Jackson 1995).

(c) Rather dramatic increases in breeding pairs are documented at colonies in the Great Lakes (Weseloh, et al. 1995), the St. Lawrence River and associated waters (Chapdelaine and B, dard 1995), New England (Krohn, et al. 1995), the west coast (Carter, et al. 1995), and elsewhere (Weseloh, et al. 1995).

(3) Great Lakes Population. Censuses of all Great Lakes double-crested cormorant colonies in U.S. waters were conducted in 1977 (Scharf 1978), 1989-1990 (Scharf and Shugart 1998), and 1997 (F. Cuthbert, pers. comm.). Census locations in 1977 and 1989-1990 included Lakes Superior, Michigan, Huron, Ontario, and Erie, and the St. Mary's River, Lake Saint Claire, and the St. Lawrence, Detroit, and Niagara Rivers. In 1997, Oneida Lake in central New York and Lake Champlain were added to the census. In 1977, 171 cormorant nests were found in four colonies; in 1989-1990, 11,099 nests were found in 36 colonies; and in 1997, observers found 48,931 nests in 69 colonies. Data from the 1989-1990 census indicated that the median colony size in the upper Great Lakes (Lakes Superior, Michigan, and Huron) was 83 nests (range 8 to 1,156) and the mean was 201 nests ( $\bar{n}$ 281.4 SD) (Scharf and Shugart 1998). Colonies can be larger, as in the lower Great Lakes (Erie and Ontario, including the St. Lawrence River to Massena, New York), where Little Galloo Island, Lake Ontario, New York, totaled 4,072 nests in 1989-90, and currently remains the largest cormorant colony in the Great Lakes (from a peak of 8,410 nests in 1994 to 5,839 nests in 1998) (NYSDEC 1999).

In the Canadian Great Lakes, similar trends over the same census periods have been documented (Blokpoel and Tessier 1996). In the lower Great Lakes, cormorants increased from 57 nests in one colony in 1976-77, to 4,701 nests in 12 colonies in 1990. In 1997, 36,386 nests were counted in 90 colonies (C. Weseloh, pers. comm.).

In total, the U.S. and Canadian Great Lakes cormorant population in 1990 approximated 15,800 pairs in 48 colonies, and in 1997 approximated 85,317 pairs in 159 colonies, which equates to a 27 percent average annual growth rate. The estimated total population in 1997 was 250,000 to 500,000 birds.

(4) Northeast Atlantic Coast Population. Double-crested cormorants (subspecies *auritus*) nest along the Atlantic coast as far north as Newfoundland, and also nest with great cormorants (*Phalacrocorax carbo*) as far south as Massachusetts. This coastal population of double-crested cormorants is documented in the archeological record as far south as Boston, Massachusetts, but by the late 19th century, the subspecies had disappeared as a breeder from New England, and was greatly reduced in Atlantic Canada due to direct human persecution and the intense use of islands for farming (Hatch 1995). Cormorants had returned to Massachusetts by 1937; they reached New Jersey by 1987, and they now breed as far south as Maryland.

Colonial waterbird censuses conducted along the U.S. Atlantic coast in 1977 (Erwin and Korschgen 1979), 1984-1985 (USFWS 1990) and 1996-1997 (USGS, unpubl. data) indicate that the coastal double-crested cormorant population has stabilized after a period of rapid growth in the 1980's. The number of nests counted was 17,182 in 1977, and increased to 34,202 in 1984-1985, and 34,090 nests in 1996-1997. In 1977, 87 percent of the breeding population, and 103 of 116 colonies (89 percent), were located in Maine; in 1984-1985, 84 percent of the population, and 121 of 144 colonies (84 percent) were in Maine; and in 1996-1997, 59 percent of breeders, and 133 of 176 colonies (76 percent) were in Maine, indicating a shift in population toward the south in both numbers of individuals and colonies. Including nonbreeders, the total U.S. Northeast Atlantic coast population may have numbered between 100,000 and 200,000 birds in the late 1990's. The breeding population for both the U.S. and Canada was estimated at 96,000 pairs in the mid-1990's (Hatch 1995), suggesting a total population of 290,000 to 580,000 cormorants in the Northeast Atlantic coast population.

(5) Lake Champlain Population. Cormorants first nested on Lake Champlain in 1982 when one nest was found on Young Island, Vermont, followed by 34 nests in 1983 (Kibbe and Laughlin 1985). In 1984, cormorants were also found nesting on the Four Brothers Islands, New York. In Vermont in 1994, cormorants expanded nesting to Mud Island (fewer than 37 nests), and in 1996 they further expanded to Bixby Island (North Sister Island) (180 nests), Shad Island (25 nests), and Popasquash Island (2 nests) (USDA 1999). (See Figure 1.)

By 1998, the cormorant population on Young Island had grown to 2,597 nests (from 1,866 in 1997) (Figure 2), on the Four Brothers Islands to 1,499 nests, on Shad Island to 32 nests, and to an unidentified number on Bixby Island (USDA 1999). In 1998, cormorants did not return to nest on Popasquash or Mud Island. The total nest count on Lake Champlain in 1998 was approximately 4,138 nests on four islands, an increase of 43 percent from 1997. Trends on Young Island were similar (increase of 39 percent from 1997). Assuming that all surviving juveniles that fledged from the lake returned in each successive breeding season, the summer population on the lake would approximate 12,500 to 25,000 birds. Population modeling predicts a lakewide breeding population of 7,100 pairs by the year 2000, based on an average annual rate increase of 21 percent (Fowle 1997). The current carrying capacity of the lake for cormorants is unknown.

### C. Ring-billed Gull Population Status

(1) General Biology. Ring-billed gulls are a long-lived species (maximum 20+ years) with low rates of mortality similar to other colonial waterbirds. Most ring-bills begin breeding at

age 3, although they are physiologically capable at age 2, and they return to breed at or near their natal colony unless nesting space is limited. They typically lay 3 eggs and fledge 2 chicks per pair. Ring-billed gulls are opportunistic feeders on fish, insects, earthworms, rodents, grains, and human refuse, and feed mainly by walking on land or plunging on the surface of water (Ryder 1993). Ring-bills also pirate a variety of avian species, including their own, by cannibalizing chicks or feeding on eggs.

(2) North American Population. Ring-billed gulls occur throughout much of coastal and interior North America. The species breeds in colonies throughout southern Canada and the northern U.S. in freshwater environments, and migrates south to the Atlantic and Pacific coasts and the Gulf of Mexico. Unlike cormorants, the species does not breed in distinct populations, and there are no subspecies (Ryder 1993). In 1990, the North American population of ring-billed gulls was estimated at 3 to 4 million individuals. Although widely distributed, almost 80 percent of the breeding population occurs in the Great Lakes.

(3) Great Lakes Population. Ring-billed gulls recolonized the Great Lakes in the 1920's following Federal protection under the MBTA, which ended a period of significant human persecution in the 1800's. Between 1967 and 1976, the population increased at an average annual rate of 7.9 percent, and from 1976 to 1984, the average increase was 11 percent (Ryder 1993). This rapid rate of growth is attributed to the introduction and spread of rainbow smelt (*Osmerus mordax*) in 1922 and alewives (*Alosa pseudoharengus*) in 1950, and the creation of nesting islands during low water cycles in the early 1960's (Ludwig 1974). The rate of dispersal into new breeding areas intensified in the early 1970's as rising Great Lakes water levels inundated previously available colony sites. The availability of food at urban landfills is widely attributed as a factor contributing to population growth, although population-level impacts are unknown.

In 1989-1990, the Great Lakes population numbered approximately 564,000 pairs, with approximately 284,000 nests at 70 colonies in the U.S. (Scharf and Shugart 1998), and approximately 280,000 nests at 34 colonies in Canada (Blokpoel and Tessier 1996). The median colony size in the upper U.S. Great Lakes was 687 nests (range 8 to 21,387) and the mean was 3,077 ( $\bar{n}$  4,816 SD). In the lower U.S. Great Lakes, the median colony size was 1,644 nests (range 10 to 84,230) and the mean was 7,110 nests ( $\bar{n}$  20,078 SD) (Scharf and Shugart 1998). The rate of population growth from 1977-1990 throughout the Great Lakes was between 11 and 15 percent per year, and the number of colonies increased by approximately 4 percent per year. Data from the 1997-99 U.S. and Canadian censuses are not yet available, therefore recent trends are unknown.

Ring-billed gulls have learned to thrive in the human landscape. Many gulls have become urbanized in that they feed, nest and rest in or near urban and suburban areas. All of the large ring-billed gull colonies occur on either man-made islands or fenced industrial sites, with the exception of Little Galloo Island, New York, which is a natural island and holds the largest ring-billed gull colony in the world (Blokpoel and Tessier 1996), numbering approximately 53,000

pairs. Many smaller colonies (up to 1,000 pairs) now nest on the flat rooftops of industrial buildings in the Northeast (R. Chipman, pers. comm.).

