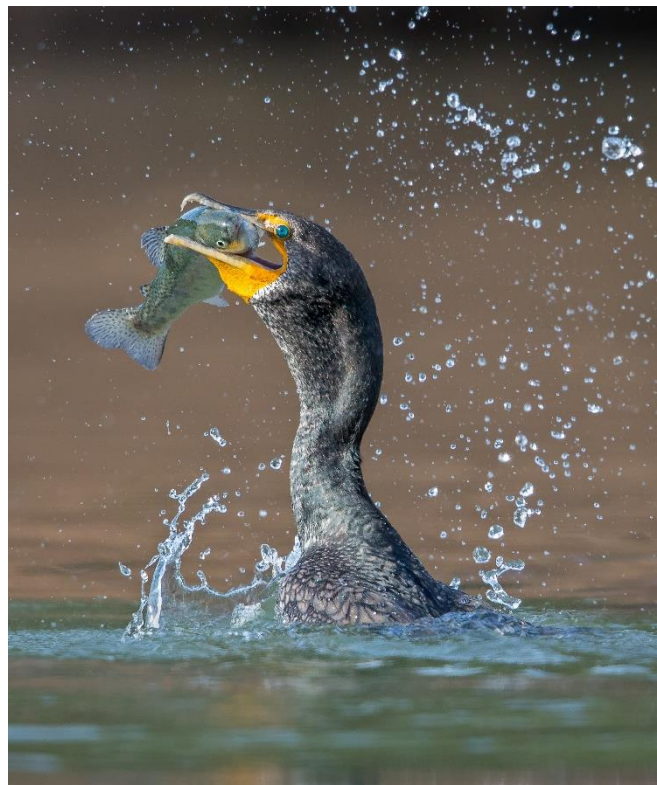


Double-crested Cormorants and Free-Swimming Fish

Regional Information-Gathering Meetings

Meeting Summary



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Background

In May 2016, the U.S. District Court for the District of Columbia remanded the U.S. Fish and Wildlife Service's (Service) 2014 Environmental Assessment (EA) supporting the Aquaculture and Public Resource Depredation Orders for double-crested cormorant (DCCO) Management. Through this ruling, the Court vacated both depredation orders until the Service prepared an adequate EA or Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act (NEPA). The Court also ruled that the Service did not update its previous analysis and did not take a "hard look" at the effect of the depredation orders on cormorants and other affected resources (i.e., fish populations) or examine other alternatives.



Since this ruling, the Service, working in collaboration with the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (APHIS or WS in this document), completed an EA in November 2017 covering the issuance of individual depredation permits for managing cormorant damage. The scope of the EA covered issuing depredation permits for the following circumstances: 1) Health and Human Safety; 2) Aquaculture; 3) Property Damage; and 4) Concern for co-nesting species. The EA did not address potential damage to free-swimming fish due to a lack of readily available scientific information on the impacts to fish populations. When the EA was completed, the Service made the commitment to engage state fish and wildlife agencies, tribes and other stakeholders in addressing the double-crested cormorant-fish conflict.

During August 2018, the U.S. Fish and Wildlife Service (Service), in cooperation with APHIS, hosted a series of four regional meetings (Little Rock, AR, East Lansing, MI, Atlantic City, NJ, and Portland, OR) with federal, state and tribal partners to discuss management issues and conflict-driven concerns over interactions between double-crested cormorants and free-swimming fish. The phrase "free-swimming fish" was used to indicate non-hatchery fish, but during the regional meetings, it became clear that there was an inconsistent understanding over the precise meaning of the term and how it is applied. This report uses the term free-swimming fish for consistency but recognizes that there may be a change in terminology needed in the future.

The primary goals of the regional meetings were to:

1. Gather available information and data regarding the impacts that cormorants have on free-swimming fish populations
2. Better understand the scope and magnitude of cormorant impacts on recreational and commercial fishing
3. Better understand the social and economic importance of the issue from the perspective of partners and stakeholders
4. Develop a model process for addressing avian predation conflicts with other species

These meetings were just the first step in the Service's efforts to collect information about conflicts between cormorants and free-swimming fish and chart an appropriate path forward in management of those conflicts. Public engagement and stakeholder input in this process is a priority for the Service. At the current time, however, the Service is not proposing any specific management method for this issue, and was only collecting biological, social, and economic data from entities we typically collaborate with initially when addressing our trust resources on a national scale.

Methods

The Service contracted with DJ Case & Associates (DJ Case) to assist with meeting format, logistics and facilitation. Prior to the regional meetings, DJ Case conducted phone interviews with key Tribal, state, and federal partners in all four regions, and the results were used to inform the format and agenda of the meetings (see [Appendix A](#) for the phone interview topic guide and [Appendix B](#) for the summary of phone interview findings).

Regional meetings were by invitation only. The Service sent formal invitations to representatives from federal, state, and tribal agency partners, asking them to send up to four meeting participants each (two from wildlife and two from fisheries) to the meeting. Invitees could attend any of the four meetings—they did not have to attend the meeting in their region.

Recognizing that meeting participants would be diverse in background, expertise, and involvement in the double-crested cormorant/free-swimming fish issue, the meeting format was designed to first provide a common understanding of the ecology, conflicts, and past management actions related to the issue, and then (most importantly) to provide a forum for partners to provide input about the current state of the issue in their jurisdictions and to solicit input on possible paths forward (see [Appendix C](#) for the meeting agenda).



Picture 1. Facilitated open discussion at Little Rock, AR meeting on August 14, 2018.

The regional meetings were facilitated by Phil Seng, Rick Clawson, and/or Dave Case from DJ Case. Each day-long meeting consisted of presentations and facilitated discussions, along with an afternoon breakout group discussion. Partners and participants unable to attend in person could monitor each meeting remotely through a live, online screen share of all presented materials and

streaming video of the proceedings (with equal opportunity to submit their input, ideas, and data sets electronically after the meetings).

Here are brief summaries of the information presented at each meeting to establish common understanding of the issue among all participants.

Overview of Conceptual Framework for Addressing Conflicts with Migratory Bird Species

In recent years the Service has been managing more and more conflicts between wildlife species and human interests (e.g., cormorants, black vultures, light geese, etc.). This presentation described the newly adopted conceptual framework, which guides management of these conflicts in a more consistent, systematic way.



Picture 2. Presentation at Little Rock, AR meeting on August 14, 2018.

History of Cormorant Management Actions to Date

In this session, presenters from the Service and USDA APHIS Wildlife Services framed the history of the double-crested cormorant/free-swimming fish conflict, management actions used to resolve them, and constraints on current management solutions.

Open Discussion

All participants were given the opportunity to share their perspectives regarding the double-crested cormorant/free-swimming fish issue. Facilitators encouraged participants to consider commenting on: Summary of the issue in their specific jurisdiction; their opinion on the usefulness of the term “free-swimming fish;” and summarizing research/data they have (and could share) that could help inform on possible paths forward.

Possible Pathways Forward

Service staff made a brief presentation on the type and scale of information needed to help inform and shape potential future actions considered by the Service regarding double-crested cormorant management.

Breakout Discussions on Possible Pathways Forward

Most of the time at each meeting was spent discussing possible pathways forward. Participants broke into small groups to discuss ideas for potential hypotheses regarding double-crested cormorant-fish interactions and to discuss options to explore in the future including possible next steps.



Picture 3. Small group discussion at Portland, OR meeting on August 30, 2018.

Results

A total of 92 partner representatives participated in the regional meetings ([Appendix D](#)). Following is a summary of participant input from the meetings. Results are presented by each major agenda item, and by each meeting location.

Overview of Species-Conflict Framework

After a brief “set-the-stage” presentation by Service staff, participants were asked if they had questions or comments. Following are perspectives offered:

- Atlantic
 - Is there an actual definition of “private property” that FWS is operating from (or is it generic like “agriculture”)? For example, are stocked fish private property? If there’s a landowner with a receipt for stocked fish, how is that different than their tractor in terms of private property definition?
 - Is there a process in mind to assess how palatable different management actions would be to the public? For example, is there a public research or input component on oiling eggs vs. other actions?
 - The Service goal seems to be focused on maintaining double-crested cormorant populations (F factor of .75), where the public seems to be leaning towards a more extensive double-crested cormorant take.
 - What is the “burden of proof” we need to bring? There is lots of data out there; much of it anecdotal, but we also see fisheries managers changing what lakes they stock and how, we have commercial fisheries folks changing their gear setups. So, there’s economic impact and value all over.
 - Permit allocation
 - What is the Service’s evaluation of the effects of the Public Resource Depredation Order (PRDO) on population control, and are there regional differences in how it’s used and the impacts?
 - Is it a numbers game? Once you issue permits for aquaculture and Health/Human Safety, there’s not much left for stocked ponds, etc.
 - Is there a priority order for how permits are issued? To give more permits to some, others have to give up their permits. How is the priority determined?

- Stakeholder engagement can be defined differently – many of our state stakeholders have been pretty vocal, so if they think we’ve backing up or starting over it could be perceived badly.
- Great Lakes
 - We did some of this back in the early 2000s, can we build up on previous efforts?
 - Is there a way to expedite the process, i.e., concurrently work on 5-6 different components at the same time? It seems like the information is all there, it just needs to be put together in a way that links double-crested cormorant management with achieving fisheries goals/objectives.
 - This issue has been around for 20-25 years; if it looks like we’re starting over there will be stakeholder backlash.
 - If stakeholders become unhappy, they could take matters into their own hands.
 - Major concerns
 - Predation on newly stocked game fish
 - Recruitment of young fish from natural reproduction into “catchable” population
- Central
 - We’ve been through this before
 - Is there a conflict?
 - Major concerns
 - Central: Aquaculture and recreational fishing
 - West: Columbia River restoration, Tribal concerns, and urban fishing/Recruitment, Retention, and Reactivation (R3) efforts
 - Permit allocation
 - It would be good to have some sort of reporting form to better inform future allocations
 - If you’ve nearly used up all your allocated permits, can you share, borrow, or reallocate unused permits?
 - Any possible categorical exclusions?
 - Prior to the court order, lots of states were just ramping up on cormorant management efforts to see what was working and what wasn’t. Kind of a kicker that now that they’re ready to test different approaches, they can’t take birds.
- Pacific
 - Is this a pathway to any future depredation order?
 - How does this fit in to the MBTA? Is Mexico a part of the MBTA as well?
 - At what point in the framework are decisions made as to who is the responsible entity for providing the resources for implementation? Management actions often push the problem off our plate and onto someone else’s. Look at evaluation at a regional or global scale, not site specific.
 - Tribal engagement needs to be more and better, giving sovereign nations the engagement that they are entitled.

History of Cormorant Management

After a brief “set-the-stage” presentation by Service and APHIS Wildlife Services staff, participants were asked if they had questions or comments. Following are perspectives offered:

- Atlantic
 - Have you experimented with effectiveness of visual barriers?
 - Can you approve all subspecies under one depredation order?
 - Biological carrying capacity – is it based on subspecies or do we not have the data to determine geographically useful capacity data?
 - Are there other fish-eating birds that have as much or more impact on fish populations? Is there a plan or approach to address that? Double-crested cormorants are an easy target as a predator: they eat fish, congregate in large colonies very visible to the public, etc.
 - Are there BMPs for stocking efforts, but also dealing with the social components/PR plan and strategy to help manage this? Need a solid science approach, but also a way to manage public perceptions so we don’t end up back in court.
- Great Lakes
 - Are there short-term control methods; are they constrained by the numbers?
 - How do we assess overall population needs/trends?
 - Is anyone addressing Canada, what they’re doing, and how that impacts us? How does this fit into the Flyway model and long-term, cumulative management?
 - Can there be a way to negotiate with the Service for desired levels of permits? Need to find a way to take existing data for a site and quickly apply it to other similar sites without a case by case review.
 - Wintering grounds and aquaculture don’t fit into current population survey and monitoring, how do you account for that? Need to adapt the frameworks for Canadian birds, and can we use feedback loops to adapt those frameworks?
 - How do we resolve conflicts? If control is not having an impact on overall double-crested cormorant populations, yet we’re trying to manage the fish populations, how do we resolve it? What is the appropriate scale for future management actions?
 - Aquaculture permits are conservative and not meeting current need, and if we want to expand control to cover free-swimming fish too, it doesn’t seem to be going anywhere useful.
 - Interpretation of allowable take could be helpful. For example, oiling eggs or taking nests: if it takes multiple rounds of nest removals to disrupt a set of nesting birds, it looks like a higher level of overall take when it’s really only nest removal to try and disrupt X breeding pairs.
 - Permit allocation
 - How did the Service determine the distribution of the 57,000 permits?
 - Did you account for nests and eggs in the level of take?
 - How did the Service know that the numbers weren’t good and that it was a weak point in the lawsuit?
 - How and when can there be flexibility for states that need it?
 - Would a better approach be to build up from the permit needs of each state for a total number of permits?
 - Can you put more controls at the local level (move this down to the states) so we can be more responsive to the public, to the local impacts and contextual needs? Like Black Vulture model – give group of permits to an agency or farm

bureau, etc. and let us allocate by state at the local level where we see the needs arise and can respond.

- Central
 - Who is responsible for breeding population monitoring? Just up north or southern states too?
 - Non-lethal management – which approaches are most effective? (Pyro, drones, lasers, falconry)
 - Would love to see some national/continental level of discussion about management – what level does the population need to be at? How and what can reduce the population down to, to alleviate some of the conflicts?
 - Is the goal to maintain/allow population growth? Wouldn't that allow or introduce more opportunities for conflict? Should we manage better for "sustainable" levels?
 - Breeding population monitoring – is that mostly up in great lakes and northern latitudes? Are we missing part of the story by not looking at southern states?
 - Will a new EA be needed?
 - Is this more of an education issue to get anglers to realize that double-crested cormorants don't impact as much as they think the birds are?
 - Lakes and water systems are complex, how do you develop useful models to help answer many of these issues/questions?

- Pacific
 - On egg take limits, how much time/energy would be saved to be out in the spring vs other times? It sounds like the goal was to drop population down to 13K nesting pair, were the estimates accurate and how close did you get?
 - Columbia River Estuary concerns – reducing the size of one colony pushed birds into other areas and onto nearby bridge (and even other state). You may find too that take around dams and other spots may be less valuable than take on the Estuary.
 - The population trend model/predictions were based on the theory of taking the full amount of permits each year, how did that track against actual take?
 - Do we need multiple NEPA docs here? The Columbia River is sky rocketing, while other western populations seem to be declining. Should there be different NEPA documents for the river vs other western populations?
 - Permit allocation
 - How were the state allocations determined?
 - Can permits be shuffled between states? What about using "depredation credits" in some areas? In Oregon for instance, we have coastal permits we didn't need to use there because other measures were effective. Don't want to lose our coastal permits but would love to shuffle them to other spots if needed.
 - Has Wildlife Services ever approached their cap?

Open Discussion - Summary of Issues

Participants were given the opportunity to discuss whatever was on their mind regarding the double-crested cormorant/free-swimming fish issue. They were encouraged to begin with a broad overview of the issue in their jurisdiction.

- Atlantic
 - Get the sense that there's a lot more data out there than we realize. There have been fisheries studies for a long time, lots of variables. How do we better tap into that and extrapolate out to other areas?
 - NC – is this mostly a communications issue? People are calling us when they see large colonies. B.A.S.S. also points to double-crested cormorants as an enemy to anglers, but bit of data we have doesn't show double-crested cormorants having large impacts (population fluctuations are linked to other factors). It's an emerging issue along the coastline.
 - NJ - Stocking trout for 10 years and starting to see growing issues on small lakes and impoundments. Double-crested cormorants show up within a day or two of stocking, and angler catch rates are shrinking on bodies of water that used to be pretty productive. Harassment techniques are just moving birds around from one small lake to another. Anglers are getting upset and not buying licenses, yet if we take birds there's outcry over that too.
 - MD – Saw first nesting pair in 1990, population grew to 4,500 pairs at peak but is down to around 500 in most recent spring survey. Not sure if weather impacts size or if colony sizes are starting to level off.
When double-crested cormorants nest on artificial structures, they become reared and reinforced with hanging around on bridges and other structures, making it harder to manage them, because knocking off a nest from a bridge counts as a take. So, we're trying to steer them away from those structures in the first place. At the same time, we also need to manage for all the species we protect and manage too. There's anecdotal evidence that there are double-crested cormorant impacts, but we need more data. But even if we have better data, it's a perception issue that the Service will need to engage with stakeholders directly (Public Fish Commissions, and others), and getting info from them will be difficult to do. Public perception can become reality really quick. Predation data will help defend approaches and future management actions and public perception.
 - RI – Double-crested cormorants were nonexistent in the 80's but we are seeing populations increase statewide and in estuaries. Every time we do a fish ladder, double-crested cormorants show up and anglers are seeing that. Winter flounder appears to see some impact, but less than commercial impacts. However, anglers are focusing on flounder in terms of double-crested cormorants, but river herring has the biggest potential of future conflict issues. Lots of money has been spent on restoring herring runs and anglers are not allowed to take them yet, so they (anglers) are unhappy about cormorants taking herring at fish ladders.
 - SC – Have had a small population and some wintering birds, have seen a small population increase. Have had some non-breeding take on Santee Cooper lake. The major public concern is that double-crested cormorants are impacting fish populations, as well as excrement destroying habitat and trees. We are interested in finding non-lethal approaches we can implement.

- VA – In approximately 20 years have gone from minimal to over 2,900 double-crested cormorants. Other areas have seen over 4,600 breeding pairs, so it's a rapidly growing population. Focusing on double-crested cormorant economic impacts is good, but need to include bird lovers/watchers in this discussion too. Tidal river herring runs present the perfect size prey for double-crested cormorants. They have propensity to deplete smaller stocked ponds. Like MD, we are seeing pound net issues (nets with fish in them have birds sitting on them). Need to be quantitative about future actions.
- Central
 - Lots of published data on double-crested cormorants out there already (diets primarily focus on various baitfish), are we just repeating ourselves?
 - If you start to approach using up your permit allocation, how do you manage in the short term? If you have unused permits in nearby states or regions, can you reallocate or borrow from others?
 - Overall, in the region aquaculture and State Fishing Recreation areas are the focus; two different areas but similar issues to deal with in both landscapes.
 - How do we all settle on an overall population size and/or goal? The biological issues we can overcome in time, but how do you best deal with the social aspects? People are calling politicians and the politicians call the agencies/directors.
 - Need to communicate and coordinate better between states, possibly through AFWA.
 - Rise of neo-tropical cormorants is an issue; need to teach people (hatcheries?) how to ID them better. Need to determine if we're actually seeing a larger influx of neo-tropical cormorants instead of double-crested cormorants.
 - Issues of scale
 - how do you best address issues at a small scale and then scale them up?
 - It's a continental set of birds; if you just focus on the state or regional level you end up just pushing the problem around. When/how do we look at the big picture?
 - AR – Cormorants are migrating in earlier, staying longer, and in larger numbers. Have seen large increases over past 30 years. Tried nonlethal then lethal control measures (balloons, ultralights, drones/remote aircraft); unsure of effectiveness but recreational fishing public very supportive of visible DNR actions in the field (nonlethal and lethal; even if only taking a few birds, public sees and is supportive of DNR staff doing stuff). Concern of sport fishermen is in double-crested cormorant take of fish: they bite into a fish and it dies. Oxbow lakes don't have dead trees for nesting, so no real impact. Concern is in managing areas where there are dead trees for nesting.
 - GA – Hatchery concerns. Currently only see double-crested cormorants in six counties, plus in fall and spring migration, plus some overwintering birds are biggest concerns.
 - KS – like MO and OK, don't see much of an issue. Suspect there are small issues, but no data to back it up.
 - MO – Not much of an issue overall. Double-crested cormorants are around, but some great blue herons and mainly otters are the bigger issues.
 - ND – Seen a tripling of breeding birds in recent years, 2014/15 estimates at over 14,000 breeding pairs. Then add in migrating birds too; has large impact on the limited number of lakes present. Adaptable and smart birds – can clean out a stocked lake within 4-5 days of being stocked. Nonlethal hazing ineffective (birds nested near a canon). Lethal take doesn't impact the population, just pushed the problem around to

other areas. Neotropical cormorants are a rising issue, but it takes training to properly ID neo-tropical cormorants vs double-crested cormorants.

- OK – The birds may be out there but don't seem to have large impact as the lakes are all nutrient rich.
- TN – expansion of cormorants along rivers, river island nesting and destruction of island habitat. Close to 100 nesting colonies currently. Marginal management success with falcons.
- TX – Neotropical cormorants are expanding north and eastward as a new population; harder to identify so be careful. Large reservoirs don't seem to be impacted, but we are concerned about small, high-quality urban ponds: stocking trout as part of agency R3 efforts. Largely a seasonal issue – fall, winter, and early spring. Also, landowners with small ponds feel left out and abandoned; they spend money to stock fish and get depredated with no recourse.

Catfish farms are a concern – time and energy raising fish only to have them eaten later. Birds adapt and habituate to non-lethal management, but if you add even a little lethal take into the mix, the non-lethal techniques become more effective.

- Great Lakes

- Resorts – on Leech Lake, MN there used to be ~ 100 fishing resorts. That has declined to about 29 now. However, this isn't as straight-forward as it seems since there of many other economic drivers besides cormorants that can (and have) affected the number of resorts (e.g. recession, stakeholders becoming involved in other activities such as ice fishing, general turnover, etc.). MN is seeing a similar pattern play out on many of their big lakes where the resort industry has been shrinking since about 1980.
- Wildlife Services: Overall, this feels like the same thing all over and we're doing what we did in 2004. Not seeing short term approaches; we have good data sets, so can a categorical exclusion suffice? What triggers? Population triggers? That could result in some management approach/technique.
- In terms of NEPA, be mindful of issues with segmenting. Try to keep everything together so that we don't look like we're trying to minimize impacts by splitting things up.
- Bay Mills Tribe – We have been monitoring nests since 2004 and haven't seen any major changes in the couple colonies we monitor. However, commercial anglers are sure interested in issue, but we're interested in the bigger picture. Even responding with something could be perceived as a positive even if we don't see much issue in our sites.
- Grand Traverse Band – We have one small bird colony in a place with a perch fishery present. We are concerned over the fishery but are also concerned for the cormorants too. Since the PRDO removal we have not seen any large changes but are aware of growing issues in other areas.
- IN – Have been studying populations since 2004, it stayed around 2,500 and then suddenly doubled in size in 2015, but then came back down to baseline. Northwest Indiana (steel mills area) has a colony of ~4,500 nests. We see some angler issues and haven't done any control there; the perch population seems ready to collapse. Have done some diet analysis and it is magnitudes larger than the angler harvest. There is also some aquaculture in the state. Need to look at management of cormorants across the entire Great Lakes, otherwise we end up just pushing the birds and issues into a neighboring state.

- Leech Lake Band – Have been involved in double-crested cormorant management since 2004. Many tribal members prefer to let nature take its course, but we’ve done some small scale management it seems to be working OK.
- MI - Fisheries are stressed. We had to reduce predator levels in some places by as much as 80% and are making tough decisions in stocking different kinds of trout to maintain predator/prey balances. Now as we add double-crested cormorants to that process, need to look at how much do they need to eat to be sustainable, and then how much impact does that have on local fisheries. It’s no longer fish vs mammals, it’s now fish species A vs fish species B. We’ve invested a lot already; feels like we’re on the cusp of losing \$2 Million of investment so far. Can we move this down to a state level like Canada Goose management?
Sustainable populations are a mandate we have, but management actions to date have not impacted the sustainability of double-crested cormorants. This seems like a larger social issue to work through as well. Legislators don’t typically get involved if it’s a biological issue, but they jump on it if it’s a social one. Good efforts on this front so far, but just talking about it won’t solve much. The Service will likely have to get into some additional social research.
- USDA-WS-NWRC – Have developed conflict models and are involved in various lake efforts. Seems that cormorants consistently predate on younger fish, so it becomes a recruitment issue.
- MN – Recreational fishing reigns supreme, so walleye is it for us. That said, our job is to sort out the social issues from the truly biological ones. Have been doing lots of diet and juvenile walleye studies., and in some years consumption outpaced production by a lot, but mortality is mortality no matter the cause (but double-crested cormorants did cause mortality rates to rise).
Tried some fisheries management approaches and it got ugly. The state mandated that we stock walleye in Leech Lake so we lost our agency effectiveness and control in that fight. Overall we’re finally seeing fish populations beginning to get back to pre-cormorant levels. But we’re also managing for zebra mussels and other issues, so we’re on the lookout future changes and possible future solutions here. At some point we do need to respond to critics on this topic, and ultimately we want healthy populations – sustainable cormorant populations and colonies alongside healthy fish populations as well.
- NY – We’re sitting on enough data to manage free swimming fish issues now. Feels like the bar is set pretty high here. As a community we won’t always have all the information we want, so it’s going to be a mix of art and science, and need to more likely defer to the art side and start taking action.
The PRDO was effective, we’ve been doing comprehensive double-crested cormorant management for quite a while. Depending on your approach, costs can vary wildly, but some items could also be implemented more effectively in the future.
- PA – The concerns and comments we hear are coming from public waters on issues like mitigating double-crested cormorant predation of newly released hatchery fish (steelhead). Haven’t seen many double-crested cormorant issues, but have seen merganser impacts. So far, natural predation of walleye has a bigger impact on that fish than cormorant predation. Anecdotally, we are seeing more cormorants around, but don’t have anything concrete to offer.

- Sioux Tribe – Double-crested cormorants have put additional stress on an already stressed fisheries. The little bit of management we've done has been effective, even if it's just from a social standpoint.
- VT – Have been doing cormorant control around Lake Champlain for quite a while. The PRDO was effective and we made a lot of headway on our management efforts, but we're afraid we're slipping back. New colonies are forming while limited permits are going to private lands folks who don't know what it takes or how to really manage them without assistance. We are afraid we'll lose all that we've gained.
- Pacific
 - Overall this is a nationwide issue, but there are lots of local and regional issues and variations. No one treatment is super effective long-term, so need a national strategy that is responsive to local needs and differences.
 - Need to involve tribes and engage them better and more often.
 - Should marine fisheries folks be here and involved too?
 - AZ – We also have resident neotropical double-crested cormorants to deal with. In terms of control, because ponds are in resident areas, we're limited in our non-lethal and lethal options. Communities vary in how much they'll tolerate us there doing stuff, but when different fish are put out on the landscape they should be afforded protections.
We're also dealing with staff and budget reductions, so it's hard to grow a program and focus on things like non-lethal control. Plus have other issues like golden algae and others that wipe out a pond. If/when permits are issued/added, we may have a small number of take that could resolve our issue. Is there a prioritization process where we could do some take and solve our whole issue?
 - Colville Tribes – The tribe operates a hatchery for chinook. The fish must pass through 9 dams in round trip travels, plus through the estuary and past Sand Island, so there are lots of challenges and impacts to those fish all over.
 - Intertribal Columbia River Commission – we don't have enough permits in the west to address all the issues (big and small). Double-crested cormorants will eat as much as is there; if it's salmonids they'll eat as much as is there when it's there. And they adapt to predation and/or just move someplace else. The East Sand Island targets are not enough; 5,500 cormorant pairs can eat the equivalent of 25,000 cormorants elsewhere. We need greater relief in the area.
 - ID – It's not just double-crested cormorants, but also white pelicans too we're dealing with. Have seen effects of cormorants and pelicans on stocked fish, in some cases they've cleared out 100% of the fish. If we don't get at least a 30% return for anglers, we stop stocking them in that location.
 - NWRS Center – Have been involved in fish-related issues all over, and it's complex, especially in the Columbia River. There are other bird species here to manage and control as well (pelicans and brants). We need a system for permitting that's adaptive (allocations, take levels, management techniques).
Small urban ponds are a concern too. It's a big component of R3 efforts for our agency. Yet most of those are vulnerable to this kind of predation. We can quantify predation in the summer months, but migration periods are tougher with other species passing through.
 - NV – We manage fish in a state without much water, but that means that cormorants zero in on the places where there is water. Urban stocked ponds are a big part of our

program, trying to provide fishing opportunities for the public. But double-crested cormorants will take 80-90% of the fish in a given location. Not really sure what the best steps to take are; you could stock later in the year, but then the public only has a few weeks to fish before winter. Have done some studies, but this really is an ongoing issue for us.

We've seen that habitat management in outback areas can work, but if you have a double-crested cormorant colony on a lake in public view, how do you best deal with that? Overall it seems that we have good breeding population monitoring, but don't have western population movement and around the Flyway/broad scale.

- OR – We manage along the Columbia River, plus 3 coastal systems. In one area we're seeing 40% predation rates on salmonids, but there is still a lot more to investigate as a lot can vary one year to another. We're looking at impacts to juvenile fish, but we still don't know how additive double-crested cormorant predation is. Yet, we still need to protect the species we're entrusted with. We support 30-50% of the entire double-crested cormorant western population, so solutions will not be easy. The Caspian tern strategy is good example of something that might work: creating habitat in areas away from fish species of concern, which would open up management steps in the areas we need to protect the fish.
- Southern Oregon Tribe – No recognized fishing rights, but concern is there. We know that double-crested cormorants eat fish, and we're seeing habitat/tree damage. We would request that lethal take permits be put into federal repository for tribal use.
- UT – Like others, urban fisheries and human population concentrated around Salt Lake City. Have seen hard predation on fish in stocked ponds, at best only 30% returns in these ponds for rainbow trout. We realize that there are no silver bullet solutions, but we're not eager to pursue active predation and prefer passive management where possible.
- WA – In the Salish coastal system we see much lower breeding use, but many adult double-crested cormorants are there, so we don't want that system and issue to get lost. Connectedness to the Basin needs to be kept in mind too: the salmon move up river and cormorants follow them. Plus, this is an altered ecosystem too, which ends up dramatically reducing natural salmonid processes while improving things for double-crested cormorants. We're trying to manage "natural systems" in a highly altered landscape. Also, treaties and executive orders for tribes that depend on them for basic subsistence can't be lost in this process either. And often we're dealing specialized predators, but double-crested cormorants are very adaptive and will eat just about anything, which makes it tougher.

It seems like there is a lot known about double-crested cormorants and others in relation to fish, but there are areas needing additional research too. How do we think about the nature of the conflict in some areas in the west? There are issues of public support a concern too. And no matter what we do, it's likely going to get expensive.

- WY – We're starting to get feedback, and lots of concern is growing over double-crested cormorants and pelicans. Not a lot a research, just a single large file of studies to date.

Open Discussion - Comments on the Term “Free-swimming Fish”

In the Open Discussion segment, given the many different interpretations and use of the term, participants were encouraged to give input on the usefulness of the term “Free-Swimming Fish.”

- Overall comments
 - Need a new and consistent definition
 - Concerns in many areas, but in particular regarding stocked fish (which require a lot of investment to grow); when and where in the release process do they lose protections and become free-swimming fish?
- Atlantic
 - Where do fee fishing lakes fit? It’s not really aquaculture, but it also doesn’t really fit in other areas.
 - Commercial fish traps in Maryland—once fish are trapped in a pound net are they still considered Free-Swimming Fish? (If a person takes fish from them, they can be charged, fined, and arrested).
 - There are different types of fish: hatchery (and various sizes/classifications there too), natural reproducing populations (game, non-game, others), dam-bound fish, and private/small impoundments. How do we shift the terminology as we move forward?
 - When does a fish become a Free-swimming Fish?
 - Stocked ponds: if we stock fish and they are quickly predated, it impacts our management decisions whether to stock there again in the future.
 - A fish going through a dam (manmade obstacle) becomes disoriented (and is predated due to disorientation), then reacclimates, so is a free-swimming fish, then not, then again?
 - Managed fish
 - Most automatically think of game and stocked fish. Don’t often think about species of concern and others. Or do we clarify that we don’t mean aquaculture? Is “managed fishing resources” a better term (lump all vulnerable species together)?
 - Wild fish – can you use wild and managed fish interchangeably?
 - Would it help to lump this in with species of high conservation concern to help cover some of this?
- Central
 - Recreational and commercial fishing have different understandings of the issue.
 - Need to include both public and private waters in definitions and in any future actions.
 - Hatchery fish – when released their classification changes (exactly when should their classification and protections change once released?), but they are still vulnerable for some time and have a huge investment in raising them prior to release.
- Great Lakes
 - Where do we draw the line on stocked fish (from transport, to lake introduction and acclimation, to when they finally disburse (sometimes days later))?
 - Not a good term when talking with the public. Better to define and talk about the species of concern or species that are impacted by double-crested cormorants. (in MN for example, they are “managing recreationally significant species”)
- Pacific
 - Should we think about or look at other terminology when dealing with the public?
 - Overall it should be seen as “any fish that’s not contained.”

- The definition should address underlining needs of the fish and their uses (tribes, etc.).
- Need to include fish in natural and artificial environments, and not just recreational fish released, but forage fish raised to support them as well. Small put and take environments are intensively used by anglers and we want to protect and support those. Plus, local and private ponds should be protected, for recreation or even for water quality.
- Including forage fish would be good to include on future discussion/considerations.
- No one definition fits our need or fits all. Were the fish there naturally or put there? Different fish stages affect outcomes later too: an egg vs a fry has different value in the possible return as an adult later. For example, look at cattle: we put calves out bigger to increase odds of survival from wolves, so what are the things we're doing or can do to protect our fish from bird predation?