(4) Lake Champlain Population. Ring-billed gulls were first recorded in 1949 as breeding in Lake Champlain on the Four Brothers Islands, New York. These birds may have originated from expanding populations on Lake Ontario or the St. Lawrence River (Ellison 1985). By 1951, the species was found breeding on Young Island, Vermont. Both primary colonies continued to grow steadily into the 1980's, with 17,347 nests on the Four Brothers Islands in 1983, and 12,995 nests on Young Island in 1989 (Fowle 1997, Daniel 1989). (See Figure 2.) By 1997, the number of nests had fallen to 15,033 on the Four Brothers Islands and 7,576 on Young Island. Nest count information is not available for the Four Brothers Islands in 1998, but the Young Island nest count that year was 7,593, indicating a relatively stable population.

In addition to the two primary ring-billed gull colonies on Lake Champlain, four other locations have also been colonized, all in Vermont. Popasquash Island was colonized in 1956 by two breeding pairs, and has since been used by approximately 300 pairs each year (Jay 1986). Rock Island, St. Albans, was colonized by ring-bills in 1987 with 107 nests, and has since fluctuated between 0 and 108 nests (LaBarr 1996). In 1995, 976 nests were found on Mud Island, Panton, and adjacent Rock Island was also colonized until 1997, but both are no longer active due to the success of control programs conducted by the USDA/WS (USDA 1999). The approximate breeding population on Lake Champlain was 23,000 pairs in 1997.

#### D. Interactions Between Cormorants, Gulls and other Avian Species

Double-crested cormorants nest in association with many other colonial waterbird species throughout their range. In the Great Lakes these include snowy egret (*Egretta thula*), cattle egret (*Bubulcus ibis*), great egret (*Ardea alba*), black-crowned night-heron (*Nycticorax nycticorax*), great blue heron (*Ardea herodias*), Caspian tern (*Sterna caspia*), common tern, herring gull, ring-billed gull, and great black-backed gull. Cormorants readily establish themselves on sites already occupied by these other species, most often by building nests adjacent to active colonies. Gradually they can expand and build new nests amidst other species, particularly tree-nesters. Some observers have also noted cormorants directly occupying nests of other species (Meritt 1996).

Several records throughout the U.S. in Audubon Field-Notes, American Birds, and Field Notes indicate that cormorants can displace nesting herons and egrets. In the Northeast, black-crowned night-herons mostly abandoned Little Galloo Island in the 1990's, approximately 20 years after the arrival of cormorants in 1974. Since abandonment, black-crowned night-herons have nested on three smaller, nearby islands, although the population status of herons on these islands was unknown before this time. On Young Island, black-crowned night-herons, cattle egrets and snowy egrets abandoned the island after cormorants began nesting in trees used by these species. Even though the herons and egrets have been displaced from these original islands, the impacts on local and regional populations have not been assessed and are unknown.

Cormorants also nest in colonies used by the larger great blue heron. In Quebec, cormorants have been observed to use old nests of great blue herons, and may even take over active heron nests if the occupants spend too much time away or the eggs are depredated by other species (Alvo 1996). As trees die of the accumulation of cormorant feces, and branches fall, the heron nests are often destroyed because they build their nests out in the branches. Cormorants, however, place their nests close to the trunk and can continue to nest in the dead trees for years after the herons are gone. In this way heronries are often transformed into cormorant colonies over the years (Alvo 1996). However, the local and regional impact of displacement of herons at these sites is not known. Other mixed great blue heron and cormorant colonies, such as West Sister Island in Lake Erie and Shad Island in Lake Champlain, have not yet shown signs of displacement by cormorants (A. Zelle, pers. comm., Shieldcastle and Martin, in press).

The impacts of cormorants on ground-nesting terns and gulls appear to be minimal. Ring-billed gull colonies on the Four Brothers Islands and Young Island declined before cormorants began moving into their nesting areas. Since then, the gull colonies have remained relatively stable, and may actually benefit from the presence of cormorants due to the increased availability of food on

the islands, including fish remains and chick regurgitates (J. Trapp, pers. comm.). Gulls also benefit by routinely preying on cormorant eggs and young nestlings when the adults are away from the nest.

Terns, in contrast, do not appear to benefit as much from these added food resources because, following disturbances, they do not return to colonies as quickly as gulls and lose opportunities to scavenge. Terns also do not typically prey on cormorant eggs or chicks. On the Great Lakes, Caspian terns share several sites with cormorants where they both prefer similar, elevated areas for nesting. On some of these colonies the nesting groups are discrete, although on a few they could be in conflict, with unknown consequences (C. Weseloh, pers. comm.). On Little Galloo Island, Caspian terns have not been negatively impacted by cormorants, and have actually increased in recent years (NYSDEC 1999). However, with this expansion in tern nests, the species nest closer together, and could compete for nesting space. Because cormorants return to nest earlier, they may usurp space used by nesting terns.

The direct interactions between common terns and cormorants are also uncertain. Common terns prefer lower-lying areas for nesting, and because of this difference in habitat, may be less likely to come into direct competition for nesting space. Usually, common terns are first displaced by ring-billed gulls, which in turn appear to attract cormorants to nest. However, cormorants may have displaced common terns on Pigeon Island, Lake Ontario, Canada, in 1998, and researchers will continue to study these interactions (C. Weseloh, pers. comm.).

Ring-billed gulls have been implicated in the decline of common terns throughout the lower Great Lakes (Blokpoel and Tessier 1986). Early-arriving ring-billed gulls compete with terns for nesting space and may eventually usurp an entire tern colony site. Numerous instances of direct competition for nesting space have been observed throughout the Great Lakes, including Little Galloo Island, Popasquash Island, and islands in Oneida Lake.

#### E. Impacts to Native Plant Communities

The presence of colonial waterbirds and their nests can substantially change the composition of an island's native plant community, unless the island is flooded annually by lake waters. On islands with trees, cormorants build their nests in trees before moving to ground nesting, and can completely fill a tree's branches with up to thirty or more nests. Within a few years, the feces that accumulate on the ground can lead to the death of the trees. The primary mechanism of death is the high soluble salt levels in the feces, which exert a strong osmotic pressure on the roots resulting in desiccation (Naumann 1994). This loss of fluids further interferes with nutrient uptake. Ground-nesting cormorants and ring-billed gulls have similar effects on herbaceous species.

The accumulation of feces also increases soil nutrients. Gull feces are known to be rich in nutrients like nitrogen, phosphorus and calcium, and an increase in such nutritional elements has been observed in the soil of some gull colonies (Ishida 1997). Also, in some colonies of the great cormorant in Japan, the nitrogen and carbon content of the soil was higher than that outside the colony (Ishida 1997). High levels of nutrients stress plants, and when excessive, can alter plant community composition.

Seed germination and seedling survival is also compromised by the accumulation of feces. In the great cormorant colony in Japan, germination success of Japanese oak (*Quercus serrata*) and Japanese red pine (*Pinus densiflora*) was negatively correlated with the amount of feces scattered on the ground (Ishida 1997). Soil water content was higher in the colony compared to similar islands without cormorants, leading to poor germination success from the lowered rates of oxygen uptake. Most acorns died before germination above the ground. Those that did take root died with symptoms such as necrosis spreading from the edge of leaves. Reductions in soil litter depths due to compaction from nests and birds also contributed to reduced germination rates.

Saplings also experienced higher rates of death in the cormorant colony. As with seedlings, saplings in the colony died with necrosis, due to the stress of a high-nutrient environment, while those outside the colony lost their leaves mainly to herbivory. In addition, the adhesion of feces to leaves inhibits photosynthesis and/or respiration, and feces contacting areas of leaf injury

further stress saplings (Ishida 1997).

## F. History of Double-crested Cormorant Control in the Northeast

A variety of control programs have been targeted at cormorants on or near their breeding colonies in the Northeast in this century. The first program was begun in the 1940's in Maine, and was a result of increasing concerns expressed by commercial fishermen about the negative economic impacts of cormorant predation to marine fisheries. In 1966, the Atlantic Sea Run Salmon Commission was first alerted to the problem of cormorant predation on Atlantic salmon (*Salmo salar*) smolts, and a second intensive control program was begun in Maine (Baum 1997). Other, smaller efforts in the 1980's and 1990's focused on restoring avian diversity to colonial waterbird nesting islands in several States, and preventing cormorants from colonizing and destroying vegetation on privately owned islands. A small number of aquaculturists (fewer than 10 per year) also lethally take a limited number of cormorants as a supplement to harassment.

(1) Maine. Between 1944 and 1952, nearly 200,000 cormorant eggs were sprayed with oil emulsion and formalin on several coastal breeding colonies. A few hundred eggs were also sprayed in Massachusetts during 1951-52 as part of this project by the USFWS Animal Damage Control program (which was transferred to the USDA/WS in 1986). Krohn, et al. (1995) concluded that egg oiling had little effect on the number of breeding cormorants because, in spite of repeated spraying, the birds apparently stopped nesting on only one the 10 Maine islands treated regularly. Because the scale of the program was large, and the amount of effort needed for repeated spraying was impractical, it failed to reduce the local cormorant population and was ended in 1954.

During the summer of 1966, the Maine Atlantic Sea Run Salmon Commission and the USFWS recovered over 600 tags from hatchery-reared salmon smolts at two cormorant breeding islands off the mouth of the Machias River in eastern Maine. Further efforts to document the extent of predation by cormorants led to a renewed control program in 1968. In 1969, the contact toxicant DRC-1347 was applied three times to cormorant nests and eggs on Old Man Island, but failed to eradicate the colony. The colony was eliminated in 1971 by shooting the nesting adults at night, but within a few years, adult cormorants from nearby islands quickly repopulated the vacated island (Baum 1997).

In 1972, when cormorants came under the protection of the MBTA, a Federal permit was issued to the Maine Department of Marine Resources for the take of cormorants along riverways to protect stocked Atlantic salmon smolts that were released as part of an extensive restoration program. That agency issued subpermits to Maine Department of Inland Fisheries and Wildlife and Atlantic Sea Run Salmon Commission personnel, who reported shooting 2,800 cormorants from 1972 to 1981 (Baum 1997). In addition to shooting cormorants along rivers, coastal nesting islands off the mouths of the Narragausgus and Penobscot rivers were harassed in 1972, and approximately 700 birds were shot (Krohn, et al. 1995). The results of this effort are unknown. Between 1982 and 1988 subpermits were also issued directly to the public, and between the late 1980's and 1992, 15 to 20 subpermits were issued each year with 160 to 590 birds reported shot annually (Krohn, et al. 1995). The program was ended in 1993 due to agency time constraints, even though there was significant public demand for the program (USFWS Permit files).

In total, the various control programs conducted in Maine since 1972 appear to have had negligible effects on the Statewide population, which increased 82 percent between 1977 and the early 1990's (Krohn, et al. 1995).

(2) Quebec. In 1989, the Government of Quebec initiated a control program to reduce the breeding cormorant population on 25 islands in the St. Lawrence River Estuary (B,dard, et al. 1995). The goal of the program was to discourage tree-nesting in an effort to halt damage to unique and restricted insular forest ecosystems. A breeding population of nearly 18,000 pairs in 1988 was about equally divided between ground-nesters and tree-nesters. Modeling revealed that the annual removal of 2,000 or even 3,000 members (12 to 18 percent, initially) of the tree-nesting cormorants would lead to high recruitment of ground-nesters. The model suggested that only with a two-pronged approach annually spraying eggs in 75 percent of the ground nests with mineral oil and shooting 2,000 adults in arboreal colonies could the population be effectively reduced. Using

the above protocol, the breeding population was reduced to 12,000 pairs (2,000 shy of the 5-year goal) in 3 years.

Continued suppression of cormorants on the St. Lawrence River estuary will, however, be necessary to keep the population at or below the objective of 10,000 pairs. B, dard, et al. (1995) recommend egg-spraying as a socially acceptable technique that is useful when large-scale intervention is required. They further recommend shooting as a last resort form of intervention to be used only when populations become clearly unmanageable. They found that in most circumstances, well-timed and repeated disturbances to nesting colonies will discourage the birds while minimizing shifts to new sites. Future plans call for the oiling of eggs in ground-nesting colonies every other year, and to prevent cormorant colonization of new islands (B, dard, et al. 1995).

(3) Massachusetts and Rhode Island. In 1991, the Massachusetts Division of Fisheries and Wildlife eliminated cormorant nesting from Ram Island in Mattapoissett as part of an effort to restore tern nesting to the island. Ram Island was an important historical nesting site for common and roseate terns (*Sterna dougallii*), a Federally endangered species, and a primary site for restoration of roseate terns under the species' Northeast recovery plan (USFWS 1988). Terns were first excluded from the island by nesting herring and great black-backed gulls in 1973, and the site was then colonized by cormorants in 1990 (B. Blodget, pers. comm.). In 1991, 190 pairs of cormorants were estimated to breed on the island, and all nests from these pairs were destroyed (totaling 551 nests including renests), along with gull nests in order to reclaim nesting space for terns. The cormorants abruptly abandoned the site in June of that year and have not returned (B. Blodget, pers. comm.). The island is now a thriving tern colony.

From 1995 to 1997, the Rhode Island Department of Environmental Management managed cormorants on Hope Island, Portsmouth, which is the State's largest and most diverse colonial waterbird nesting colony. Cormorants first nested in trees on the island in 1991, and the colony had grown to 286 nests in 1994. Other tree-nesting species on the island included glossy ibis (*Plegadis falcinellus*), great, snowy and cattle egret, black-crowned night-heron, and little blue heron (*Egretta caerulea*). The State's objective was to keep cormorants out of the island's tree nesting area, and limit the species to only rocky and herbaceous vegetation areas. Each year, to supplement the use of harassment (pyrotechnics), the State shot 50 to 100 cormorants, mostly early in the nesting season (April and May), to dissuade the birds from establishing nests in trees used by other species. In 1995, the eggs in 40 nests were also sprayed. Because the program successfully kept cormorants away from the trees used by other species, and had reduced the island's nest count to 157 by 1997, the program ended that year.

(4) New York. Since 1993, the New York State Department of Environmental Conservation has managed cormorants on Oneida Lake to reduce competition with common terns, a State threatened species (French and Pence 1996). Terns intermittently nest on several Oneida Lake islands, and became impacted by nesting ring-billed and herring gulls in the 1970's. In 1985, cormorants also began nesting on these islands (R. Miller, pers. comm.). In order to prevent movement into the tern nesting areas, the State destroyed 59 cormorant nests in 1993, two nests in 1996, and the nests from 100 pairs in 1998 (USFWS permit files). Also on Oneida Lake from August to September 1998, the USDA/WS used harassment (pyrotechnics), nest destruction, and a limited lethal take of birds, to successfully move cormorants off the lake to reduce predation on sport fish.

On Lake Ontario, the State has also managed cormorants since 1994 to reduce competition with black-crowned night-herons, a locally rare species in northern New York, and to protect vegetation on unique island communities. In 1994, cormorants began nesting on Gull and Bass Islands, two small islands in Henderson Harbor with nesting night-herons. The State destroyed all cormorant nests on these islands (178 total), and in 1995 the cormorants did not return. In 1996, cormorants again attempted to nest, and the State destroyed five nests. In 1997, cormorants expanded to Calf Island with 75 nesting pairs, and all nests from these pairs were destroyed. In 1998, 175 nests were destroyed on Calf Island; Gull and Bass Islands were not used by cormorants that year. In addition to the destruction of nests and eggs, some non-lethal management techniques were used, including terror balloons and some habitat manipulation (the cutting of large nesting trees). The results from these efforts indicate that small, pioneering colonies of

cormorants can be successfully excluded from islands through the destruction of nests and eggs. However, one year's effort may not be adequate, and the birds can return in later years, necessitating an ongoing management program.

Also on Lake Ontario, in late July 1998, cormorants were illegally shot on Little Galloo Island, resulting in the death of almost 900 birds. Because most of the birds shot were flightless juveniles, any impact to the island's breeding population is not expected until at least 2000, when 2-year-old birds may begin to breed. Other cormorants on or in the vicinity of Little Galloo Island were also shot illegally earlier that year, resulting in a total loss in 1998 of approximately 2,000 birds.

(5) Vermont. Beginning in 1994, the USDA/WS and the VDFW have managed cormorants in Vermont waters of Lake Champlain to prevent their expansion to new islands (USDA 1999). From 1994-1997, a total of 37 cormorant nests and 20 eggs were removed from Mud Island, and the birds did not return to nest in 1998. In 1996, the VDFW removed two cormorant nests from Popasquash Island to prevent potential movement of cormorants into the State's largest common tern colony. Also in 1997, the USDA/WS shot one cormorant in the State's largest great blue heron colony on Shad Island, Missisquoi National Wildlife Refuge, to assess the impact of shooting on both species, which was minimal (A. Zelle, pers. comm.).

In 1996-1997, the USDA/WS and VDFW assisted the owner of Bixby Island in removing 238 cormorant nests with eggs and chicks (USDA 1999). The nests were dislodged from trees using water under high pressure from fire hoses; however, nests higher than 50 feet were not successfully removed. No documented production of cormorants occurred on this site in 1996 or 1997. In 1998, the birds again returned to Bixby Island, and the USDA/WS initiated an integrated harassment program to discourage nesting. Initially, 148 cormorants were found loafing in trees on Bixby Island but were continually displaced using pyrotechnics, propane cannons, and distress calls, and only 15 nests required removal. The success of the above programs indicates that cormorants can be successfully displaced by harassment and nest destruction on Lake Champlain when they expand to new islands. It is unknown whether the displaced individuals move to other breeding colonies, or whether they abandon nesting for that year.

#### G. History of Ring-billed Gull Control in the Northeast

Ring-billed gulls are regularly controlled at specific sites where damage or other problems occur in the Northeast. Because ring-bills can successfully outcompete some threatened species of colonial waterbirds, many State wildlife agencies and private wildlife conservation organizations routinely exclude ring-bills from mixed waterbird colonies by destroying or adding eggs in gull nests. In the Northeast, limited ring-billed gull control has been undertaken on colonial waterbird colonies in New York and Vermont in the 1980's and 1990's, for the purpose of reducing competition with common terns and impacts to island vegetation.