Picture 4. Small group discussion at Atlantic City, NJ meeting on August 23, 2018.

Open Discussion - Research/Data sets

In the Open Discussion segment, participants were asked if they had research/data they could share with the Service to help inform future direction.

- Atlantic
 - Service should start with a comprehensive literature review to pick up on new diet studies, etc. and better understand what double-crested cormorants are eating.
 - Double-crested cormorants are visible around recently stocked ponds but need to see more data on predation rates. Fish predation is also a natural mortality, so in some places double-crested cormorants could be useful?
 - Is it a problem if you pass the Maximum Sustainable Yield? Seems like they can bounce back quickly.
 - Is this a cultural issue or carrying capacity?
 - Lots of assumptions embedded in data/charts out there; do we have a significant number of double-crested cormorants in the U.S. during breeding or other periods? Can we effectively monitor and manage the population to the Maximum Sustainable Yield? Can we knock them back enough where it takes several generations for them to climb upwards again?

- MD – Anecdotal evidence that there are double-crested cormorant impacts but need more data. What are impacts after a fishing tournament (lots of fish released in one spot, all a little beat up)? Did some food habit studies (eating hog choker and less desirable species; no game fish), but hard to collect this data during migration.
- NC – The data we have doesn't show that Double-crested Cormorants are having a large impact on fish populations. Have done some basic diet studies and starting to survey the coastline areas (sounds and nearshore areas) via air and ground.
- RI – studied fish consumption in the 1990's in the bay.
- SC - Have some data sets: herring commercial and passage data, etc. and have done some fly overs to survey double-crested cormorants. Don't have any cause-effect data for sure, but still trying to pull everything together because it's relatively piecemeal.
- Central:
 - What data do you need and what do you plan to do with it? Are you exploring data from universities, fish farm research centers, USDA too?
 - AR – studied this loosely, but no quantifiable data
 - ND – diet studies in years past (opportunistic in eating whatever fish happened to be in that lake)
 - OK – some earlier diet studies (looks like birds are eating shad). Not a big issue in our state so not a lot of research.
 - TN – 2006 statewide survey, plus check on major colonies in state the past few years
 - TX – lots of published data out there already; have conducted diet studies on large public reservoirs, but can't link diet to impacts on overall fish populations).
 - Data questions:
 - Is water turbidity a factor in double-crested cormorant diets (game fish hang lower vs shad near the surface) or is diet merely a matter of opportunity/eating what's close at hand?
 - Any research showing that fish stocked for a certain period of time in a small pond or lake that show less predation after some time (a few days? A week?)
 - Sociology/Human dimensions issues...how/why do anglers think what they think and how could we possibly influence that?
- Great Lakes
 - The ecosystem has changed since the PRDO was put in place and perch isn't the only food choice, some other fisheries are being predated by double-crested cormorants, so be sure to factor that into your diet studies.
Need to look at the biomass of double-crested cormorant impacts vs anglers. We're typically talking about double-crested cormorant effects on recreational fisheries, and not talking about double-crested cormorant effects on other fish species. If you're talking about biomass totals, there's no metric to follow.
 - Prey - Some predators track well with specific prey species while others don't at all. This makes it difficult to understand prey response to double-crested cormorant increases and requires conceptual models to be species specific (i.e. the functional response of prey in relation to cormorant increases will look different depending on the prey species)
 - Angling effort – National survey (requirement of Dingell-Johnson Sport fish restoration act) provides information on dollars spent per fishing trips. Paired with creel surveys where the number of fishing trips are estimated, the economic impacts of double-crested cormorant increases and/or response to management activities can be

approximated. Analysis over time should provide information about when and where fishing trips have declined (i.e. to get at economic loss/impacts).

- This should be easy to address within 6 months using creel data on systems where control programs have been implemented
- Fishing pressure – can get this information from creel survey data. MN DNR has this from 2008-2011 in Leech (more sporadic elsewhere in the state). This data is collected annually on the Great Lakes using a port approach (some important ports are “fixed” and surveyed every year; other ports are surveyed on a rotating basis)
- Bay Mills Tribe – We have done double-crested cormorant nest counts since 2004 and haven’t seen any major changes to the colonies we monitor.
- IN – Some diet studies; double-crested cormorant harvest of fish is magnitudes larger than the angler harvest.
- Leech Lake Band – Have conducted artificial egg studies, replacing one egg in the nest with an artificial one, so parents have 1 chick to raise and don’t abandon or re-nest elsewhere. Approach is effective on cormorant population and cost-effective to implement.
- MI – Have hard drives full of data, with stuff like long-term fisheries data, and some double-crested cormorant interactions. How much do you allocate to each group and how much do you want to allow for escapement? If you reduce it to that, it should be manageable.
Cormorant population will look like recruitment early on in the phases, so need to be careful about how we monitor and characterize double-crested cormorant predation. How do we evaluate double-crested cormorant impacts moving forward? Have to look at mortality rates – first fish mortality, then look at double-crested cormorant mortality. Begin to develop models of double-crested cormorants as another fisheries perhaps? How vast are these populations? What about scarring rates or other criteria to investigate?
- MN – Have tried some artificial egg approaches, as well as lots of diet and juvenile walleye studies. When double-crested cormorant consumption exceeded the threshold, then we saw population blips, with maturity and recruitment levels climbing, but we’re curious to compare to other systems with good data. Our bigger lakes have long term data sets from annual surveys.
- PA – We have lots of good water data via University of Michigan systems, but since the PRDO was revoked, it seems like a good time to monitor nest counts in the meantime to see what’s happening.
- Sioux Tribe – We have long-term fish population data sets, but it’s been hard to link to double-crested cormorant factors vs other factors.
- VT – Have done diet studies for several years via fisheries. Trying to figure out how best to use all the data we have, but have been stymied at showing a cause-effect in regards to cormorants. Can we use good data from successful sites to inform management decisions on other lakes?
- Pacific
 - As the process moves forward, if you anticipate new modeling, what would help you to refine those? What data gaps do you have?
 - Do the management actions we’re taking add to the numbers of adult salmon returning, and is that the right metric? We can reduce predation on juveniles and call it success?

- The number of double-crested cormorant's is one issue, but would love to know more about the conditions of the fish (barge vs spillway vs others), are integrated hatcheries eaten at diff rate than segregated? Plus more research into predation rates would be great.
- How does/might the framework adapt to areas where the data isn't very good? Also need to focus on understanding the magnitude of the problem (are the birds presumed guilty or innocent first until proven otherwise?).
- AZ – We have data on banding cormorants to look at movement in urban settings, plus others.
- ID – Have data that demonstrates double-crested cormorants and pelican effects on stocked fish (in some areas they take 100% of stocked fish). We can quantify the effects of cormorant predation in the summer, but harder to peg down during the migration because of other species passing through. ID Columbia River Commission also has lots of data available.
- NWRS Center – Salmon smolts face issues out in open water too, so more research and monitoring is needed to better understand salmon fisheries.
- NV – Below Davis Dam (Bureau of Reclamation site on the lower CO river), we have a study looking at avian predation on sucker fish.
- OR – Have lots of data and a 1-page paper we can share.
- WA – We have tons of data, but need to index it and also ID data gaps. Would love to see comparable knowledge in the Salish Sea area as we do in the Columbia basin. Linking the data we know to breeding would also be helpful.
- WY – We have a single 5 lb. file that is the sum-total of all we've done. We did a study in the 80's on double-crested cormorants, which attributed 80-100% predation rates on recreational fish. But we lack any current data and need to address this moving forward.



Picture 5. Small group discussion at Little Rock, AR meeting on August 14, 2018.

Possible Path Forward

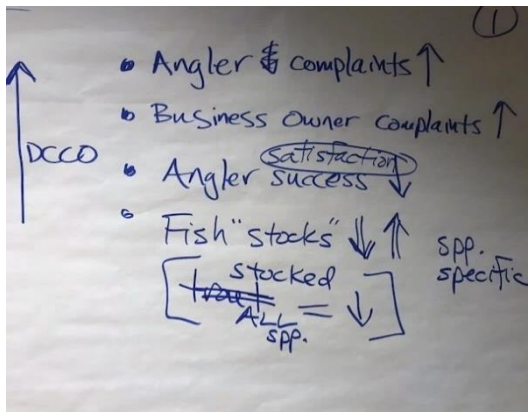
The majority of time in each meeting was spent discussing possible pathways forward. Participants were asked to consider, discuss and provide their ideas on possible steps and/or hypotheses that would help improve the current double-crested cormorant/free-swimming fish issue. Participants in each region were divided into breakout groups (in whatever geographic or issue-related groupings seemed most appropriate in that region), and were given 1-2 hours to address the following items:

Key questions to discuss and address in breakout groups:

- Can you identify the factors that are impacted when double-crested cormorant populations increase? (creating graphs on flip charts),
- What research topics would most inform the cormorant-fish conflict? (if there were no money or budget concerns; what would help crack this nut?), and
- What elements are necessary to better understand the first item above?

Atlantic Region

- In the Pathways Forward presentation, Hypothesis 1 and 1A: in #1 some fish may increase if you outline that as Hypothesis 1B. Hypo 3 - Could also relate to forage fish.
- Possible hypothesis/breakout groups
- Blue Group



P. 1 – as cormorant populations go up, what happens to fish stocks, angler interactions, etc.... increase angler complaints, lower angler success (lots wrapped up in "angler success" – needs to be better defined)..trout stocking for instance.

- What about bird watcher complaints possibly going down?

Scales of Impacts (2)

	<u>Complaints</u>
⇒ Impoundments (e.g. <250 ac.)	+++
Large >250 ac.	++++
⇒ Natural Lakes	++
⇒ Rivers	++
⇒ Fish barriers (e.g. dam, culverts, weirs)	+++
⇒ Sounds/Estuaries	++

P. 2 – scales of the impacts...AFS less than 250 acres for small impoundments. Large lakes should include natural lakes too? As far as stream size – not seeing double-crested cormorant's in small streams as compared to larger rivers and estuaries.

Temporal scales (3)

Breeding

- ⇒ ~15 mile forage radius
- ⇒ Larger water bodies
- ⇒ Islands attractive

Wintering

- SE States

Migration

- Timed to fish migrations
- Spring stocking timed to migration

P. 3 – Temporal scales...larger water bodies with islands seem attractive. ~15 mile radius around islands for foraging ground? Wintering in the south a factor. Double-crested cormorant focus in on heavily stocked areas.

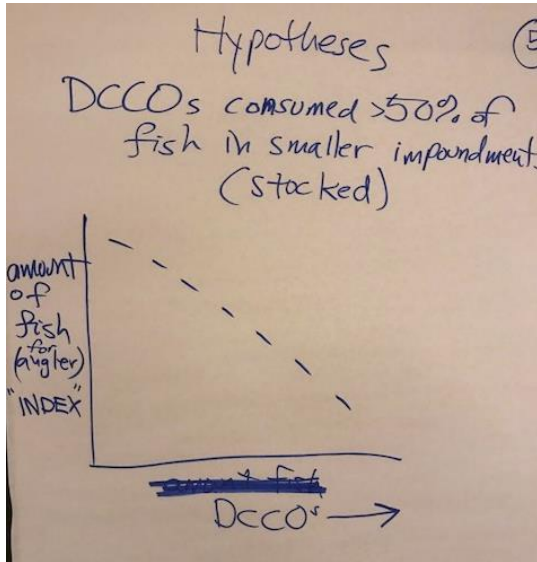
④
What info./data do we need
to proceed?
small impoundments
- quantify fish being removed.

Case studies? (~3)
empirical data
- fish ^{study}
- birds
- human dimensions (Anglers)

Focus - small impoundments
- pound nets (stacked)
- at barriers (dams)

*Economic Loss Data!!

P. 4 - Take studies...there are a lot of literature out there that should be looked at. Need to look at stock density and food studies and other factors. Economic loss data would be super helpful.



P. 5 – Hypothesis: double-crested cormorant may consume 50%+ or greater of small impoundments?

- Red Group

2 potential Questions/objectives

Managing DCCO sustainability

Managing for minimizing Fisheries Conflicts

ψ We need to determine at what level is there an impact

Def of impact
 Biological, ~~economic~~ Socioeconomic
 ↳ ties back to court decision

P. 1 – minimizing conflicts, what level, court findings...

② Biological Impact

Small

- Closed system

Mortality Sources

Stacked → ~~more~~ easier to measure economic impacts

non-stacked

Inputs = (N + age classes)
 Fishing mortality info by way of Cree |
 Cost per fish/BIASS
 CPUE
 Value ~~of~~ of each fish to local economy
Collator - compare species composition of system versus DCCO by way of fish habit study

Oh crap, getting into the weeds!

P. 2 – closed small system study exploration...we're focused on double-crested cormorant, but there are also other fish-eating species that would have an influence.

③ Need Better Diet Data for many geographic areas

e.g.) Bluecatfish / blue crab diet example

```

    graph LR
      DS[Diet Study] --> DCO1[DCO not eating]
      DCO1 --> NLM1[No Lethal Mgmt]
      DS --> DCO2[DCO eating]
      DCO2 --> C[Compensatory]
      C --> NLM2[No Lethal Mgmt]
      DS -- Public Process --> DCO2
  
```

Bring this understanding to the public, ask for acceptability or rejection

- Do we need to know the cultural carrying capacity for DCO and compare to that to Biological Carrying Capacity
- Perhaps bringing bigger (spatial) in during lit review, into ecosystem hitting lightly, but then returning to DCO problem.

P. 3 – need better diet data...but the real issues are in the social realms...cultural carrying capacity vs biological carrying capacity.

④

Bird Advocates

Fishers/Anglers/Fish interests

people

DCO →

arr. pop.

cur. pop.

IDENTIFY?

% instances where FISH impacted?

① Reduce Broot spp?

- No Silver Bullet – what will move us forward imperfectly classic adaptive mgmt.
- Consent building – can you get to a point w/o outright oppos? Not jeopardizing effort?

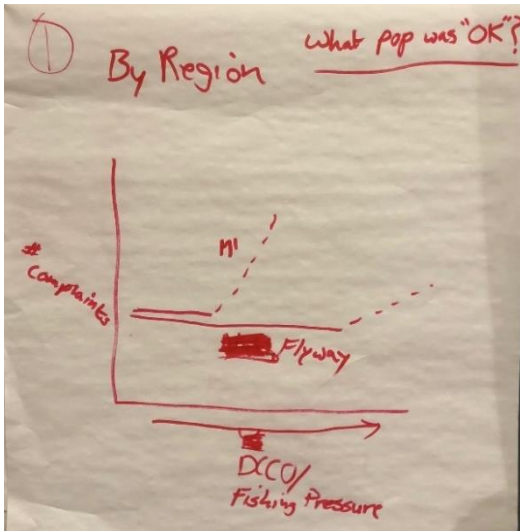
P. 4 – exploration of cultural carrying capacity – if you controlled anglers, some may still think you need to kill more. How do you find the ideal? End result = no one happy, but both groups are at least not sabotaging the effort.

P. 5 – (no picture provided) long term process of managing this resource...how can we incorporate one small step into this process? Lit review perhaps to incorporate?

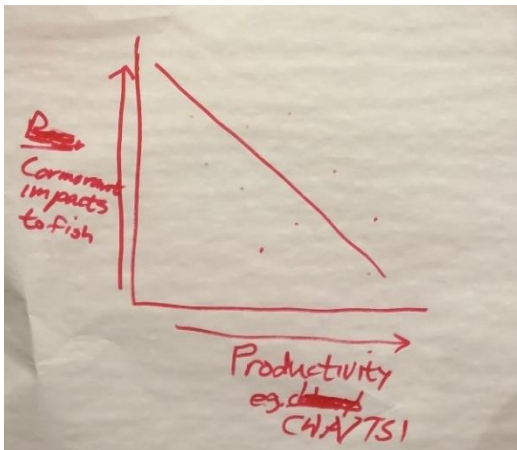
- Padding - Incorporating evaluation into management decisions?
- Angler satisfaction greatly influenced by good stringer of fish, whether there's a double-crested cormorant there or not.