Ring-bills have also expanded their nest sites to flat-roofed buildings in the Northeast. Many building owners have implemented nest and egg destruction in order to reduce the number of young that fledge from a site. In addition, exclusion modifications such as anti-perch devices or roof grid-wires are an important element of an integrated damage management program. Often these urban gulls feed at local landfills where they are also controlled using a variety of non-lethal techniques, such as immediate coverage of refuse and pyrotechnics, which can be supplemented by limited shooting. The use of Avitrol Concentrate (Environmental Protection Agency (EPA) Reg. No. 11649-10) can also be authorized by Federal permit and applied by certified applicators. Avitrol is a powdered poison that is applied to bread cubes and baited at scattered locations at landfills, airports, and structures where gulls feed, nest, loaf or roost. Gulls that consume the treated bread react with unusual behavior, and may also be killed, thereby alarming others in the flock.

In Vermont, the VDFW began managing ring-billed gulls on Popasquash Island in 1987, to prevent their movement into areas used by nesting common terns (LaBarr 1996). From 20 to 150 nests with eggs have been destroyed each year at the beginning of the nesting period, and the project is expected to continue in 1999 (USFWS permit files). Despite this repeated destruction of nests and eggs, ring-bills continue to nest on the island after a decade of control activity.

However, common tern productivity and nesting population size have steadily increased since the implementation of a variety of management strategies, including closure of the island to public access, the placement of chick shelters, and the riddance of tiny thief ants (*Solenopsis molesta*), which prey on chicks as they hatch from eggs (LaBarr 1996). However, enhancements to productivity related specifically to gull control cannot be determined.

Ring-billed gulls have never been managed on Lake Champlain's primary colonies at Young Island and the Four Brothers Islands. In the mid-1980's, just prior to the peak of ring-bill nesting on Young Island, the VDFW considered population management of the State's primary colony, but did not act based upon the recommendations of a research study (Jay 1986). The results of that study suggested that a variety of control strategies, including lethal removal of adults and the suppression of reproductive success, would fail because of the continued immigration of birds from other colonies into the managed site. Since then, the population has declined and stabilized, thereby exhibiting natural population regulation, perhaps due to reductions in food availability from the increased closures of landfills.

### III. ALTERNATIVES INCLUDING THE PROPOSED ACTION

#### A. Alternative 1: Requested Action by the State of Vermont

Under this alternative, the USFWS would issue a depredation permit for the take of cormorants and ring-billed gulls as proposed by the VDFW in their permit application. Because the numbers of cormorants and gulls on Young Island in 1999 are not yet known, and the VDFW did not request specific numbers to be taken, the authorized numbers would reflect 1998 numbers plus a reasonable margin to allow for growth. The permit would allow the oiling of eggs in up to 3,000 cormorant nests, and to lethally take up to 100 cormorant chicks by asphyxiation (assuming one chick hatched in 3 percent of the nests) on Young Island. Authority would also be granted to allow the administration of avian contraceptives (DiazaCon and Nicarbazin) to 6,000 cormorants (treatment of females reduces egg laying and treatment of males reduces fertility) (USDA 1999). Considering that the VDFW's objective for nesting ring-billed gulls on Young Island is to limit productivity to 8,000 pairs, authority would be issued to treat eggs in up to 1,000 nests (including re-nests), assuming that the population may increase to 9,000 pairs.

On other State-owned islands (Burton, Button, Knight, Mosquito, Mud, Rock, Shin, Sloop, and Woods Islands, and the Lamoille River Delta), authority would be issued to destroy up to 100 cormorant and ring-billed gull nests on each island, and to lethally shoot up to 10 cormorants on each island.

#### B. Alternative 2: Requested Action with Modification (Proposed Action)

The proposed action is to issue a depredation permit to the VDFW for the oiling of eggs in up to 3,000 cormorant nests on Young Island in 1999, using mineral or vegetable oil. Oiling could be done as often as necessary from early May through late July to prevent the hatching of chicks.

Activities that would not be authorized include the euthanization of chicks, because insufficient information was provided supporting this request. In particular, the projected number of chicks expected to hatch is not specified, and the damage imposed by this unspecified number of chicks to avian and plant diversity is not quantified, other than identifying that these birds would recruit into the lakewide population. Further, the USFWS authorizes the take of migratory bird chicks only for emergency safety purposes, and often requires that these chicks must be transferred to permitted Federal avian rehabilitators for rearing and subsequent release to the wild.

The requested activity to use reproductive inhibitors would not be authorized by the permit. Neither DiazaCon nor Nicarbazin is registered for use on cormorants. The compounds could, however, be tested in the future by the USDA/WS with proper experimental permits (USDA 1999). Because these experimental permits would be sought by the USDA/WS, and the compounds would be administered by personnel from that agency, the activities would be done under that agency's jurisdiction, and would not need USFWS permit approval.

The request to oil ring-billed gull eggs on Young Island would not be approved under the

proposed action. Insufficient information exists documenting that the number of ring-billed gull nests exceeds or is likely to exceed 8,000, which is the VDFW's objective for the island. The VDFW may submit an amendment request for this activity once the nesting population has been verified to be over 8,000 pairs in 1999, and subsequent permit decisions would be expedited and based on this EA.

Likewise, authorities to destroy cormorant and ring-billed gull nests, including any eggs, on Burton, Button, Knight, Mosquito, Shin, Sloop, and Woods Islands and the Lamoille River Delta would not be granted at this time, because neither species has historically nested on these islands, and the likelihood of colonization appears minimal. Further, threats to avian and plant diversity have not been identified for these islands in the VDFW permit application. The VDFW may submit an amendment request to take cormorant and ring-billed gull nests once the species have been documented as loafing or nesting on these islands, and that harassment during the pair-bonding and nest-building stages has largely failed.

The lethal removal of adult cormorants by shooting would not be authorized for these islands. Harassment, in combination with nest destruction, has been shown to be a successful deterrent to cormorant colonization on Lake Champlain and elsewhere and, if used, would likely eliminate any need for lethal removal.

Authorities to destroy cormorant and ring-billed gull nests and eggs would, however, be granted on islands with a known history of nesting by these species. On Mud Island, the permit would authorize the destruction of up to 100 cormorant and 100 ring-billed gull nests, and the destruction of up to 100 ring-billed gull nests on adjacent Rock Island. These numbers would include any re-nests. Given that threats to avian and plant diversity are not identified for these two islands, the VDFW's primary concern is to maintain the islands free from cormorants and gulls to limit the further expansion of their lakewide populations. This authority would be conditioned that harassment must be used during the pair-bonding and nest-building stages. The lethal removal of adult cormorants would not be authorized for Mud Island because harassment and nest or egg destruction should be sufficient.

The permit would require a report of the following: (a) an estimate of the number of breeding pairs in 1999 for each colonial waterbird species on the 17 islands covered by this EA; (b) the number of cormorant, ring-billed, herring or great black-backed gull nests either destroyed or treated by egg-oiling for each island, by date of treatment, including any taken by USDA/WS; (c) an estimate of the number of cormorant chicks that hatch on Young Island; (d) a description of the non-lethal management techniques used on these islands, and the efficacy of each; and (e) information on the movement of colonial waterbirds to any new sites within Lake Champlain, Vermont.

In addition, a detailed description of the impacts to target and non-target species resulting from the presence of persons treating eggs on Young Island, for each visit must be reported. This would include: (a) a description of the behavioral response of cormorants and ring-billed gulls to each visit on each island, including an estimate of the number of birds flushed, the distance at which they flushed, and the average time elapsed before the birds return to their nest sites; and (b) an estimate of the number of eggs or chicks by species that are pirated on Young Island by ring-billed gulls, and an estimate of productivity for this species. All reporting would be due by the permit expiration date, February 29, 2000.

For permit renewal, the VDFW must provide a status assessment of colonial waterbirds on Lake Champlain, Vermont, including management objectives for these species. The VDFW must also submit a status assessment of waterfowl on Lake Champlain, Vermont, including management objectives for these species, if their permit request again incorporates objectives for waterfowl.

### C. Alternative 3: No Action

Under this alternative, the USFWS would not issue a depredation permit for the requested action, and the current permit for 1999-2000 would not be amended. The authorities in the current permit allow the VDFW to remove and destroy up to 200 ring-billed, herring, and great black-backed gull nests, in any species combination, which are found on any of the six historic common tern

islands, combined. The permit also authorizes the destruction of up to 20 cormorant nests on Popasquash Island.

Under all of the alternatives, any activity requested by the VDFW, and not authorized by the USFWS, may still be conducted by USDA/WS personnel as identified in the proposed actions in their EA (USDA 1999).

#### IV. AFFECTED ENVIRONMENT

##### A. Physical Environment and Plant Communities

Lake Champlain occupies part of a large north-south valley between northeastern New York and western Vermont, and extends a short distance into the Province of Quebec, Canada. After the five Great Lakes, it is one of the largest coldwater lakes in the U.S. The total lake water surface area is 435 square miles of which 62 percent is in Vermont, 34.5 percent in New York, and 3.5 percent in Quebec. The mean elevation of the lake is 95 feet, maximum depth is 400 feet and mean depth is 73 feet. The foothills of the Adirondack Mountains rim much of the western side of the lake, whereas the eastern half of the basin is a broad plain with the Green Mountains located 20 miles to the east. The lake itself extends for 107 miles from its southern end near Whitehall, New York to its outlet, the Richelieu River, which flows northward through Quebec into the St. Lawrence River. The maximum width of the lake, 12 miles, occurs a short distance north of Burlington, Vermont. The southern portion of the lake is very narrow and shallow and is more characteristic of a river than a lake.