Central Region

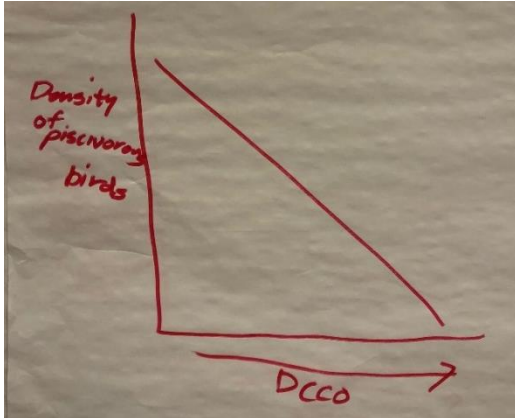
- ID the factors that are impacted when double-crested cormorant populations increase? (creating graphs on flip charts)
 - Conflicts proportional to bird #'s
 - Impacts on small systems can be assessed (or assumed), but large systems are difficult
 - Expand EA PTL, lower limit delta to cover free-swimming fish
 - Relationship (even qualitative) between limited take (establish threat of lethality) and hazing
 - Assign private water fish to category under aquaculture
- Red charts/hypotheses



#1 – What pop was OK? Chart – correlation between # of complaints received with size of double-crested cormorant population. Is there a point at which they are not creating perceived damage (free-swimming fish, but also other bird habitats)?



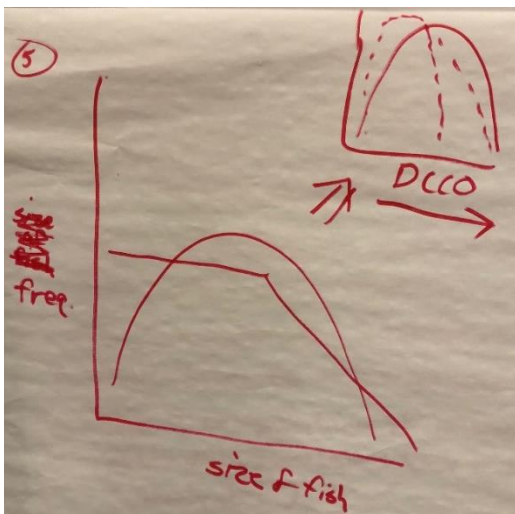
#2 - As Cormorant impacts decline, productivity increases (can fisheries increase productivity to decrease cormorant impacts?)



#3 – Double-crested cormorant abundance (increasing) vs diversity of other piscivorous birds (increase in double-crested cormorants shows drop in other bird species)



#4 – size of double-crested cormorant pop and diversity of sport fish in a body of water (drop in abundance from increase in double-crested cormorant pop)



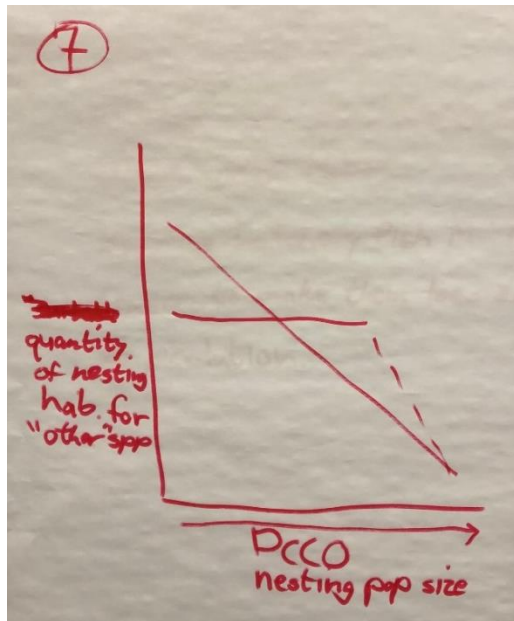
#5 – relationship of double-crested cormorant pop size and the size of the fish they choose to prey upon. What happens when the optimal size of fish gets decimated?

- ⑥ doc incidence of fish injury (DCCO - caused as index of sublethal prob.)

Research Topics

- DCCO productivity vs. level of take (i.e. - degree of DD response)
- What is best way to disperse roost sites to minimize depreat.?
- What is composition of immigrants after disturbance (same birds or new) (already done?)

#6 - double-crested cormorant nesting pop size vs quantity of nesting habitat for other species (impacts habitat and on other more sensitive species)



- need lit review of disturba
- ⑧ techniques/efficacy
- effect of structure on DCCO pred rates.
- keeping hatchery fish in "runw longer to make them less suscep to predation.

- Blue charts/hypotheses and possible research topics

* Data needs for economic impacts to private lake fish losses

* Define free-swimming fish

* better understanding of relationship of other colonial bird predators (e.g. neotropical white pelicans) - and their distributions and abundances

- Economic impacts to private lake fish losses
- Define free-swimming fish
- Better understanding of relationships between double-crested cormorants and other colonial bird pops like Neotropical cormorants and pelicans
- Document the incidence of fish injury (double-crested cormorant-caused) as index of sublethal problem
- Double-crested cormorant productivity vs the level of take (degree of DD response)
- What is best way to disperse roost sites to minimize depredation? (or breakup/spread of colonies to other bodies of water)
- Composition of immigrants after disturbance (same birds or new coming back to site)
- Need lit review of disturbance techniques/efficacy
- If structure is increased in a lake, will it result in diminished impacts of the fisheries)?
- Keeping hatchery fish in "runways" longer to make them less susceptible to predation.

* Conflicts proportional to bird #s

* impacts can be assessed (or assumed) at smaller, simpler systems; assessing impacts on large, complex systems difficult - break out system categories into groups

* Expand aquaculture EA PTL lower limit (the Δ) to cover free-swimming fish (at least smaller water bodies)

* Relationship (even qualitative) between limited take, threat of lethality and hazing

* Assign private water fish to category under aquaculture EA (e.g. private property)



Great Lakes Region

- Are you looking to create a model (a generic double-crested cormorant-fish interaction model, but not specific to any body of water)? And if so, what would be the objective of that model?
- Michigan already has a Great Lakes model for double-crested cormorants, not just for interactions, but for management effects and bird management too.
- In the case, seems like the judge was asking: is it worth it and what are the impacts to double-crested cormorant populations? What's the risk for cormorants – have we explored this?
- Identify inland systems in N. America where control programs have been implemented for a duration sufficient enough to observe measurable changes in cormorants and presumably fish populations (i.e., ability to identify “tipping point” in fish populations associated with double-crested cormorant expansion and management). Using an index of system productivity relative to take (i.e. morphoedaphic index [MEI] safe harvest levels, other similar models/metrics), plot “safe” cormorant population level (foraging days per acre, consumption per acre, etc.) as a function of system productivity (MEI, chlor-a, total P, etc.). If the correlation(s) is strong, this approach may help set double-crested cormorant targets that would be more sustainable and guide future efforts within this context. Potential lakes for which this data likely exists includes Oneida, Leech, Brevort, Champlain (perhaps others in the south?). It would be best to look at lakes across a latitudinal range. (“Large Lake Model”)
 - Can the large lake model (Leech Lake Approach) be applied to discrete areas of the Great Lakes with high cormorant-fish conflicts? Example areas discussed were Green Bay, Beaver Islands, Saginaw Bay, and Les Cheneaux Islands.
 - Application to the regions in the Great Lakes, for the purpose of setting double-crested cormorant management targets and balancing free-swimming fish consumption, could follow these steps based on the large lake example:
 - Establish a productivity measure, similar to MEI, but based on prey fish per hectare estimates in large-scale regions of the Great Lakes.
 - Use the productivity measure to scale double-crested cormorant consumption with other major predator fish and their consumption of prey fishes.
 - Apply estimates of fisheries effort, catch, and cost per trip data to proportion prey fish production for fisheries and double-crested cormorant consumption to inform double-crested cormorant management targets.

○ Eastern Breakout Group

FSF = free swimming fish
Eastern EA
①

Starting Point

where have impacts been identified?

Does control of DCCO ~~at~~ ^{for non-fish nat. resources} colonies reduce DCCO to the level that helps ~~at~~ free swimming fish?

Perhaps

If yes, it becomes less urgent to control for FSF

②

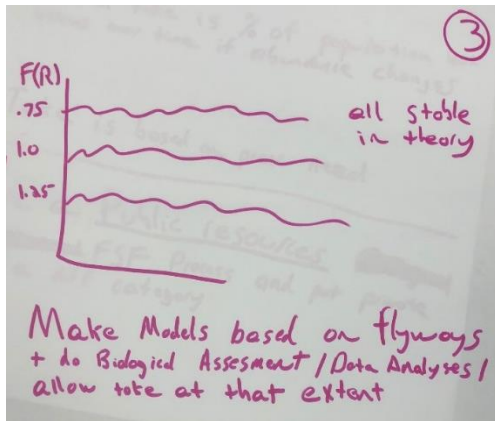
Small Systems are likely the ones where impact extrapolation is possible, but systems are often diff from larger systems

Non-breeders in the system
What role did they play?

Why not just update the old EIS/EA with the best available information?

Can current EA

Group charts, P. 2 – some of the system with biggest impact is your smaller local ones. No talk about non-breeders as well. What about simply updating the old EA with new data?



P. 3...we have a recovery factor of .75...stable population, could it be stable at a lower level? National approach and species conflict; b/c the species is at a flyway scale, why not try to align those factors?

-
- ④
- 3 Approaches
- ① Manage for population goals
eg. Leach lake
 - ② Lethal take is % of population but varies over time if abundance changes
 - ③ Take is based on prev. need
- Have a Public resources
- ~~FSF~~ Process and put private into a diff category

P. 4 – 3 approaches for looking at the allocation of take. A) Leach Lake model, keep a flat level. B) PTL approach taking a percentage of the population. C) ? Def of free-swimming fish...there are benefits to expanding the definition, but also detriments (more analysis, but open to more criticism too). So take a step back and look at it as Public Resource management.

⑤

Hypothesis

H) There are economic inputs at fisheries
what do we need?

Lets take the data we have and write a great EA!

P. 5 – let's take the data we have and write a great EA!

⑥

Rather than saying - "We need new data, we need new models"

A better strategy is...

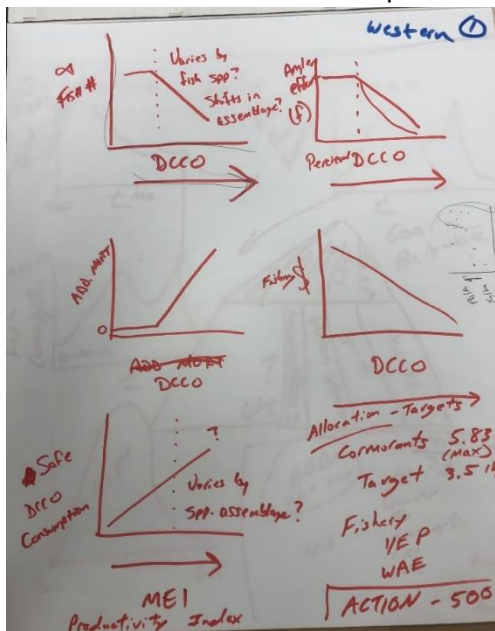
"We think you have good data, we need your help to help us understand the current landscape of knowledge"

P. 6 – could be different approaches for this data call...vs we think there's good data out there, lots of long term work – we don't have the expertise, so can you please come together and help us through this?

Messaging...we don't look to you to prove anything to us, we are looking for your help.

- Central Breakout Group
 - Allocation of mortality...difficulty of doing that.
 - Statistical catch at age models...we have much of the requisite data, but don't have age of fish being caught. Borrow data from fish community? Or go back to Maruka models of eating at age 1, 2, 3?
 - If predation was reduced, how would that relate to a sport fishery? What ratio would be brought back into the fishery?
 - Economic issues...\$5M in expenditures pre-collapse.
 - What factors are impacted when double-crested cormorants increase?
 - Fish of course, since double-crested cormorants eat fish. But that's necessarily bad and it may not be actionable. Think about actionable impacts, which leads to policy issues.
 - Lots of folks want to keep this as a biological issue...think climate change. Spend more time talking other stuff instead of focusing on the policy issues that could/should come out of that.

- Western Breakout Group

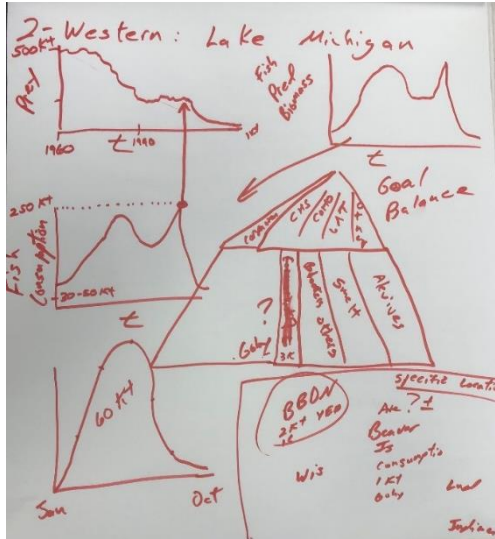


- P. 1 – Leech lake model (inland lake model?)

Economic impacts model/chart

Productivity impacts (foraging days, or consumption rate)...good to point but then see impacts

- Lead to an action of 500 nests...we may not have data to fill all these, but what if we did?



P.2, sequence of charts:

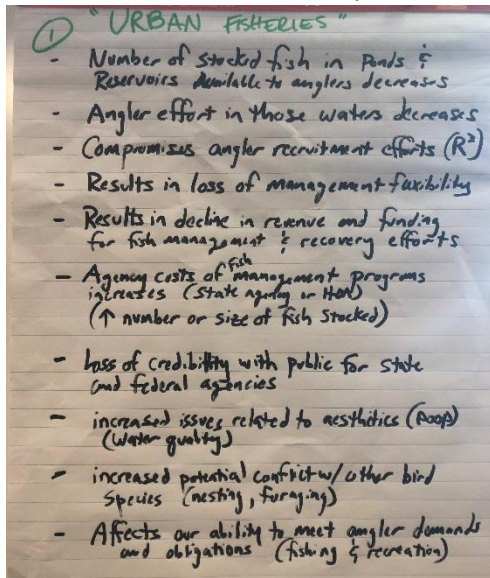
- Can we apply this approach/model to big bay?
- Lake Michigan model...productivity model is tough.
- Fish predator models next – mussels cleared the water, so despite the downtick saw a brief blip up in predator mass before a crash. So then from those models – adding it up it showed it wasn't sustainable. Then into gobies...seasonal component that built and diminished each year.
- So, apply the Leech Lake model scale it up to address local and global scale. Need to know more target species data, bird composition, etc. to adequately scale this into a usable model.

We think the data is there, but if we use it better and apply it to areas (not the whole great lake) it could be useful.

Pacific Region

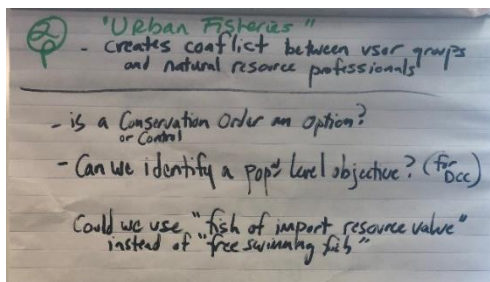
- The Caspian tern strategy is good example of something that might work: creating habitat in areas away from fish species of concern, which would open up management steps in the areas we need to protect the fish.
- Understanding relationships better would be helpful; fleshing out some of the graphs to work through control measures. Just remember that there's enough data to look at some predation factors, but there are lots of things at play in the estuary so beyond very simple relationships, it may really tough. And some southern areas don't have the data we need. What's the bar at this stage?
 - We need to see areas that we have the data to ID the relationships and can apply monitoring strategies together and try to find some areas of success with this.
 - Some of this can applied to salmon recovery trends, instead of sport landings you look at salmon recovery. In NMFs and some other models, using lifecycle info, we can develop some hypo focusing on salmon recovery trends.
 - Building in uncertainty to all of these will be key. How we prioritize uncertainty for a listed species is different than for other species like yellow perch. How certain or uncertain do we need to be?
 - Do we need to establish a baseline? Are we looking at increasing or decreasing double-crested cormorant populations or conflicts?

o Urban Fisheries Group



P.1 - if double-crested cormorant numbers increase, available #'s of ponds decrease.