The 17 islands included in this EA vary in their size and location. The vegetative communities on the islands differ based on their soils, elevation, and size. The larger and more vegetatively diverse islands are likely characterized by the following plant communities: (a) lakeshore dry shale cobble, mostly found on the shores of Lake Champlain; (b) lakeshore grassland, characterized by low grass, sedge and forb communities on moist gravels and cobble; (c) lake sand beach, which may be nearly devoid of vegetation, but with sparse forbs; (d) lake bluff cedar-pine forest, with softwoods such as northern white cedar (*Thuja occidentalis*) and red pine (*Pinus resinosa*) dominant; (e) mesic transition hardwood forest, with calcareous bedrock soils and hardwood species such as sugar maple (*Acer saccharum*) and red oak (*Quercus rubra*); and (f) temperate calcareous cliff, characterized by herbaceous species such as black sedge (*Carex eburnea*) and bulblet fern (*Cystopteris bulbifera*). (See Appendix B for a more complete description of these communities.)

Young Island (also known as South Sister Island), which is the focus of this EA, is approximately 7 acres, and lies 0.6 miles off the western shore of Grand Isle, Vermont. The main portion of this flat island is open, with scattered patches of various herbaceous species, including stinging nettle (*Urtica dioica*), bull thistle (*Cirsium vulgare*) and field mustard (*Brassica rapa*). The soil is predominantly rocky loam. The island's native plant community has not been well documented, although it has been described as a mixed habitat of small wetlands, herbaceous vegetation of various species, and a mix of hardwood and softwood species. The Canadian milk vetch (*Astragalus canadensis*), a State endangered species, is currently found only on adjacent Bixby Island, and its historic occurrence on Young Island is unknown. Popasquash Island is a small (1-acre) island located 0.3 miles from the mainland. Its flat, bedrock surface is barren of vegetation, although a few cottonwood seedlings occur on the steep sides of the bedrock. Mud Island is 1 acre in size, and is often flooded and colonized by annuals. Adjacent Rock Island is also approximately 1 acre.

##### B. Biological Environment

(1) Birds. The colonial waterbird resources on Lake Champlain are similar to those found throughout the Great Lakes, and in general lack the diversity more commonly found in the southern and coastal waterbird colonies of the U.S. Species that regularly nest on the lake include ring-billed, herring and great black-backed gulls; double-crested cormorants; great blue and black-crowned night-herons; cattle egrets; and common terns. The great egret is noted as an occasional nesting species within great blue heron colonies on Lake Champlain, and green herons (*Butorides viriscens*) nest semi-colonially on island and marsh habitats (Laughlin and Kibbe 1985). Of these

species, only common terns are listed under Vermont State law as endangered, and they are also a species of management concern in the U.S. Great Lakes (French and Pence 1996, USFWS 1996). Although none of the other species have protected status beyond the MBTA, colonial waterbird nesting sites in general receive an added degree of protection by wildlife managers due to their vulnerability.

Young Island is the largest colonial waterbird colony in Vermont, and currently supports the State's largest numbers of ring-billed gulls and cormorants. During the 1980's, the island was also used by black-crowned night-herons, cattle egrets and snowy egrets, but these tree-nesting species abandoned the island concurrent with the expansion of the cormorant nesting area sometime in the 1990's. On the Four Brothers Islands, both night-herons and cattle egrets continue to nest, along with ring-billed, herring and great black-backed gulls, great blue herons and sometimes green-backed herons.

Waterfowl commonly found nesting on Lake Champlain islands include Canada goose (*Branta canadensis*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), green-winged teal (*A. crecca*), American black duck (*A. rubripes*), mallard (*A. platyrhynchos*), northern pintail (*A. acuta*), blue-winged teal (*A. discors*), common goldeneye (*Bucephala clangula*), hooded merganser (*Lophodytes cucullatus*), and common merganser (*Mergus merganser*). Gadwall (*A. strepera*) and American wigeon (*A. americana*) are occasional nesters (Laughlin and Kibbe 1985). Young Island is a historical waterfowl nesting site, used by Canada geese, American black ducks, mallards, gadwalls, and common goldeneyes, but waterfowl are now limited to adjacent Bixby Island, where up to 20 nests of various unidentified species are found each year (USDA 1999).

Songbird breeding diversity is generally undocumented, although on Young Island, eastern kingbird (*Tyrannus tyrannus*), purple martin (*Progne subis*), American crow (*Corvus brachyrhynchos*), yellow warbler (*Dendroica petechia*), chipping sparrow (*Spizella passerina*), song sparrow (*Melospiza melodia*), red-winged blackbird (*Agelaius phoeniceus*), eastern meadowlark (*Sturnella magna*), common grackle (*Quiscalus quiscula*), European starling (*Sturnus vulgaris*), American goldfinch (*Carduelis tristis*), and house sparrow (*Passer domesticus*) have been recorded during the breeding season (Laughlin and Kibbe 1985). Killdeer (*Charadrius vociferus*), spotted sandpiper (*Actitis macularia*), common snipe (*Gallinago gallinago*), and American woodcock (*Scolopax minor*) commonly breed along the lake's shorelines.

Popasquash Island is the largest common tern nesting island on the lake, and is one of six islands used by the species for nesting since 1980 (LaBarr 1996). The number of breeding birds has varied markedly at each site, probably due to varying predation pressures, particularly from great horned owls (*Bubo virginianus*). Popasquash Island has been used most steadily by terns in recent years, although all six islands remain relatively unchanged and are currently suitable for use by nesting terns. Although competition by nesting ring-billed, herring and great black-backed gulls, and also cormorants is limiting nesting space on Popasquash Island, habitat availability is not currently considered a limiting factor for common terns overall on Lake Champlain (LaBarr 1996).

(2) Fish, Reptiles and Amphibians. The fish of Lake Champlain are part of an aquatic community that includes diverse assemblages of plants, phytoplankton, zooplankton and benthic organisms. At least 81 species of fish have been documented in Lake Champlain and its tributaries (NYSDEC and USFWS 1987). Forty-five percent of the lake surface area has deep, cold water, with sufficient levels of dissolved oxygen to support salmon and trout in summer. Shallower areas of the lake support a diverse warmwater fish community, with sport fish consisting of largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), walleye (*Stizostedion vitreum*), sauger (*S. canadense*), northern pike (*Esox lucius*), chain pickerel (*E. niger*), brown bullhead (*Ictalurus nebulosus*), channel catfish and yellow perch (*Perca flavescens*). Minnows include emerald shiner (*Notropis atherinoides*) and golden shiner (*Notemigonus crysoleucas*), and sunfish species include bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*) and rock bass (*Ambloplites rupestris*).

Coldwater sport fish include lake trout (*Salvelinus namaycush*), landlocked Atlantic salmon

(*Salmo salar*), steelhead trout (*Oncorhynchus mykiss*), brown trout (*S. trutta*) and rainbow smelt (*Osmerus mordax*) (USFWS 1987). In addition to fish, 19 species of reptiles and 21 amphibians have been documented in Lake Champlain and its tributaries.

### C. Human Environment

The Lake Champlain Valley comprises both the State's largest urban and suburban center, Burlington, as well as many rural communities. Population data from 1998 indicates that Chittenden County (including Burlington) was home to 142,642 residents, Franklin County 44,017 residents, Addison County 35,186 residents, and Grand Isle County 6,236 residents, for a total four-county population of 228,081 (U.S. Bureau of the Census 1998). The total employment in the service sector in these counties ranged from 27 to 30 percent in 1996 (U.S. Bureau of the Census 1996), and the total earnings in this sector ranged from 19 to 34 percent (U.S. Department of Commerce 1996). The total employment in the retail trade sector ranged from 21 to 25 percent, and the total earnings in this sector ranged from 9 to 14 percent. The service sector includes hotels, campgrounds, amusement and recreation services, as well as home and business services. The retail sector includes department stores, food stores, service stations, restaurants, and recreational equipment stores. Local economies are also based significantly on agricultural production, including dairy and grains.

Year-round and seasonal home development along the lakeshore is concentrated near communities, particularly in the vicinity of Burlington, Chittenden County. Islands located in Lake Champlain are mostly in private ownership, although 10 are owned by the State of Vermont, 3 by the State of New York, and 2 by the USFWS. Many islands are small, from 1 to 5 acres, and only nine islands are larger than 100 acres (USDA 1999). Most islands are either undeveloped or used mostly as seasonal residences. Two islands are used as State Parks (Burton and Button Islands), and four are owned by the VDFW (Young, Mud and Rock Islands, and the Lamoille River Delta). The USFWS owns two islands (Shad and Metcalf) located within the Missisquoi National Wildlife Refuge in Swanton, Vermont. Islands in private conservation ownership include Popasquash Island (Green Mountain Audubon Society), Carleton's Prize (Lake Champlain Island Trust) and the Four Brothers Islands (The Nature Conservancy).

Lake Champlain is a popular recreational destination in Vermont. Wildlife users on the lake include anglers, hunters, and birdwatchers. In addition to the economic contributions of these users in both the service and retail sectors, additional revenues are gained through small commercial fisheries.

## V. ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

### A. Alternative 1: Requested Action by the State of Vermont

(1) Cormorant Populations. Under this alternative, cormorant productivity would be reduced on Lake Champlain in 1999 by egg-oiling and the lethal take of all cormorant chicks on Young Island. Colonies that are expected to continue to produce young would be limited to Shad Island and the Four Brothers Islands. In 1998, approximately 64 percent of cormorants nesting on islands in Lake Champlain occurred on the islands proposed for control under this EA. Assuming a lakewide increase of 21 to 43 percent, based on 1998 nest counts (4,138), the total number of active nests is expected to be 5,000 to 6,000 in 1999. Therefore, approximately 2,000 pairs would be expected to produce young in 1999. Given that productivity averages about 2.5 young per pair, approximately 5,000 cormorant chicks could fledge from Lake Champlain in 1999 under this alternative.

Assuming that survival of first-year cormorants is 58 percent, and that survival of second- and third-year cormorants is 75 percent (Fowle 1997), recruitment into the Lake Champlain breeding population in 2002 would approximate 1,600 breeding adults. Also, assuming that: (a) all young that fledge from Lake Champlain return there to breed; (b) annual adult survival is 80 percent; (c) breeding first occurs at age 3; (d) egg-oiling does not cause abandonment of breeding adults; and (e) egg-oiling effectively prevents hatching and relaying, and continues at least through 2001, the lakewide breeding population would continue to increase at current rates until 2002, and then

increase slightly through 2004. Mathematical modeling of this control strategy indicated a 6 percent annual rate of increase of cormorants lakewide (Fowle 1997). Under this alternative, the most significant impact to the lakewide cormorant population is that expansion to other islands is expected to subside. This would reduce the total number of colonies on the Lake to three (Four Brothers, Young and Shad Islands). Given the propensity for this species to increase and colonize, this relatively small number of colonies should not make the lakewide population vulnerable to extirpation.

The number of cormorants projected to nest on Young Island would also likely remain relatively stable in 1999 and beyond, or decline slightly, assuming that: (a) egg-oiling continued annually; (b) breeding adults on Young Island continued to return there in successive years; and (c) that birds fledged from the Four Brothers Islands would replace adults on Young Island lost to attrition. In addition, immigration from other colonies in the Great Lakes or perhaps the Northeast Atlantic Coast could occur, which would support continued population increases on Young Island and elsewhere on Lake Champlain. The magnitude of immigration is unknown, but considering the current high rates of growth in the Great Lakes population, this could be an important factor in future Lake Champlain population numbers. The impact of this control strategy in 1999 on the larger Great Lakes or Northeast Atlantic Coast populations is insignificant.

The assumption that abandonment would not occur is reasonable, particularly for primary colonies (DesGranges and Reed 1981), and especially if all visits to the island occur after pair bonds are established, nests are built, and eggs are laid. The assumption that emigration from other colonies in the Great Lakes would likely occur is also reasonable only if visits are made after egg laying. Birds new to the colony would be more easily disturbed early in the breeding season because they would not have established strong bonds to a nest site. The magnitude of future immigration is unknown, but considering the current high rates of growth in the Great Lakes population, this could be a significant factor in future Lake Champlain population numbers. The impact of this control strategy in 1999 on the Great Lakes population is insignificant.

The effects of administering avian contraceptives on cormorants on Young Island would be similar to egg-oiling. DiazaCon has been shown to reduce egg laying in common quail (*Coturnix coturnix*) almost completely for 2 months, and to reduce fertility in males for 2 months; therefore, treatment of cormorants with this oral contraceptive could prevent egg laying for one breeding season. Nicarbazin reduces the hatchability of eggs, but the rate of effectiveness on cormorants is unknown. Assuming that egg-oiling would be coupled with either of these contraceptives, the net result would be similar to using egg-oiling only.

The effects of shooting up to 10 cormorants on 10 islands, for a total take of 100, is insignificant to the Lake Champlain population (2 percent of the projected 1999 breeding population).

(2) Ring-billed Gull Populations. Assuming that 1,000 Ring-billed Gull nests were treated by egg-oiling on Young Island, approximately 4 percent of the lakewide breeding population would not produce chicks in 1999. The remaining 22,000 ring-bill pairs would still fledge chicks, and with 2 chicks per pair, productivity would be approximately 44,000 fledglings. This rate of control would have minimal impacts on the Lake Champlain population and no impacts on the entire Great Lakes population. The nesting colony on Young Island would also be minimally impacted.

Ring-billed gulls on Young Island could be impacted by the presence of persons oiling cormorant eggs and euthanizing chicks. These impacts will depend upon the timing and number of visits to the island. Because oiling would be done after the formation of pair bonds and the building of nests, the potential for abandonment would be reduced significantly. However, repeated disturbances during the incubation and early fledging periods would result in continual disruption of incubating gulls, and the temporary abandonment of nests. This would lead to the increased vulnerability of ring-billed gull eggs and chicks to predation by other ring-billed, herring and great black-backed gulls. The extent of this additive mortality is unknown. In contrast, the flushing of cormorants would leave their nests vulnerable to predation by gulls, providing enhanced food resources for ring-bills.

(3) Other Birds. Because the oiling of either cormorant or ring-billed gull eggs on Young

Island is not expected to have significant impacts on the populations in this colony (unless disturbance abandonment occurs), it is unlikely that other avian species will be attracted to nest on the island. Common terns in particular are unlikely to colonize the island due to the continued presence of the large ring-billed gull colony. Even though tern decoys and vocalizations could attract common terns to the island, appropriate nesting space would remain generally unavailable. Because common terns are limited primarily by predation and human disturbance on Lake Champlain, and not habitat, it is unlikely that they would colonize an island used by ring-bills where predation and competition could be intense (S. Kress, pers. comm.). Unless areas slightly removed from the cormorant and ring-bill sites were voided of these species, and the vegetation recovered, ground-nesting ducks are also unlikely to return to Young Island. With the loss of the island's trees, the tree-nesting ducks, herons and egrets would also not find suitable nest sites.

On Popasquash Island, and the other 5 historic common tern colonies, the removal of cormorant nests, and gull nests in particular, on those islands should continue to enhance the productivity of common terns. In addition, egg-oiling on Young Island should reduce cormorant expansion from that island to the common tern nesting islands, and reduce the need to destroy cormorant nests on these islands. On the 10 state-owned islands also targeted for cormorant and ring-billed gull control, no impacts to other colonial waterbirds would occur because the islands are not known to be used by other species. The impacts of nest removal are expected to prevent loss of some waterfowl nesting sites, but because the specific nesting status of waterfowl on these islands is unknown, the impacts to these species' populations cannot be analyzed. Any colonial waterbirds or waterfowl on other islands in the lake outside of State ownership could also benefit, but because the status of these species elsewhere is unknown, the impacts cannot be analyzed.

(4) Native Plant Communities. This alternative is expected to prevent any changes to native plant communities on the 10 state-owned islands. Because the specific communities on each island are not described, the impacts to these communities lakewide cannot be assessed. On Young Island, it is unlikely that the native plant community would be restored naturally because cormorant and gull nesting populations would not change significantly. On Popasquash Island and the 5 other historic common tern islands, elimination of nesting by cormorants and gulls would help to prevent changes, although the islands would remain impacted by common tern nesting. Native plant communities on islands outside of State ownership could also benefit, but because the status of these communities on the Lake is unknown, the impacts cannot be analyzed.

(5) Fish, Reptiles and Amphibians. Impacts to fish would be minimal under this alternative. Because lakewide cormorant populations would increase slightly, and then generally stabilize, current levels of predation would continue. Although cormorants feed predominantly on yellow perch in Lake Champlain, the total biomass of yellow perch in the lake is unknown, and impacts cannot be determined (Fowle 1997). Other species commonly consumed by cormorants in Lake Champlain include emerald and golden shiner, bluegill, pumpkinseed, rock bass, and largemouth and smallmouth bass, but impacts to these are unknown and likely minimal. The impacts to fish from ring-billed gulls would also be minimal due to their diverse diet. The impacts from both cormorants and gulls on reptiles and amphibians are unknown, but we assume these to be minimal.

(6) Endangered and Threatened Species. Common terns, a State endangered species, are not expected to be impacted by this alternative. However, if the species is successfully attracted to nest on Young Island, nests might fail due to predation, and a negative net result could accrue to the Lake's common tern population. Canadian milk vetch, a State endangered species, could benefit if cormorant colonization of Bixby Island subsided due to egg-oiling in the primary colony. Expected impacts to this plant elsewhere in the lake are unknown. No Federally endangered or threatened species would be impacted under this alternative.