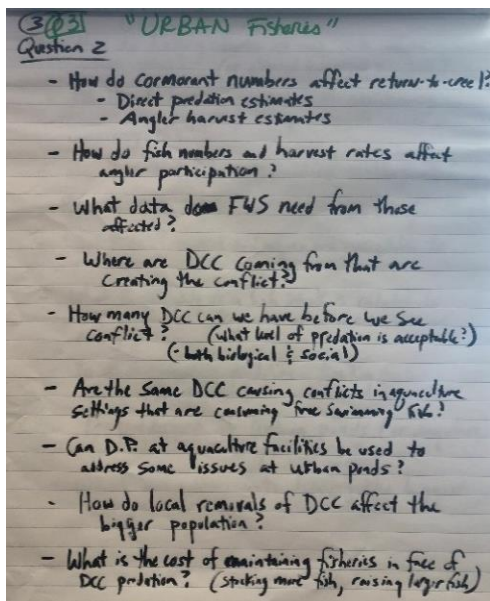
- Catch rates go down.
- R3 will have trouble achieving goals.
- Increased double-crested cormorant losses make it harder for fish management. Leads to long term loss of funding for agencies.
- When sport fish \$ goes down, the ability to manage for other species decreases too.
- Not stocking is not an option, so if predation, we need to pump more fish into the system to make up.
- Lose credibility with the public.
- Aesthetics issues (impacts R3)
- Conflicts with other bird species.
- Impacts ability to meet angler demands.



P. 2

Increases conflicts with other recreational groups. Is a conservation order possible? Are we willing to take out double-crested cormorants so that other species can benefit?

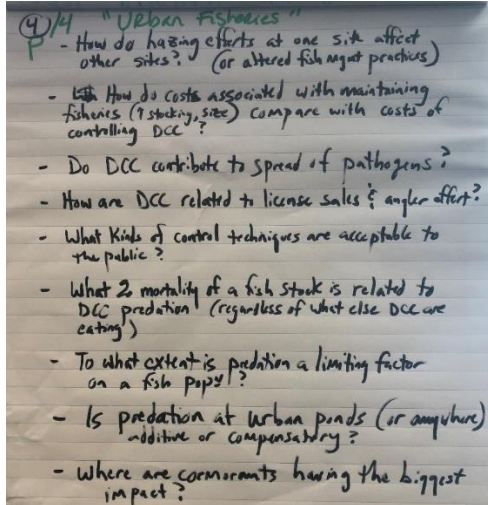
- Can we ID a population objective for double-crested cormorants where anglers, public, etc. are OK with?
- Can we use fish import value (update definition of free-swimming fish)



P. 3 – what info most inform double-crested cormorant/fish conflicts? And elements needed to better understand this?

- Double-crested cormorant effects on return of krill, fish stocks, etc.
- Angler harvest, etc. other data available?
- Angler satisfaction – just getting out there or catch rates related to angler success/happiness?
- What data does USFWS need to prove (burden of proof) that double-crested cormorants is an issue, has an impact on our operations and fisheries?
- Where are the double-crested cormorants coming from, how many are there, what is the picture like as a meta population? If we move them, what's the cause-effect? Will others just move in and from where?
- At what level can double-crested cormorant-fish co-exist w/o a conflict?

- Aquaculture setting – is the same birds as in other settings?
- How do we quantify and put a value on raising larger # of fish, bigger fish, etc.?

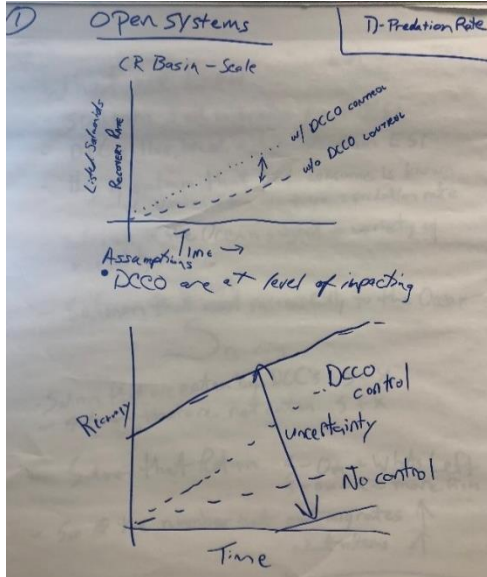


P. 4 – (cont'd.)

- How does hazing on one site affect another pond?
 - If we change mgmt. on one site (aquaculture) do they just move to another site like a dam?
- How does the cost of stocking fish compare to costs of controlling double-crested cormorants? [Several folks like this one]
- Do double-crested cormorants impact the transmission/spread of pathogens (algae showing up in other systems that aren't linked)
- What kinds of control and at what level is acceptable?
- What is the overall mortality of overall fish stock?
- To what extent are double-crested cormorants a limiting factor on fish pop? (compensatory?)
- Is predation at urban ponds compensatory or additive?
- Where are double-crested cormorants having biggest impact?
 - In a control order or any action, there is pop monitoring that will be needed to illustrate the impacts of that action...could lead to states needing to kick in support. States are already kicking in \$\$ to compensate for losses)
- Color of the money and eligibility...funds are coming from wildlife...
 - Decision making should be around the species framework. Coming to a regional agreement is important on this. Often already different groups (wildlife vs fish) in our own agencies, let alone adding Tribal into this.
 - MBTA pushes through Flyway, which is often wildlife chiefs
 - Pacific Flyway is in good shape...hopefully on par with what we're already doing
- Urban fisheries being managed...are we even using the right model? This is almost like aquaculture – small, controlled ponds with high #'s of fish. Becomes a public loss issue. How do we view and address this?

- Would need to agree on a uniform monitoring approach if we're to try to address a country-wide population objective.

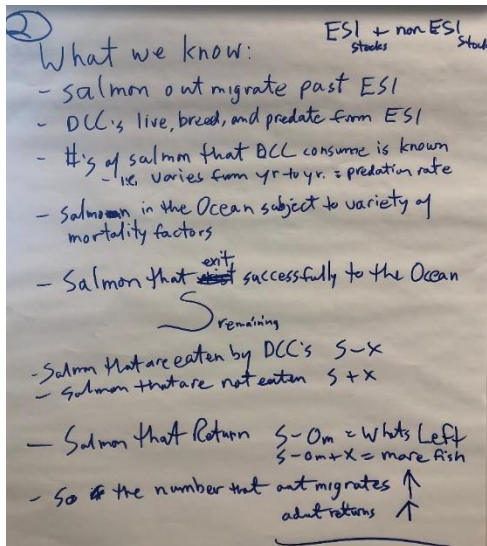
- Open Fisheries Group



P. 1 – how do we know how big of a problem it is, and impact we're having?

- Chart 1 - if double-crested cormorants having an impact on recovery on the Columbia River, vs time...no double-crested cormorants should be measurable/comparable impact

- Chart 2 – double-crested cormorants impacting fish runs...but still could be so much uncertainty in the system that it's hard to prove the linkages. So how do we deal w/ the uncertainty?



P. 2 – we know what happened to smolts and can make assumptions about double-crested cormorants predation. We could make predictions about SAR/adult return, in theory reducing the amount of predation will lead to increase in population size.

③ To include nonbreeders in future analyses

- Consider splitting WP into different Mngt units - analysed separately
- What about these created habitats
- Low connectivity between ~~WP + State of~~ Coastal + interior?

P. 3 – uncertain components of predation impact is # of non-breeding birds in the population. Take Salish Sea – overwintering birds...how do you account for that? Understanding the influence of non-breeders.

- Understand the coast a fair amount...but what's happening on the Columbia could apply to other areas in the interior (like AZ)... but those states could be limited in their response b/c of what's happening on the Columbia. Knowing the connectedness of the systems- actions on one and how does that affect the other?

④ Put + take fisheries - open waters

stacking rivers

P. 4 – chart: if you have an increased number of double-crested cormorants = low angling success

⑤

Burden of proof vis a vis uncertainty?

P. 5 – uncertainty theme...steelhead returns fluctuate a lot already...so how do you detect small changes in the population due to double-crested cormorant predation? Given extreme uncertainty, what's the burden of proof? Best to favor the species of concern (in this case threatened/endangered fish)

⑥ Small systems

- easier relationships simpler
- are they the same birds? Movement + data needed

P. 6 – smaller systems have less uncertainty – relationships can be more easily identified. For instance, are the same birds that move from an urban pond to dam or hatchery, or are new birds coming in? what's the movement pattern? Are just playing whack-a-mole? Keep that in mind in terms of overarching policy decisions.

⑦ Validity of modelling approach (pred. impacts)

If uncertainty

→ Precautionary Principle favouring special status spp.

P. 7 – validity issues...if you can't test via hypothesis double-crested cormorant impacts on salmon populations, that doesn't mean that your management actions didn't have an impact.

⑧ Model example

$$SAR = M_{Dams} + M_{Pred} + \dots$$

DCCO

SRKN

California S.L.

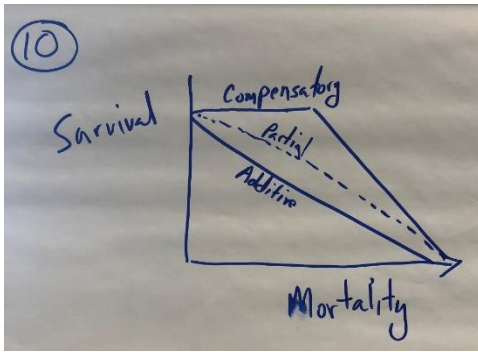
Take....

P. 8 – SAR/Smolt return chart/model. One model could cover predation. Changes in one predator could have other impacts – thinking in a model-specific way could be one way to justify management.

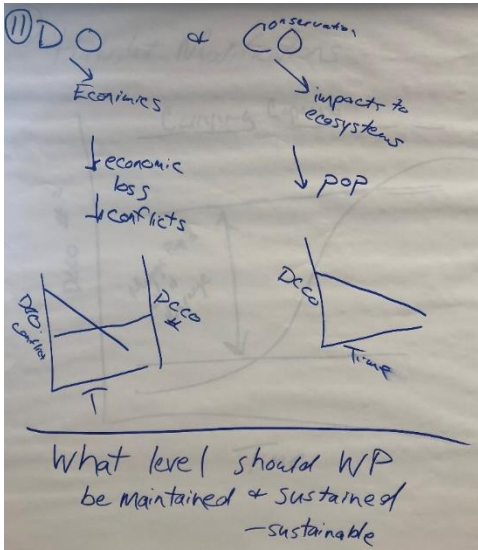
⑨

- Common Metric for Predation Adult equivalents (inform DCCO fish conflict)
- Compensatory vs. Additive Mortality (-2)
 - spatiotemporal influences, effects
 - greater benefit for additive effects

P. 9 – What's the diff of predation on adult vs smolt? On which part of the river? Lots of factors that affect population...perhaps this is a way to prioritize take. Additive mortality if double-crested cormorants are directly predating on a species.

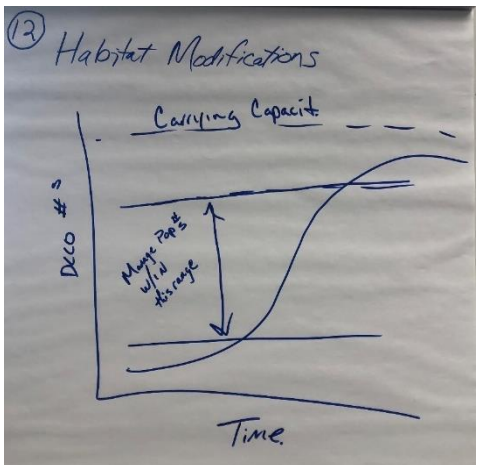


P. 10 – compensatory vs additive mortality. If double-crested cormorants were predating smolts, if mortality is completely compensatory, we need to know. Additive mortality, each incremental decrease survival at one stage directly results in an increase in mortality in the next stage.



P. 11 – Depredation Order (DO) vs Conservation Order (CO).

- DO influence population impacts
- Which is more appropriate? Would a CO be more appropriate for coastal or Columbia River areas? Just the number of double-crested cormorants, the pop is too high to effectively manage the resource we're trying to manage.
- What population levels would be sustainable in the western populations? How low can we go in the western population?



P. 12 – Habitat Modifications

- Where do we manage the populations? They've already nearly gone extinct twice, but they can rebound too... Low levels vs high levels – where is the long-term sustainable population or carrying capacity?
 - Is it really carrying capacity? Does predation by eagles and others kick in before you ever really hit CC? -- forage fish seem to impact CC as well as available nesting habitat. Look more at social CC factors.
- Certain areas may be at carrying capacity due to habitat modification, etc. but then the birds adapt and colonize new areas.
 - Depleting local resources impacts reproductive capacity – they are a centralized species (return to a colony, only go so far to get their food). Density dependent effects in great lakes more effective than some others.
 - Open systems in the West are really hard to peg down (boundaries of certainty that can be reasonably expected). Likely will lead to litigation, so we need a common understanding that there is a certain level of uncertainty we will have to live with.

Common Themes and Next Steps

In summary, the primary purpose of these regional meetings was to listen to the Service's Tribal, state, and federal partners, document their issues and concerns regarding cormorant impacts to free-swimming fish, and encourage them to provide information that the Service could use to help formulate a path forward. The meetings were not intended to be a forum where the Service could answer questions about any possible new policies or potential proposals to address cormorant-fish conflicts. Please see below regarding the common themes shared at the meetings, as well as next steps describing how the Service will proceed. We are encouraged and extremely grateful to our Tribal, state, and federal partners by the amount of input received through the meetings.

Common themes summarized from the four informational meetings, as outlined by Meeting Objectives (1-3):

Objective 1: Gather available information and data regarding the impacts that cormorants have on free-swimming fish populations

- A definition of *free-swimming fish* is needed, as there are multiple assumptions surrounding the term. Clarity regarding the inclusion of hatchery release fish and when they become free-swimming is also needed.
- There is a need for clarification of the Service's approach to management of non-game species such as cormorants, including defining population objectives, and how objectives play a role in managing conflicts with other species.

Objective 2: Better understand the scope and magnitude of cormorant impacts on recreational and commercial fishing

- Concerns and impacts to fisheries vary widely across the country, and it is clear that solution(s) will need to consider the complexity of managing at a population-level scale.
- Partners requested the Service provide specificity of the data needed to quantify the extent of the conflict and develop biologically defensible solutions.
- Acknowledgement that federal, tribal, and state partners have discussed this issue before and there is a need for renewed emphasis for fisheries and bird disciplines to coordinate their efforts in any future conflict management actions.

Objective 3: Better understand the social and economic importance of the issue from the perspective of partners and stakeholders

- Meeting attendees primarily represented angler and fisheries interests; however, there was recognition that additional partners, specifically Tribes, need to be included at the table.
- In addition to newly received data and information collected at these meetings, partners requested the Service also review and use existing data and information to formulate solutions. The Service set up a web portal to facilitate information gathering.
- Partners requested more information on the length of time necessary to implement any new management of this conflict requiring a federal action (note: for more information, please see below for more information on next steps and NEPA).
- The situation is urgent and short-term solutions need to be undertaken to provide relief.

- Some meeting participants expressed feelings that the 2016 Court ruling vacating the two depredation orders was based on failure of NEPA process, and not the biological evaluation of cormorants. These participants felt that it should not be hard to overcome those problems to reinstate the older depredation orders. (note: while the Court considered the NEPA analysis to be inadequate, the Court also concluded that the Service did not sufficiently consider the effects of the depredation orders on double-crested cormorant populations and other affected resources, and, failed to consider a reasonable range of alternatives in the EA issued in 2014).

Following the four meetings, the Service identified these following next steps:

- The Service is exploring increasing the 2017 EA allocation of allowable take of cormorants. While the scope of the 2017 EA cannot change without new, significant analysis, increasing the allowable take maybe a short-term option. It is unclear at this time if the allocation can be increased. The Service will evaluate and address this option during the winter of 2019.
- The Service is reviewing information received from the regional meetings and web-portal to identify viable management options, strategies, and timelines for different options. Management options must be built on a strong biological foundation and fully account for the cumulative impacts of lethal cormorant control activities on cormorant populations across the United States. This will ensure cormorants are managed sustainably and responsibly and in compliance with federal laws, regulations, and the four international conventions. Although the Service does not have a precise timeline for specific products, we will proceed expeditiously to formulate potential paths forward as we assess the information. As such, Service leadership will complete the evaluation of management options during the winter of 2019.
- The scope of possible management options identified by Service leadership will determine the level of National Environmental Policy Act (NEPA) required. NEPA requires federal agencies to assess the environmental (and related social and economic) effects of their proposed actions prior to making decisions. Through NEPA analysis, federal agencies provide the public opportunities to review and comment on any proposed actions.

Appendix A: Pre-Meeting Interview Topic Guide

OMB Control No. 1090-0011

Expires 08/31/2018

Double-crested Cormorant Information Sharing Interviews Topic Guide

6-21-18

Name:

Date:

Hello, my name is Phil Seng, with DJ Case & Associates. I am working on contract for the U.S. Fish and Wildlife Service to interview fish and wildlife agencies about the extent to which double-crested cormorants are preying on free-swimming fish within your jurisdiction. You have been identified as someone who would be particularly knowledgeable about this issue in your agency. Would you be willing to provide information on this important issue? The interview will take roughly 40-60 minutes, depending on how much you have to say. [Schedule a call in the future or proceed.]