(7) Socioeconomic. Under this alternative, the most apparent economic impact would be the maintenance of State property values because cormorants and gulls would be less likely to expand to these islands and cause damage to vegetation. In addition, this alternative could also benefit the owners of at least 40 islands (those less than 10 acres), both in loss of property value and the costs of deterring cormorants from their islands. These costs could include fees paid to USDA/WS or private pest control operators, equipment rental fees, and loss of income due to employment absences. However, no economic data is available for analysis.

The appearance of Young Island would not change under this alternative. Many people believe that colonial waterbird nesting islands are visually unattractive due to loss of trees, and have excessive noise from bird vocalizations and odors from feces. In contrast, some people find these islands to be fascinating parts of the natural world. During periods of visitation for egg-oiling and the lethal take of chicks, birds would be flushed and become more vocal, but this is unlikely to adversely affect boaters or nearby landowners. The oiling of eggs and the killing of chicks would be visible to the researchers only, and should therefore not cause visual adverse impacts to persons concerned with the welfare of individual animals. However, those persons knowledgeable about the oiling and killings, and opposed to lethal actions against birds, would be impacted vicariously. In contrast, persons who believe that cormorants are responsible for declines in fishing success would be positively impacted under this alternative, due to perceived benefits to sport fishing.

#### B. Alternative 2: Requested Action with Modifications (Proposed Action)

(1) Cormorant Populations. Under this alternative, a depredation permit would be issued for the oiling of eggs in up to 3,000 cormorant nests on Young Island in 1999. The impacts of this alternative to cormorant populations would be mostly identical to those resulting from egg-oiling in Alternative 1. Because chicks would not be euthanized, some productivity is likely to occur depending on the frequency of oiling, although the number is unknown and is likely to be minimal.

The impact of destroying up to 100 cormorant nests on Mud Island in 1999 would be minimal because this colony represents approximately 2 percent of the lakewide population.

(2) Ring-billed Gull Populations. Under this alternative, up to 100 ring-billed gull nests would be destroyed on each of Gull and adjacent Rock Islands. Because this represents less than 1 percent of the lakewide population, no significant impacts would occur. Ring-billed gulls would be adversely impacted by the oiling of cormorant eggs due to disturbance, as described under Alternative 1.

(3) Other Birds. The impacts under this alternative to birds are the same as under Alternative 1.

(4) Native Plant Communities. The impacts under this alternative are the same as under Alternative 1.

(5) Fish, Reptiles and Amphibians. No impacts are expected to fish, reptiles or amphibians as described under Alternative 1.

(6) Endangered and Threatened Species. The impacts under this alternative are the same as under Alternative 1.

(7) Socioeconomic. The impacts under this alternative are largely the same as under Alternative 1. Persons concerned with the welfare of individual birds will be less adversely impacted under this alternative because cormorant chicks would not be euthanized.

#### C. Alternative 3: No Action

(1) Cormorant Populations. Under this alternative, the current permit issued to the VDFW would not be amended, and cormorant, ring-billed, black-backed and herring gull nests could continue to be removed from any of the six historic islands used by common terns. Because the current permit authorizes the take of up to 20 cormorant nests (less than 1 percent of lakewide population), the population would not be negatively impacted, and instead would continue to increase in size and numbers of colonies.

(2) Ring-billed Gull Populations. Under this alternative, up to 200 gull nests (ring-billed, herring and great black-backed, combined) could be removed from the six historic tern islands. This would have no impact on the local and regional ring-billed gull population. The ring-billed

gull population on Young Island would not be impacted, and the lakewide population would probably remain stable.

(3) Other Birds. Under this alternative, no negative or positive impacts to other birds are expected on Young Island. Expansion of cormorants or gulls to new islands could, however, negatively impact avian diversity on individual islands and also throughout Lake Champlain. Because the status of tree-nesting herons and egrets on other islands is not well documented, specific analyses of these impacts cannot be determined. However, in general, these species would be negatively impacted on the islands where they nest with cormorants. Waterfowl on islands with new cormorant or gull colonies could also be negatively impacted due to loss of nesting habitat. Because this alternative allows for the continuance of cormorant nest destruction on the common tern islands, this species would continue to benefit, especially on Popasquash Island.

(4) Native Plant Communities. Under this alternative, cormorants could continue to expand to new islands throughout the Lake and cause damage to native plant communities. However, because the potential for colonization is unknown, and the status of these plant communities on the Lake is unknown, the impacts cannot be determined.

(5) Fish, Reptiles and Amphibians. No impacts are expected on fish, reptiles or amphibians as described under Alternatives 1 and 2.

(6) Endangered and Threatened Species. The impacts under this alternative are largely the same as Alternatives 1 and 2, although Canadian milk vetch could be negatively impacted on some islands. However, this cannot be thoroughly analyzed due to the lack of information on the status of this species on Lake Champlain.

(7) Socioeconomic. Because cormorants are likely to continue to expand to other islands, landowners may experience economic loss due to declines in property values and expenses related to deterrence. The magnitude of this potential loss is unknown.

## VI. COORDINATION AND CONSULTATION

An informal consultation with USFWS endangered species personnel was conducted to ensure that the proposed action will not likely jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of their critical habitat.

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## VIII. APPENDICES

Appendix A. Permit Application submitted by the State of Vermont on March 19, 1999

Appendix B. History of Depredation Permit (MB-751275) Issued to the State of Vermont for the Control of Double-crested Cormorants and Ring-billed Gulls on Lake Champlain, Vermont

1990-93: Authorized to remove and destroy up to 50 ring-billed gull nests annually at Popasquash, Rock and Hen Islands and Gull Rock. Reported take: 0 nests (1990), 0 nests (1991), 22 nests (1992) on Popasquash Island, and 20 nests (1993) on Popasquash Island.

1994: Authorized to remove and destroy up to 50 ring-billed, herring and great black-backed gull nests at Popasquash, Rock and Hen Islands and Gull Rock. Reported take: 34 ring-billed gull nests on Popasquash Island.

1995: Authorized to remove and destroy up to 70 ring-billed, herring and great black-backed gull nests at Popasquash, Rock, Hen, Savage and Grammas Islands and Gull Rock. Reported take: 70 Ring-billed gull nests on Popasquash Island.

1996: Authorized to remove and destroy up to 120 ring-billed, herring and great black-backed gulls and double-crested cormorant nests at Popasquash, Rock, Hen, Savage and Grammas Islands and Gull Rock. Reported take: 150 ring-billed gull nests and 2 cormorant nests on Popasquash Island.

1997: Authorized to remove and destroy up to 200 ring-billed, herring and great black-backed gulls, in any combination, and up to 20 double-crested cormorant nests on Popasquash, Rock, Hen, Savage and Grammas Islands and Gull Rock. Reported take: 81 Ring-billed gull nests and 1 great black-backed gull nest on Popasquash Island.

1998: Authorized to remove and destroy up to a total of 200 nests, and all eggs contained therein, of ring-billed, herring and great black-backed gulls, in any species combination, from all islands combined (Popasquash, Rock, Hen, Savage and Grammas Islands and Gull Rock) and authorized to remove and destroy up to 20 nests, and all eggs contained therein, of double-crested cormorants at Popasquash Island. Reported take: 84 ring-billed gull nests and 1 herring gull nest on Popasquash Island.

1999: Authorized to remove and destroy up to a total of 200 nests, and all eggs contained therein, of ring-billed, herring and great black-backed gulls, in any species combination, from all islands combined (Popasquash, Rock, Hen, Savage and Grammas Islands and Gull Rock), and authorized to remove and destroy up to 20 double-crested cormorant nests, and all eggs contained therein, at Popasquash Island.

Appendix C. ADC Forms 37 submitted by the USDA/WS as Supplements to the State of Vermont Permit Application

Appendix D. Native Plant Communities on Lake Champlain Islands, Vermont

Appendix E. Summary of Public Comments on Double-crested Cormorant and Ring-billed Gull Control on Lake Champlain, Vermont, received prior to May 4, 1999, in response to the Draft Environmental Assessment

On April 14, 1999, the USFWS released a Draft Environmental Assessment (DEA) of a Service action to issue a migratory bird depredation permit for the take of cormorants and gulls on Lake Champlain Islands, Vermont. Copies were sent to appropriate Federal and State agencies, scientific organizations, and other interested parties with a request for comments that might contribute to the development of a Final Environmental Assessment. During a 15-day public comment period, which ended on April 29, 1999, the USFWS received 13 comments regarding the DEA. An additional 11 comments were received during the next 4 days and are also included in the following summary. All of these comments (with tallies of the number of respondents on each issue) are addressed in the following summary. Responses to detailed public comments are provided in Appendix F.

1. Support for Alternative 1 as presented in the DEA issuing a depredation permit to VDFW for the take of cormorants and ring-billed gulls as well as oiling of eggs in cormorant nests and administration of avian contraceptives to cormorants.

2 - General Public 1 - Private Organizations

2. Support for Alternative 2 as presented in the DEA issuing a depredation permit to VDFW for the oiling of cormorant eggs on Young Island, and the destruction of cormorant and gull nests with eggs on Mud and Rock Island, Panton.