I'm not recording this call, but I'll be taking notes to be sure I capture your thoughts correctly. My report from these interviews will contain aggregated information from all participants, but your name and agency name will not be attached to any specific comments. Do you have any questions for me before we begin?

Quantify the Conflict/Impacts (biological and social)

1. How would you "rate" your agency's (Tribe's/organization's) concern about the degree to which cormorants are causing conflicts in your state? (I'm just looking for a general sense of it. Let's say 1 = no problem and 10 = the biggest problem we face as an agency.)
2. Please give me a brief overview of the range of biological conflicts that cormorants are causing in [state]. [prompt as needed: threatened & endangered fish, gamefish, hatchery fish, aquaculture, nesting birds, etc.]
3. How are cormorants perceived by your various recreational user groups? [prompt as needed: angler satisfaction, user perception of quality of recreational activity (fishing, boating, wildlife viewing, swimming, etc.) when cormorants are seen, catch per unit effort, etc.]

4. Do you have any information on direct economic losses that can be attributed to cormorants? [prompt as needed: license sales, resort visitation, reduced fishery, loss of property (hatchery fish), success of commercial anglers, etc.]

Management Actions

5. What non-lethal management actions have your agency employed? [prompt as needed: education, outreach, hazing, capture-relocation, etc.]. Were those methods successful? By what measure?
6. What lethal management actions have your agency pursued for managing cormorants? For instance, did you previously manage them under the vacated depredation orders? Did the management improve the situation for free-swimming fish? What information (e.g., data/evidence) do you have that the situation improved through lethal management?
7. Has your agency attempted to balance competing values on cormorant management amongst recreational users? For instance, do you have to balance the interests of those who want more fish against those who want more birds? How do you currently handle that?

Information Sharing

As I mentioned at the top, the Service is trying to locate as much empirical data as it can find on this topic from across the country. The Service is confident that agencies like yours have data on this topic, and they would be grateful if you are willing to provide this information.

With that in mind, does your agency have information you can share on any of the elements of cormorant management we've been discussing? [I'm not looking for details right now, just whether you have some that you can share.] What form is the information you have in? Is it published in peer-reviewed journals, exist in internal technical reports, or is it mostly anecdotal, etc.? (All of it will be helpful, but we're especially interested in information that includes measurable objectives, such as reduction in depredation, economic loss, number of complaints, population size, etc. We need the kind of information that could withstand rigorous scientific scrutiny.)

If you have such information, [provide directions for how to submit it].

Appendix B: Pre-Meeting Interview Summary

INTERVIEW RESPONSES DCCO PHONE INTERVIEWS NOT FOR DISTRIBUTION

Following are “raw” notes from DJ Case interviews with selected state agency and tribal representatives regarding the double-crested cormorant (DCCO) issue. The names of respondents and specific locations have been redacted to protect respondent anonymity, which we promised as part of the OMB approval process.

The notes are organized by region and by question and are listed in no particular order.

Quantify the Conflict/Impacts (biological and social)

- 1. How would you “rate” your agency’s (Tribe’s/organization’s) concern about the degree to which cormorants are causing conflicts in your state? (I’m just looking for a general sense of it. Let’s say 1 = no problem and 10 = the biggest problem we face as an agency.)***

ATLANTIC

Respondent #1:

I’ve seen one instance where it was a 7. We had stocked a small pond for put and take with rainbow trout. Corms came in and demolished the population and fishing opportunities we were trying to create. Anglers were very unhappy. The corms left and didn’t show up this spring. We have them in [Name] almost year-round. They migrate when water temp gets really cold. We have other areas where they’re not a problem at all.

We have largemouth bass tournaments in tidal freshwater portions in the Bay. There are corms hanging around. No evidence of direct impacts, but it’s hard to believe they wouldn’t eat the fish after the fish are released (when they’re weak or vulnerable or disoriented). These are catch-and-release tournaments, but the fish after release aren’t in great shape.

Respondent #2:

As a fisheries manager, regarding their impacts to our fisheries, I’d put them as a 2 or 3. But after conversations with watermen, I would move it up to a 4 or 5. Some of our commercial fishermen see it as an 8 or 10 problem. Especially those using pound nets, it’s a big deal for them. We don’t have much data, but it’s clearly gotten worse. These nets are staked in the water, they aggregate fish that are alive; pound nets usually don’t have a

top to them, there's a funnel that fish follow into the heart or pound of the net, there are pine tree trunks that are permanently staked in the water from March till September roughly. I talked with one fisherman who sets crab pots in northern [Name] Bay and a pound netter near mouth of [Name] River ([Name] flats), and both described it was a major issue for them. There's not much we can do as a fishery manager. There's not much ecosystem-based managing that we're doing now.

Respondent #3:

About a 4 in [State]. Just not much of an issue here: we haven't put resources into dealing with corms or educating the public about them because it's small relative to other issues.

Respondent #4:

About a 7 heading into an 8 as time goes on. Corm population is increasing and angling constituency is getting more and more upset.

CENTRAL

Respondent #1:

Probably a 5, right in the middle.

Respondent #2:

Relative to all the other issues we face, I'd score it a 4. However, it's nuanced and situational. We have perceived heavy impacts in some places and low impacts in other places (specific water body types).

Respondent #3:

It's not a statewide issue. But on specific lakes it's an 8 or 9. Most of our lakes aren't conducive to corms, but about a third of them are. But much lower than that in terms of acreage of water. It's not an issue on big reservoirs in mountainous areas. Much larger acreage.

Respondent #4:

Depends on who you ask. The aquaculture folks see it as an 11. Up on [Name] River basin, they roost in large numbers and devoid areas of vegetation, then there is great erosion of those areas. Losing island habitat. We didn't used to have them throughout the summer. They used to go back north during the summer.

Respondent #5:

In [State] we don't perceive any biologically significant impacts on our fish populations. Crappie, largemouth bass, other species – no yearly impacts we see. We can't put a finger on the size of corm populations and sport fish populations.

[Name] River basin has large corm population and yet we haven't seen declines of sport fish. If anything, the year classes have been large. ([Name] is one of the major tributary streams to [Name] basin. There are 9 hydro projects on it. We have large concentrations of corms, but we also have had a large year class on crappie and largemouth bass.)

Indirectly, we don't think we're having an issue with forage species either. Otherwise, we wouldn't be having these large classes. Our biggest worry is silver carp. Can we train the corms to eat them? 😊

GREAT LAKES

Respondent #1:

If we're looking at all the problems that [agency] deals with, I'd put corms around a 7.

Respondent #2:

It's a 9, because of stakeholder priorities. Agency staff might rank it lower, but to our stakeholders, it's one of the biggest.

12M people live around the lakeshore on Lake [Name]. You're not going to let things fluctuate normally. We're constantly impacting these lakes. Whatever the species – we don't have the luxury of saying, "Let the ecosystem take care of itself."

Respondent #3:

I give it a 5 or so. Tribal members have the whole range of opinion. Most want to let nature take its course, so it's not hugely controversial.

PACIFIC

Respondent #1:

It's a 10.

[Name] River estuary – right by [Name] or [Name] – [Name] Island, manmade by Army Corps of Engineers. Home of largest colony of DCCOs in the world = ~40% of the Pacific population *just on [Name] Island*. At its peak, there were ~14,000 breeding pairs. We've been managing and trying to reduce those numbers. Hundreds of thousands of dollars have been spent studying their impacts on salmon. An EIS has been written; one product of the EIS is management of the colony, including lethal take ("culling"). DCCOs at that colony alone are responsible for consuming ~12M smolt / year.

Bald eagles are starting to raid nests and take eggs. Last year, eagles flushed the colony; DCCOs abandoned their nests. No productivity, no chicks were fledged. Even though there were thousands of birds, there were only 50 nests counted, so only 50 pairs were included

in the Western population. By FWS accounting, the Western population declined by 40%, when in reality, there was the same number of birds. Audubon Society jumped on this and reported a major decline in the Western population, when the birds weren't actually in trouble. Therefore, no more culling was allowed.

Current numbers on the island = 3,050 nests now. Double that to get breeding pairs; there are also nonbreeding birds, too. Many have moved to the [Name] [Name] bridge, so ([State] Dept of Transportation) is involved. Coast Guard reports they nest on navigational buoys.

EIS: nest is a proxy for a breeding pair now. Bird populations are dependent on breeding pairs, not just individuals. Per the EIS, we got locked into management based on breeding pairs on [Name] Island in particular—as opposed to actual numbers of birds.

*“These birds cannot be managed based on breeding pairs.” The measurement should be *individuals* – NOT breeding pairs.

Respondent #2:

7 or so. Localized issue. There are areas where it is THE issue. It is a growing issue as well. Eliminated a fishery in several places.

Respondent #3:

Not really sure. Different people would view it differently. They are concerned about salmonid populations. They have a number of ESA listed species. But it is an 8 or 9 or something.

Respondent #4:

I'll say 6.

Respondent #5:

Depends on who you talk to. Community Fishing Program would rate as a 10. Research Branch here would rate it more as a 5 or a 6. But it's a bigger problem in local areas. We do have ponds where we've documented 2500 birds at one colony – that's a health and sanitation issue just because of all the guano. One pond especially is a water treatment facility owned by [Name], primary activities there are nesting; they go and return every night because the pond can't support feeding there every day; we tried to get a pattern of movements, but we couldn't tag enough birds to say much about that yet. Our sense is they probably come back to that pond every night, then disperse to golf course ponds during the day (that have tilapia) that can support the cormorants.

2. Please give me a brief overview of the range of biological conflicts that cormorants are causing in [state]. [prompt as needed: threatened & endangered fish, gamefish, hatchery fish, aquaculture, nesting birds, etc.]

ATLANTIC

Respondent #1:

Hatcheries: As far as I know, we don't have problems there. I work at a hatchery, and we don't see them.

Stocking: one direct impact from when we were stocking trout (see above). More of a social impact than a biological one.

Native species, T&E: I don't have information.

Respondent #2:

Impacts to commercial fisheries: Pound net fishermen are seeing an impact. They have to spend more money to modify their nets so corms don't eat all the fish in them. Story: one angler had thousands of pounds of fish in one net, and then came back the next day and there were maybe 20 bushels left. American shad and blue-back herring and other anadromous fish, [Name] Dam: corms seem to pick them off when they're coming to spawn. Even see eels in corms mouths. Folks on water are seeing more corms. [Name] River, rookery area: everything around it has turned completely brown.

Respondent #3:

W have them. We see issues in rookeries: guano on ground causes vegetation to die. Perception that corms eat all the fish in a body of water. Corms swoop in after we stock trout, and eat them. We've seen localized depletions happen. "Not a widespread problem, more a here-and-there thing." Prior to this call, I talked to folks throughout the state: [Name] Park and [Name] Reservoir came up.

Respondent #4:

The primary issue is that they prey on naturally occurring and stocked sport fish species. They could interrupt food web constructs as well. Secondly, they destroy habitat for colonial nesting birds, decimate vegetation on nesting islands, etc. They don't impact T&E species in [State]. Gamefish are usually stocked by truck, and fish are very vulnerable on the surface before they descend. Corms recognize the hatchery trucks and congregate when stocking happens. Aquaculture is not really an issue for them. Most is in indoor facilities. Corms don't really cause impacts at fish hatcheries (great blue herons do more damage there). It's primarily upon release into water bodies.

CENTRAL

Respondent #1:

We have an extensive aquaculture industry in the state. We've worked especially with USDA to reduce their impacts. Primarily located in eastern half of the state – east central to southeast [State]. Common along large bodies (lakes). Close to [Name] River.

Our agency has a series of hatcheries where we raise bait fish and fish for stocking. That's located throughout the state. Our fisheries folks are constantly struggling. Our agency is somewhat included in the aquaculture side, but it's much bigger than just us (e.g., growing catfish for consumption).

They're fairly common along [Name] River, [Name] River, [Name] River, so there's general negative perception that they impact fish populations. I'm not up to speed on what their actual impact is on those streams. Some concern about vegetation destruction at some of the roost sites (but lower concern than impacts to aquaculture).

Respondent #2:

In [State], keeping in mind you're talking to a fisheries person, they have most impact on private aquaculture.

In free swimming fish, biggest impact is in "small impoundments" in public and private small impoundments. Actual impact they have is hard to quantify because so many confounding factors involved. Hard to show a causal impact.

In rivers and streams, we don't see a whole lot, although we have anecdotes – when gamefish are gathered in particular spawning areas. We get some angler complaints about low catch rates, but I don't know if it's just their perceptions. It's hard for us to show a quantitative impact on our fisheries from birds. We're trying to do more put and take stocking in small urban impoundments. Especially in winter when we're stocking trout, those areas are heavily visited by corms. We don't have data to prove it, but we have stories from fisheries biologists who are stocking.

We have numerous private recreational impoundments (lakes), and these private landowners are paying thousands of dollars to stock these (e.g., bluegill, shad, bass), and they're getting depredated heavily. DCCO in ~March timeframe. We also have neotropical corms (year-round) and white pelicans that add to the difficulties. Those three in combination are a problem.

Respondent #3:

Free swimming gamefish. Smallmouth bass, crappie, sunfish, occasional catfish. Another problem is shad. In our lakes, especially if they aren't particularly fertile. [Name] Plain is a good example. Shad is the prey base for sportfish. We are stocking shad in some of the

lakes because of it. Probably wouldn't have to do that without cormorants. In some lakes, it's more of a problem eating shad than eating the actual sportfish. No T&E species. Huge impacts on aquaculture operations. They would rate it a 10. They got Congress to allow lethal take. Corms also impact hatchery operations. They can take some corms under the fish farming allowance, but probably not enough. At least two of their hatchery operations have problems on site. One is right along a lake where corms exist. The other is right in the middle of a minnow production area, which attracts corms.

Respondent #4:

Impacts are on free swimming fish: shad, especially gizzard shad; didn't see many game fish consumed by the birds. Vegetation and guano in water.

Respondent #5:

Along areas where corms have rookeries, especially on small islands, most of vegetation is destroyed. We start to see shoreline erosion and loss of habitat for fish. Bank erosion because of vegetation being killed. I can't comment on wildlife since I'm a fish biologist.

We've had some minor issues in smaller public fishing lakes. E.g., an 80-acre public fishing lake in [Name] County: after it was drained and restocked, we had high densities of corms there, and that fishery was slow to develop, our guys went into control mode (lethal take under USDA permit), and then it wasn't a problem.

We operate 3 fish hatcheries. Have had a nuisance problem at one of them, managed through aggressive harassment. When we see the scouts, we chase the "scouts" till they leave, then they go away. Have had more trouble with mergansers than with cormorants. We don't communicate with aquaculture folks much, so I don't know.

GREAT LAKES

Respondent #1:

Started by looking at impacts to aquaculture, mainly in [Name] ([State], [State], etc). This field station where I work was established largely to conduct research on aquaculture – corms and catfish aquaculture. I've been here since 1996. I and colleagues have done a lot of research. The research continues because production methods change, the species change, the way corms use habitat change, policies and regulations surrounding their management changes.

I've also looked at corms and island habitats, co-nesting species of birds, particularly in the north throughout the Great Lakes (and as far east as Lake [Name]). Destination of aquaculture: food. Very small amount used for stocking recreational ponds and lakes.

Respondent #2:

Fish stocking: a big issue, especially as the lakes cleared. We stocked trout, walleye, muskie, salmon, etc. The fish tend to be stunned when you first put them in, especially brown trout stocking, and we saw just annihilation. A brown trout might be \$3-5 in value, so when you see 20,000 get eaten in a week, that's a lot of money. We use volunteers to scout when to bring stocked fish: "Don't bring now" or "We'll harass them for a week."

Vegetation: secluded islands denuded. e.g., [Name] Island before and after corms. Terrestrial vegetation and sensitive amphibians now gone. Allowed to do some level of lethal control on particular islands. Other nesting colonial birds: some evidence of that.

Respondent #3:

2 issues. Corms are competing for nesting space with other colonial nesting birds. Common terns and caspians (only caspians in [State]). Not that they were displacing the terns directly; cormorants displace ring-billed gulls, which in turn displace the terns. The secondary issue is fish. Diet studies and modeling with [name] in [State] have shown that if corm numbers are really high, it could affect walleyes at a certain size class. They have a hatchery, but cormorants haven't really been a problem there.

PACIFIC

Respondent #1:

Salmon are game fish, treaty fish, commercial fish. There's also fishing agreements with foreign countries (e.g., Canada). Steelhead is consumed more frequently than others. Not selective on free swimming fish. Corms also eat anchovies, Pacific lamprey (have been proposed for listing before), perch, and other fish. Corps of Engineers has many years of diet analysis.