0 - General Public 0 - Private Organizations

3. Support for Alternative 3 as presented in the DEA no action; not issuing a new depredation permit and not amending the current VDFW permit. Many of these comments simply asked that a permit not be issued. Some comments suggested the scientific evidence for cormorant and gull control was insufficient.

15 - General Public 6 - Private Organizations

Appendix F. Responses to Detailed Public Comments on Double-crested Cormorant and Ring-billed Gull Control on Lake Champlain, Vermont, received prior to May 4, 1999, in response to the Draft Environmental Assessment

A. Response to Schubert & Associates, The Fund for Animals

1. Thank you for your comments.

2. We agree that it appears unlikely that the oiling of eggs on Young Island will result in the enhancement of avian diversity at that site. Although by limiting recruitment into the lakewide population, egg-oiling could prevent the colonization of cormorants at other sites where waterbirds may nest.

3. Because the proposed action of egg-oiling is not expected to significantly reduce the nesting cormorant population on Young Island, we agree that the vegetation on the island is also not expected to change. The island's herbaceous vegetation was originally impacted by the arrival of ring-billed gulls, and later the trees and additional herbaceous vegetation were further impacted by cormorants. However, the expansion of cormorants to other islands would result in changes to vegetation at these sites.

4. We agree that immigration to Young Island from elsewhere on Lake Champlain or the Great Lakes could occur and moderate any reductions in the Young Island cormorant population. However, productivity and potential further recruitment would be suppressed by egg-oiling.

5. Non-lethal management techniques typically deter birds from a local site of damage and move them elsewhere. Because the purpose of the proposed action is to reduce cormorants throughout Lake Champlain, and not just one island, these techniques would not achieve the desired result. In multi-species colonies, non-lethal management techniques often affect both

target and non-target species. Pyrotechnics (noise-makers) in particular effect all species, and could be targeted at cormorants only if the species returned first in the Spring. Because cormorants typically arrive after ring-billed gulls, this technique could also displace gulls on Young Island. Visual frightening devices could be placed more locally at cormorant nesting sites, but we are unaware of the efficacy of these on breeding colonies. Non-lethal chemical repellents and habitat exclusion devices could likewise result in abandonment of the colonies, and lead to colonization elsewhere. We are not aware of other potential non-lethal means to reduce cormorant nesting populations in an area as large as Lake Champlain.

6. A fourth alternative of rescinding the current permit was not proposed. A fifth alternative for issuing a permit for the use of non-lethal management techniques was not considered because no permit is required for these purposes under 50 CFR 21.419(a). Rather, the use of non-lethal management techniques can be added as a permit requirement in conjunction with lethal actions. As explained under A(5), these techniques would not likely work, and are therefore not a proposed permit requirement.

7. The EA has been modified in the Socioeconomic sections under Environmental Consequences to incorporate your comments.

8. The EA was modified to include additional information on the potential impacts of the proposed action on ring-billed gulls. (See page 26.) We agree that repeated visits for egg-oiling are likely to cause disturbance to ring-billed gulls and could result in some disturbance abandonment, but given the stage of nesting, this would be minimal. Although the intrusion would be limited to the cormorant nesting areas only, these are immediately adjacent to the ring-billed gull area. Cormorants readily flush as persons walk toward their nests, and gulls follow closely behind and begin pirating cormorant eggs or chicks. This could result in a net benefit to the gulls, but only if persons stay away from the gull area and do not flush them from nests. Doing so will result in the pirating of gull eggs and chicks by other nearby gulls.

The disturbance caused to nesting cormorants by egg-oiling is likely to cause some abandonment of the colony. However, this is dependent on when the visits occur. Intrusion early in the nest season will result in more abandonment than later in the season. Because the objective of minimizing expansion to other islands would be hampered by early visits, the permit will contain the date restrictions of egg-oiling from early May through late July. (See page 19.)

9. We have addressed the cumulative impacts from previous control efforts, and the potential impacts from the continued oiling of eggs for a 5-year period. We are not aware of any other potential requests for permits for the take of cormorants on Lake Champlain, however, the USDA/WS may conduct additional activities as described in their EA.

10. Thank you for your comments.

11. Thank you for your comments.

12. The issuance of permits to enhance populations of endangered, threatened, or species of conservation concern, such as common terns, is supported by USFWS depredation permit policies.

13. See A(5).

14. The USDA/WS has submitted a recommendation supporting the proposed action. (See Appendix C.)

15. The oiling of eggs on Young Island, if repeated for at least 5 years, is likely to stabilize the cormorant population in Lake Champlain by 2004. Expansion to other islands is expected to diminish, and the continued colonization of Popasquash, Bixby and Mud Islands by cormorants could also subside. Therefore this action is likely to meet the objective of enhancing nesting opportunities for black-crowned night-herons and common terns, and preventing the destruction of vegetation on other islands in Lake Champlain.

## B. Response to Jeremy J. Hatch, Ph.D.

1. Thank you for your comment.
2. The oiling of cormorant eggs has not been done in recent years in the U.S. Great Lakes or Northeast Atlantic Coast, and detailed information from earlier projects is not available. The Government of Quebec has used egg-oiling in the St. Lawrence River Estuary in conjunction with the lethal take of adults to successfully reduce the local population. However, the effects of oiling eggs versus killing adults were not detailed. On Lake Ontario, Canada, a 1-year study found that oiling conducted during each of the first, second, and third week of incubation resulted in preventing the hatching of 95-98% of the eggs (Shonk 1998). For comparison, the treatment of ring-billed gull eggs has been most effective when done between the fifth day after laying of the last egg and at least 5 days before anticipated hatching (USDA 1999). Repeated oiling during the breeding season at 10-day intervals would ensure that most eggs, both early and late, and those missed during visits, would be oiled 1-2 times during the incubation period.
3. Several assumptions are made when evaluating the efficacy of oiling cormorant eggs on Young Island. Some of these assumptions are based on recent population censuses and research in the Great Lakes, such as survival rates, population growth rates, and age at first breeding. Any of these demographic parameters could change based on the current status of the population. The overall rate of growth in the Great Lakes population has increased rapidly during the 1990's, and it is difficult to project how long the population will continue at these rates. However, we believe it a reasonable assumption that the population will continue at these rates over the next 5 years. The assumptions regarding the movement of birds among colonies are the most tenuous because little information is available on the rate of inter-colony movements. In general, though, cormorants are known through banding records to return to their natal colony, or recruit into a nearby colony with available space. Movement from colonies outside the local area is less well known, but certainly has occurred in the past as demonstrated by the successive colonization of each Great Lake from the 1910's to the 1940's, and the colonization of Lake Champlain in 1982.

We agree that disturbance coupled with low reproductive success at Young Island may have the opposite effect to that predicted: cormorants could abandon the island and nest elsewhere. However, given that Young Island is one of two primary colonies on Lake Champlain, and has been in use since the 1980's, site tenacity should be extremely high, and visits during the incubation period should not result in significant abandonment.

4. The proposed action is for the 1999 breeding season only, because depredation permits are limited to 1 year by regulation (50 CFR 21.41(d)). We assume that the VDFW will submit a renewal request in 2000 in order to meet their longer term objectives for avian and plant diversity in Lake Champlain. At that time we would conduct analyses under NEPA and provide appropriate opportunity for public input.

## C. Response to Wildlife Watch, Inc.

1. Thank you for your comments.
2. The migratory bird depredation regulation provides flexibility regarding the type of weapon or other technique that can be used to kill birds (see 50 CFR 21.41(c)(2) on page 3), but any exceptions to the use of shotguns must be specifically authorized. However, we are not proposing to authorize any lethal take of cormorants on nesting islands.
3. We agree that control techniques other than the killing of birds are successful on nesting islands. In particular, harassment coupled with nest/egg destruction has successfully deterred cormorants from several new, small colonies in the Great Lakes, including Lake Champlain. However, these techniques must be used each year if cormorants return. For larger, well-established cormorant colonies, harassment and nest/egg destruction or egg-oiling would not succeed in deterring birds in the first year of treatment, but would need to be replicated indefinitely.

4. All of the colonial waterbird species nesting on Lake Champlain are distributed widely either nationally or internationally, and are not currently threatened rangewide; many in fact are increasing rangewide, including black-crowned night-herons and ring-billed gulls. The status of common terns is less secure, though, and the Great Lakes population is listed as a species of management concern. We do, however, recognize the legal mandate and interest of the State of Vermont to maintain viable and diverse natural communities within its borders, and consider the local status of a species when issuing depredation permits to benefit other wildlife.

#### D. Response to Vermont Audubon Council

1. Thank you for your comment.
2. We agree that the ring-billed gull population on Lake Champlain appears stable.
3. Thank you for your comment.
4. The USFWS has been monitoring the great blue heron and cormorant colony on Shad Island, located in the Missisquoi National Wildlife Refuge. We will continue to monitor this colony to assess interaction between these species.
5. We interpret the VDFW permit application as a request to prevent reproduction in all cormorant nests on Young Island in 1999. Because 2,597 pairs nests on Young Island in 1999, and further population growth is expected, we determined that authority for 3,000 nests would allow a reasonable margin for growth in the population.
6. Thank you for your comment.