USFWS doesn't limit bird populations. Everyone else is being managed except for bird populations. Migratory Bird Act doesn't allow anything to alleviate the problem.

Respondent #2:

Primarily a gamefish issue on put and take trout fisheries. To their knowledge. No T&E. Commercial facilities and state hatcheries have issues. Suspects impacts on other colonial waterbirds, but he is not the guy for that.

Respondent #3:

Focus is largely on salmonids. They have a lot of hydro dams, forests that are industrially managed, harvest activity. All those folks have come together. They call it 4-H: habitat hydro, hatcheries and harvest. They have tried to reach common understanding of where we are re salmonids. Didn't really include predation by birds so far. If you talked to certain

publics, you'd hear about predation on other types of fish, but it's not nearly at the level of that in [State].

Most emphasis is on listed species. Certain stocks are in much worse condition than others. Low populations. Draw most of the attention. He is not a fisheries biologist, so doesn't have many details about that part of the agency.

Respondent #4:

Conflicts with sport fish stockings. Considerable impacts at our hatcheries for native T&E species and also sport fish hatcheries.

Also a conflict with human health wrt large concentrations around rookeries + local stagnant water sources.

Respondent #5:

We have the 2 species, including neotropics. The neotropics have been in highest numbers around [Name]. We do get double-crested in reasonable numbers in the metro area here; they tend to be more common across the state. Anglers say the cormorants are eating all the big stocked fish right after stocking. Some stories about cormorants spearing big fish that they can't swallow, so instead they spear them in the gills. I haven't observed this myself (could be herons). Issues of guano and public health due to congregations. Water quality also decreases in those ponds where high numbers of birds. Noise when nesting: 2500 birds all croaking can be irritating to neighbors.

3. How are cormorants perceived by your various recreational user groups? [prompt as needed: angler satisfaction, user perception of quality of recreational activity (fishing, boating, wildlife viewing, swimming, etc.) when cormorants are seen, catch per unit effort, etc.]

ATLANTIC

Respondent #1:

Everyone: I don't know they're paid much attention to.

Anglers: when complaining about corms eating stocked fish, they called them "fish ducks" – not a big overall concern, just wanted the fish to stay in the stocked lake.

Respondent #2:

Haven't heard from other users specifically, but I haven't elicited information.

Respondent #3:

Anglers: perception that those groups of corms are having negative impacts on population. At a larger reservoir, they might not make much of a difference. My

interactions are with recreational anglers. Commercial fisheries managed by different agency.

Wildlife folks: concerned about dead trees and dead vegetation in rookeries, but we don't have that nearly as much as you'd see in the Great Lakes.

Viewers: a split between "don't do depredation" versus "some depredation is ok if necessary"

Boaters: haven't heard anything. Would probably be concerned about hitting one, but I haven't heard anything.

Respondent #4:

Recreational anglers are by far the most concerned. Birders are concerned about other colonial nesting birds. The general public is sort of oblivious to it. People who have businesses related to fishing are concerned as well. If cormorants degrade the value of the recreational fishery, fewer anglers will come and business will decline. Tourism boards share that concern as well. Anglers saw us go down this road in 1990s, and watched cormorants decimate sportfish populations. They remember what happened last time. Federal govt gave us the depredation order, which helped, and then took it away. Now we are starting down that road again. In [State], anglers often help with stocking operations, and in some cases have watched in horror as the fish they put into the water were picked off by corms.

CENTRAL

Respondent #1:

Anglers: perception is negative, perceive impacts to fish populations.

Wildlife viewers: neutral, don't get a positive or negative sense from them, just perceive them as part of the environment

Boaters: neutral, don't get a positive or negative sense from them, just perceive them as part of the environment

Landowners: a strong, strong, negative perception from aquaculture owners

Respondent #2:

Boaters: don't know. We don't hear from them. Probably not a big concern for them.

Wildlife viewers: don't know. Comments probably go to wildlife staff instead.

Respondent #3:

Cormorants are major problem in [Name] plain. Nothing he has ever done has been more popular than D.O. on cormorants. People offered to buy shotshells for them, etc. A lot of people watch cormorants work schools of fish—it's traumatic. Get TONS of comments. People don't understand the federal jurisdiction. Makes it really hard on the state agency.

The concern is primarily the sportfishing community, but also people who live along lakes. Wildlife watchers.

No complaints from swimmers, boaters, etc., because the lakes that are good for corms are not conducive to swimming.

Respondent #4:

Viewers: small subset that like them. Most don't like them because of what they've done to the islands.

Anglers: make DCCOs a scapegoat if they have low success fishing.

Respondent #5:

We get some complaints from rec anglers. We can't tell any effect: "there's probably more bass killed by bass tournaments than by cormorants."

Wildlife viewers: no complaints that I know of, haven't heard anything from Wildlife division.

GREAT LAKES

Respondent #1:

Aquaculture producers, especially catfish: corms are their #1 depredating species. Cause the most depredation.

Anglers: some grumbling in the Southeast, but most issues re free-swimming fish have been on their *northern* breeding grounds and impacts to sport fishing up there.

"Northern" = Lake [Name] through Great Lakes to Lake [Name] – that's where I've heard the most about negative impacts of corms. There are also issues in Canada, but I'm not as familiar about them.

Viewers: bird watchers, NGOs, Audubon groups, view them positively as part of nature.

Army Corps: in [Name] River, there's some issues with threatened and endangered salmon species. There's also multiple species of corms that utilize the areas where these conflicts occur. Some support by environmentalists who are more concerned about T&E species of salmon.

Respondent #2:

Commercial fisheries folks are especially concerned: Migratory bird people at the Service have failed to connect these issues. In 1950s and 1960s, the contaminants didn't help with fish-eating bird populations. Then non-native birds increased. Brought in Pacific salmon. Corm numbers going up. 1990s: zebra and quagga mussels arrived. They absorbed all the nutrients. No spring blooms. They cleared the water, too. Any predator has this advantage: they can see their prey hundreds of feet further. Crystal clear waters. Prey is nutrient-limited, so swimming lower. We keep telling our stakeholders that our stocking is going down. Commercial fisheries in [Name] [Name], [Name] are highly stressed. Corms can fly to productive ponds, bays, other areas under stressed food web dynamic.

Sport fish folks: have been most vocal, write to legislators, near-shore Great Lakes fisheries and inland fisheries were semi-productive, but once corms' food off-shore became limited, they moved to feeding on-shore (pike, etc.), so anglers saw declines in fisheries. Anglers see corms feeding on a declining fishery. To some folks, this is why people moved out of fishing communities, why their businesses have dried up (e.g., Bed and Breakfast, rental cabins). We went from 6M angler hours to 2M angler hours between 2000 and 2010. They know it's the mussels that are starving the fish underwater, but people visibly see the corms. And state can't do anything about it.

Wildlife viewers: Some folks recognize the need for balance in the ecosystem, let them fluctuate naturally and populations will come down vs. we manage other birds (e.g., mergansers) so we should control these, too. I've heard both opinions argued to me. I worry about the folks who say "let them be" – I think they're jeopardizing corms' appearance on the T&E list.

Respondent #3:

Sport fishing and resort industry are big complainers. On [Name] Lake the perception is that corm populations got out of control. They have just one missing age class of fish, and people really raised a fuss.

PACIFIC

Respondent #1:

Subsistence / commercial anglers: not popular. As DCCO populations have grown, they have reduced salmon stocks. The colony has not been there historically. The Corps created a perfect bird sanctuary. The system was already out of balance, but this threw another weight to keep it even further out of balance. Anglers say, "I'm being managed (regulated), but we're going to let corms grow unchecked?!"

Boaters: one captain = "kill them all!"

Wildlife viewers: We have experience with local Audubon chapter. They are dead set against lethal management on that island. See description above of what happened when bald eagles raided nests, and Audubon spread misinformation that population numbers were in decline.

Respondent #2:

They are perceived as more of a problem than they are. Devil birds, etc. long tradition of bad news. But that's a minority. In general, not a big outcry by angling public. But it's a big deal in localized water bodies. No input from other groups.

Respondent #3:

Huge range there. Some see cormorants as a huge problem. Others who see them as part of the natural system and should be left alone. He doesn't really know if anglers are angry.

He gets an occasional input, but not very much. He is not in the right position in the agency to give a good summary of that.

Respondent #4:

The most vocal groups are anglers: they see them as a high depredation species; they're concerned about the lack of management options we have to control. Double jeopardy: Both a perception of high impact and zero ability for agency to take action.

Respondent #5:

We hear about mess and noise from golf courses. Our research project has worked with ~100 volunteers across the state. The majority have been members of angler groups. They say cormorants are bad, and anglers don't get them. We ([Name]) have to manage for all 800+ species, and not just people's favorites. Wildlife viewers wouldn't be happy if we mass removed the birds, but they don't seem too concerned about some depredation. They seem to recognize that a healthy ecosystem needs balance.

Boaters: only had small interaction with them. Paddlers: don't have any big issues because they're not on community fishing waters. Birds aren't at Lake [Name] or Lake [Name].

- 4. Do you have any information on direct economic losses that can be attributed to cormorants? [prompt as needed: license sales, resort visitation, reduced fishery, loss of property (hatchery fish), success of commercial anglers, etc.]**

ATLANTIC

Respondent #1:

No. Just one instance (corms eating stocked pond).

Respondent #2:

No numbers, but I've heard from commercial fishermen that they have to buy additional gear to cover their pound nets. One angler also adds bars to his pound net to prevent corms from get in. Corms seem to eat the food fish first (not bait fish), which anglers get more money for.

Respondent #3:

No specific numbers. I'd be surprised if corms were causing a decline in license sales.

[Name] Park or [Name] Lake: they're eating trout (about \$2/pound to raise a trout), so any large-scale eating that's happening there, we're losing money on it.

Respondent #4:

Study done in late 90s by APHIS-did economic impact on [Name] Lake fishery. They don't have direct data on most of it, but tons of anecdotal data. [State] has conducted studies – population indices in eastern Lake [Name]. Fish pops go down as corms go up. Cormorant

diet studies. Were hoping that round gobis would serve as a buffer to walleye and perch but it apparently is not so. He will see what information they can gather for us.

CENTRAL

Respondent #1:

No. Fisheries Division staff might have some information along those lines.

Respondent #2:

No data. But we do have data on economic importance of fisheries. Hard to show a cause and effect relationship due to confounding factors involved.

Respondent #3:

If we do it's from hatcheries, and he doubts it.

Only data he has is from stomach contents study. They will bring that to the meeting.

Nothing from the free-swimming side. The trade groups might have hard data.

Respondent #4:

Would be good to see actual studies.

Respondent #5:

No. We can't even detect biological losses; certainly don't have data for economics.

GREAT LAKES

Respondent #1:

Definitely with respect to catfish aquaculture, there are estimates. About a decade ago, there was work on direct economic losses of ~\$5.5-12M annually in [Name] alone, not including multiplier effects or adjusting for inflation.

Regarding free-swimming fish, there's not much info on impacts. Some work on Lake [Name] that's been published. It showed there could be substantial losses, multiplier effects, as people stop fishing – potentially millions of dollars in impacts to local fisheries.

Respondent #2:

Yes. In [Name] Islands, we measured perch populations at time X and time Y, then calculated impact of declined trips... I provided testimony to our congressional representative.

Some folks say they moved out of the area. But I don't know how many people left. I just know fishery trips dropped substantially.

Respondent #3:

No studies done that he knows about. Resort industry made it sound like it was a bigger problem than it really was. Screamed about it and people stayed home. They never lost their brood stock in the lake, like has happened in other places. Just a year class or two. There was a decline in the resort visitation in the early 2000s. But they also had high gas prices and economic downturn, so blaming it all on cormorants was not appropriate.

PACIFIC

Respondent #1:

No Response

Respondent #2:

It's a stretch, but they have a couple economic surveys that estimated the spending associated with different water bodies in the state. Small sample size, but they do think they can show economic loss attributable to cormorants and white pelicans. What percent of stocked trout are being taken? About 30%. They can show how they lose anglers in those areas. They can directly estimate the monetary loss in stocked fish. They know what it costs to produce them. They radio tag stocked fish and follow them back to a colony if they disappear from the lake.

It's easier with pelicans because no correction factor is needed on estimates.

Respondent #3:

He is not aware of it. He guesses there are folks who might have that. Annual expenditures related to hatcheries, etc., but he doesn't. They have a lot of hatcheries around the state. He presumes they release all kinds of salmonids.

Respondent #4:

Our goal is to have management authority and do active management to limit impacts to other recreational activities. This seems to be a very achievable goal. But this is something we haven't been able to do for a long time now in the Pacific flyway. Just need to show we're helping.

Respondent #5:

I've heard anecdotes: "I didn't buy a license this year; why would I just want to help feed the cormorants?" But I don't really know. Our research project includes estimating the economic impact of cormorants by estimating the amount of stocked fish they eat. An adult can eat 1.5 pounds of fish a day. When you have 2500 birds, that's a lot of fish loss. Maybe some impact from places that are closed and no longer available for recreation.

Management Actions

5. *What non-lethal management actions have your agency employed? [prompt as needed: education, outreach, hazing, capture-relocation, etc.]. Were those methods successful? By what measure?*

ATLANTIC

Respondent #1:

None.

Respondent #2:

None. Heard a story about [State] where they tried using air cannons, but the birds habituated quickly.

Respondent #3:

No harassment, no relocation.

Respondent #4:

They have done a limited amount of hazing. It can work well for short term. Very labor-intensive. Maybe do it while we're stocking fish. But done repetitively, it loses its effects. Not many other tools in the toolkit from the fisheries side.

CENTRAL

Respondent #1:

We have on our own properties. We've cooperated with APHIS (USDA), recommendations to aquaculture land owners – hazing, education, outreach. Nothing successful long term. Short term benefits to hazing, but then they return a little later.

Respondent #2:

At 9 state fish hatcheries: we use numerous techniques – effigies, lasers, propane cannons, structural physical barriers, lines across top of ponds, drive vehicles to scare them. Haven't tried capture and relocation yet. We've learned that without threat of lethality, corms become habituated and brazen. Private land owners have used numerous techniques as well. Similar story of habituation. Techniques become almost impotent.

Respondent #3:

They do a lot of noise-makers on all the impacted lakes. Have non-lethal plan before any lethal methods (before they lost the DO). Got it from APHIS. Worked with them on the plans. He thinks effectiveness is close to zero. They will leave the immediate area, but

won't leave the lake. Only impact corms for about an hour. They work better on hatcheries and aquaculture.

They don't use nonlethal techniques when they release fish. Doesn't know if corms recognize hatchery trucks.

Respondent #4:

No response.

Respondent #5:

Just at that one fish hatchery, someone drove around on an ATV to shoo them off for a day or two. We've been successful at running them off with that. Successful with 4-8 birds, but wouldn't work with hundreds of birds.

GREAT LAKES

Respondent #1:

I haven't done any management, but I've researched their effects. Hard to limit just what corms are doing, but certainly they're a factor.

In [State], I was lead researcher on egg oiling and lethal take on [Name] islands in [State]. We studied the issue for years and published info. We found that those actions did limit the mortality of particular fish species in that fishery. We had an adaptive management approach to adjust if things were going well or going poorly. In the future, perhaps predictive modeling would be useful or accurate, but I don't think we're there yet.

[Name] Lake and [Name] studied both harassment and lethal control. Migrating corms were keying in on walleye and perch. Programs ran for years, fisheries were monitored, both locations had positive responses. There was less lethal corm take in those instances.

Corms habituate to harassment methods over time. Short of barriers, there's no highly effective nonlethal option for free-swimming fish.

We've tried nonlethal approaches with catfish aquaculture, but they're not effective, not cost-effective, even though they seem promising. Very little has worked with catfish aquaculture. The closest I've seen that's worked is limited lethal take and harassment at [Name] Lake and [Name] Island.

Respondent #2:

Harassment – air horns. Unsuccessful because they get habituated. Some members of public volunteer to do harassment.

Respondent #3:

They tried egg addling. Doesn't work on [Name], because ring-billed gulls have learned to predate the eggs. They follow the oilers around and bust the eggs, which makes cormorants re-nest. APHIS did harassment work. Some are migrants, and they push further north. Helped some. They have been trying artificial cormorant eggs (ceramic). Replace 3 of the 4 eggs with fake ones. They are writing it up right now. They are still fledging some young, but not nearly as many. They did a couple pilot studies; this year went with 100 nests. He doesn't know anyone else who is doing it.

PACIFIC

Respondent #1:

Have tried dispersion and attraction: tried to disperse them, and then attract them somewhere else. Have also tried hazing and nest modification. Those haven't worked, so we asked for EIS for lethal take. The estuary is too big to haze the whole area. You would need a lot of people, maybe even drones. One promising technique is using lasers, but only where there aren't people, cars, etc. You would need a lot of people. Have been studying the birds since the 1990s. They find ways to nest. DCCOs are willing to nest just about anywhere.

Respondent #2:

They haven't really used hazing. They stock at night and other methods to make them less available. Use giant dancing men by hatcheries. Use them when they put fish in the water. It is successful for a time.

Respondent #3:

They have done hazing and dissuasion.

Respondent #4:

There's a zero allowance for removal (depredation) because of Migratory Bird Treaty Act. We have a research project – doing diet studies and population estimates ([Name]). But that's not management action.

Respondent #5:

Have done a lot of education and outreach. We tried to trap and put tags on cormorants to track across the valley. I think the few days we spent harassing the cormorants by tagging them, many got up and moved. At some lakes, cormorants have gotten used to flashers. At hatcheries, crew tried harassing with remote controlled helicopters + flashy stuff, but they got used to it and ignored it. Other things we're looking into are: Can we alter stocking schedules such that we stock at night so they have opportunity to recover? Can we cut down dead trees around parks?

6. What lethal management actions have your agency pursued for managing cormorants? For instance, did you previously manage them under the vacated depredation orders? Did the management improve the situation for free-swimming fish? What information (e.g., data/evidence) do you have that the situation improved through lethal management?

ATLANTIC

Respondent #1:

No.

Respondent #2:

I don't think so, but I will double check.

Respondent #3:

No.

Respondent #4:

Under the DO, we were taking limited number of adults and egg addling. [Name] Lake, Lake [Name], maybe some on [Name], (not sure) and Lake [Name]. Each water body had goals set. Worked closely with the Service. Implemented by aphis for a short time under contract from [State]. But as corm population decreased, [State] took it over. He thinks they did it from 1998 until 2016. They reduced the corm populations and then maintained levels at a place where it was manageable. Anglers were pleased. It took a while, but eventually they came around.

CENTRAL

Respondent #1:

Not within Wildlife Division, but when depredation order was in place, USDA and Wildlife Services staff did some work within the state. We felt that there was a positive impact. I don't have hard and fast data though. Our Fisheries staff might have data to quantify the impacts of lethal management. Our perception + that of land owners + Wildlife Services staff saw it as more impactful than hazing.

Respondent #2:

With ability to take, even if it's really limited, if you can convince the other birds that humans mean business, then harassment techniques become influential again. Need to use harassment and lethal take in concert.

*We kept track each year: permittees reported to us their take each year, and I have the data. Ranged from 3,000 DCCO to 6,000 DCCO statewide, private and public take.

Respondent #3:

They used lethal in about 5 lakes. Best days were still relatively small numbers of birds—maybe 50-100 birds a day, maybe 4 times a year. Didn't have the staff time to devote enough to it to have a major impact on the populations. No cap on numbers from the Service. What they were doing was more PR than anything else.

There were a few years where they think they reduced the population, but they don't have any hard evidence of it. They heard it from lakeside residents that the flock would leave the lake. But then a new flock would come in.

Don't know how they would measure impacts on the larger lakes. On smaller lakes he thinks they could have an impact, but it would be very difficult to prove. Too many variables.

Respondent #4:

No response.

Respondent #5:

At the public fishing lake, around 2005, under the USDA permit, we initiated lethal take.

GREAT LAKES

Respondent #1:

No response.

Respondent #2:

None right now. We think we should be able to use lethal control at our fish stocking sites.

Respondent #3:

In 2004 did limited collection in the fall for diet work.

After they got the PRDO in 2005 they take between 470 to 3,000 in a year. In 2005, suppressed firearms could only be used by SWAT teams. They got the law changed in 2006 so they could use them as well. Sometimes use precharged air rifles. Most are taken by pass shooting from an island a half mile from colony. It takes effort and some days are better than others, but they have it mostly figured out. Accelerated control—take them early in the year so its fewer foraging days on fish. They manage for 500 reproducing pairs on a 112,000-acre lake. They work until they hit the population goal. Take aerial photos and count. This year, WS is using a drone. Works pretty well.

PACIFIC

Respondent #1:

No response.

Respondent #2:

DO didn't apply there. They have nothing for free-swimming fish. They want the DO reinstated and make it apply to the west as well. They aren't really killing cormorants at state hatcheries right now. Mostly herons. Some private commercial hatcheries may have some permits.

They are playing catch-up on documenting conflicts. They have anecdotal evidence that is has been a problem for a long time, but not much quantitative. They raise the size of fish they stock so they aren't as vulnerable to predation.

Respondent #3:

They have not been directly involved in DCCO mgt actions. The active current mgt in Pacific NW is happening on at least one colony along the [Name] River. Driven by the Service and Corps of Engineers. There has been some permitted lethal take because of ESA species. Egg oiling. The goal at the [Name] River estuary was to reduce the overall population from the previous level (15,000 pairs down to some lower level—at least a few thousand pairs lower).

Last year there was disturbance of the colony by bald eagles. Then there was a total collapse of the nesting colony, but birds stayed in the area. Audubon says it was cumulative effect of mgt actions. Was that success? Depends on how you define it.

Respondent #4:

None.

We have 2 species – a neotropical cormorant, a further complication in the Southwest, majority of distribution is in [Name], but a little bit in [State]. This sub-species complicates the situation. The Service needs to defend that any depredation removals won't impact the population. But when you have multiple species that are difficult to discern on the wing, it's tricky to identify them. Need to have and model different management actions, and that's difficult. Causes more conflict to have the two species.

Respondent #5:

At some point, cormorants *may* have been on depredation permits at hatcheries, but I'm not sure. I've heard some stories of public shooting paintballs or bullets at them at ponds.

7. Has your agency attempted to balance competing values on cormorant management amongst recreational users? For instance, do you have to balance the interests of those who want more fish against those who want more birds? How do you currently handle that?

ATLANTIC

Respondent #1:

No need to.

Respondent #2:

So far, isn't something we've had to handle. Maybe we should be trying to sort it out, but we haven't had to yet. I don't have an example where another species has impacted a fisheries resource.

Respondent #3:

Just hasn't been a big enough issue.

Respondent #4:

They do hear from some people who don't want to see any birds killed, but it is dwarfed by the number of people who are demanding reduction in cormorant population to more manageable level. The state has NO interest in eradicating cormorants—only to manage them at lower levels in key areas.

CENTRAL

Respondent #1:

No response.

Respondent #2:

A good question. It starts internally with us. It's not about pitting one resource against another. It's about managing public resources to find a balance and about alleviating conflicts. We are careful about tone. We want to provide quality fishing opportunities that are convenient and close to where people live. We know that corms affect that objective. We don't want to deal with corms at a population scale; we want to do targeted interventions at local scale. How do we provide recreational opportunities and enhance quality of life for people.

Private citizens want their government to serve them. We are dealing with a lot of frustration; they want to reach a resolution on this.

Lethal management under EA: if we can just take a handful, that would be helpful. *How many of the birds under the aquaculture permits were actually allocated, how many were taken, is there room left for take in free swimming fish areas?

This is a more comprehensive issue than just DCCOs. Birds can be misidentified. Need to consider white pelicans and neotropic corms as well.

Respondent #3:

The only complaint he ever got about their cormorant control was from a landowner whose dogs not liking the gunshots. Not anything else from the other side.

Respondent #4:

No response.

Respondent #5:

No response.

GREAT LAKES

Respondent #1:

Corms aren't always a problem, neither are they never a problem. I think they're unfairly and legitimately blamed, depending on the case. I think it takes careful examination of the situation on case by case basis to determine if management is needed. Any time we're doing lethal control on a species, we need to be confident what we're doing will be effective. I'm always looking for nonlethal approaches to manage wildlife. Anything that comes up, I'd like to look at it and see it pursued.

Early research focused on diet data and concluded corms have limited impact on sport fish. But we know now that diets change throughout the season. I.e., you can't just look at regurgitated food during early rearing. If you don't sample through the whole time period, you might get a misleading picture of what they're eating. Too much weight is placed on these diet studies. More recent research is more robust in estimating potential damages to both bird and fish populations. *These newer studies should be given more weight. Older studies don't answer the question that's often ascribed to them.

Respondent #2:

Not a major surprise to the Service that this is a major issue. But they might not understand the socioeconomic gap between fish folks and stakeholders. Even in an area where fisheries were impacted by corms and there was compensation, people are still talking about the social and economic impacts. If prey fish came back, zebra mussels died

off, I think there would still be pushback about corms. This is an area where we don't know as much as we should.

We think there's a better solution to allocate resources. We're ready to sit down and roll up our sleeves and come up with a solution that will last. This is a big issue, and we want to work for the right solution.

Respondent #3:

Not a big controversy. He thought it would be more. Some want to let Nature take its course. But not too bad.

PACIFIC

Respondent #1:

No response.

Respondent #2:

They haven't had opportunity to kill cormorants, so they don't know. For pelicans it is a problem. They have a statewide plan. Had public input. Got a lot of comments. Pretty contentious issue. The plan called for moderate control. Colony objectives. The Service cannot talk in terms of population mgt. Only local control. They can only manage the predation issue. This is the big crux of the issue. They are over objective levels for pelicans, but people don't care. They still want more.

Respondent #3:

It is very delicate. It requires communication. Our role was different than it would have been if we were the agency doing the lethal take (it was COE). We were a stakeholder. We pushed the idea that science should drive the decision-making process. Pushed for an adaptive process where mgt could be adjusted either way over time. Didn't really see it in the final plan. A lot of people don't understand it.

Respondent #4:

This is anecdotal, but in some conversations I've had with Audubon, they don't seem to be strongly concerned about depredation. We certainly don't want to reduce the populations, but we're looking for authority to manage in high-conflict areas.

Respondent #5:

No response.

Appendix C: Regional Meeting Agenda

MEETING AGENDA
Double-crested Cormorant and Free-Swimming Fish
Information Gathering Meetings
(instructions to listen to meetings remotely on next page)

8:00 a.m. Welcome and Introductions

U.S. Fish and Wildlife Service and Facilitator

Objectives of Meeting

U.S. Fish and Wildlife Service

Overview of Species-Conflict Framework

U.S. Fish and Wildlife Service

Break (15 minutes)

History of Cormorant Management Actions to Date

U.S. Fish and Wildlife Service and U.S.D.A. Animal and Plant Health Inspection Service

11:30 a.m. Lunch on your own (1 hour)

Open Discussion for Participants to provide available information and data on the impacts cormorants have on free-swimming fish populations

Facilitator

Break (15 minutes)

Possible Pathways Forward for Management of Cormorant Predation on Free-Swimming Fish

U.S. Fish and Wildlife Service

Breakout Sessions or Open Discussion on Possible Pathways Forward for Management

U.S. Fish and Wildlife Service and Facilitators

Closing Remarks and Next Steps

U.S. Fish and Wildlife Service Staff and Facilitator

5:00 p.m. Adjourn

Appendix D: Meeting Participants

August 14, 2018: Little Rock, AR (Central)

U.S. Fish and Wildlife Service Staff:

Lesley Kordella
James Dubovsky
John Stanton

Brian Smith
Scott Carleton

Meeting Participants:

Last Name	First Name	Organization
Austin	Kyle	Kansas Wildlife & Parks
Batten	Ben	AR Game & Fish Comm.
Bonds	Craig	Texas Parks & Wildlife
Booth	Thurman	USDA
Carner	Brad	AR Game & Fish Comm.
Civiello	James	MO Dept of Conservation
Cunningham	Ken	OK Dept. of Wildlife Cons.
Emerson	Chase	U.S. Sen. John Boozman
Engeling	Todd	Texas Parks & Wildlife
Gangle	Scott	ND Game & Fish Tennessee Wildlife Resources Agency
Hanni	David	USDA APHIS-Wildlife Services
Kendrot	Steve	OK Department of Wildlife Conservation
Kuklinski	Kurt	AR Game & Fish Comm.
Laird	Thomas	AR Game & Fish Comm.
Olive	Jason	AR Game & Fish Comm.
Rowe	Karen	AR Game & Fish Comm. GA Department of Natural Resources
Sargent	Bob	Texas Parks & Wildlife
Shackelford	Cliff	USDA APHIS-Wildlife Services
Wimberly	Ryan	USDA APHIS-Wildlife Services
Wisdom	Josh	MO Dept of Conservation

Phil Seng, DJ Case & Associates
Rick Clawson, DJ Case & Associates

August 16, 2018: East Lansing, MI (Great Lakes)

U.S. Fish and Wildlife Service Staff:

Lesley Kordella
Rachel Pierce
Tom Cooper

Bryan Kleuver
Charles Bronte

Meeting Participants:

Last Name	First Name	Organization
Ania	Andrea	US Forest Service
Barton	Nathan	Grand Traverse Band Natural Resources Department
Bordenkecher	Theresa	Indiana Department of Natural Resources
Bronte	Chuck	U.S. Fish and Wildlife Service
Claramunt	Randy	Michigan Department of Natural Resources - Fisheries
DeBruyne	Robin	USGS GLSC
Dickenson	Ben	Indiana Department of Natural Resources
Dorr	Brian	USDA-WS-NWRC
Duffiney	Tony	USDA APHIS-Wildlife Services
Farquhar	Jim	New York State Department of Environmental Conservation
Fielder	Dave	Michigan Department of Natural Resources
Gillet	Allisyn	Indiana Department of Natural Resources
Gobeille	John	Vermont Fish & Wildlife Dept.
Grischke	Todd	Michigan Department of Natural Resources - Fisheries Div.
Lederle	Pat	Michigan Department of Natural Resources - Wildlife
Martin	Emily	Bay Mills Indian Community
Mason	Russ	Michigan Department of Natural Resources
McConnell	John	USDA APHIS-Wildlife Services
Mendoza	Dionne	USDA APHIS-Wildlife Services
Milliken	Andrew	U.S. Fish and Wildlife Service
Mortensen	Steve	Leech Lake Res. DRM
Murray	Chuck	Pennsylvania Fish & Boat Commission
Palmer	Eric	Vermont Fish & Wildlife Dept.
Pogmore	Fred	USDA APHIS-Wildlife Services
Potter	Brad	U.S. Fish and Wildlife Service
Roerick	Tanya	Leech Lake DRM
Schoenung	Brian	Indiana Department of Natural Resources

Schultz	Doug	MN Department of Natural Resources
Silet	Brad	Sault St. Marie Tribe of Chippewa Indians
Wagner	Kim	USDA APHIS-Wildlife Services

Phil Seng, DJ Case & Associates
Rick Clawson, DJ Case & Associates

August 23, 2018: Atlantic City, NJ (Atlantic)

U.S. Fish and Wildlife Service Staff:

David Miko
Bryan Kleuver
John Stanton
Paul Padding

Michelle McDowell (remote)
Rachel Pierce (remote)
Kaycee Coleman

Meeting Participants:

Last Name	First Name	Organization
Anderson	Scott	North Carolina Wildlife Resources Commission
Barno	Lisa	New Jersey Division of Fish and Wildlife
Beuth	Josh	RI DEM DF&W
Brinker	David	Maryland Dept. of Natural Resources W & HS
Brown	Allan	USFWS - Southeast
Bunch	Aaron	Virginia Dept. Game & Inland Fisheries
Coakley	Brett	Maryland Department of Natural Resources
Coleman	Kaycee	U.S. Fish and Wildlife Service
DeMario	Devin	Association of Fish & Wildlife Agencies
Gwynn	Becky	Virginia Dept. Game & Inland Fisheries
Kennedy	Carrie	Maryland Dept. of Natural Resources
McConnell	John	USDA APHIS-Wildlife Services
Mendoza	Dionne	USDA APHIS-WS
Oakley	Corey	North Carolina Wildlife Resources Commission
Tegeler	Amy	South Carolina Department of Natural Resources

Phil Seng, DJ Case & Associates
Rick Clawson, DJ Case & Associates

August 30, 2018: Portland, OR (Pacific)

U.S. Fish and Wildlife Service Staff:

Nanette Seto
 Lesley Kordella
 Kelli Stone
 Michelle McDowell

Todd Sanders
 Georgia Basso
 Roy Elicker
 Mike Green

Last Name	First Name	Organization
Alex	Matt	USDA APHIS-Wildlife Services
Bagdovitz	Mark	U.S. Fish and Wildlife Service, Pacific Region
Baldwin	Beth	Colville Tribes
Buchanan	Joe	Washington Dept. of Fish & Wildlife
Busso	Georgia	U.S. Fish and Wildlife Service
Dillon	Jeff	Idaho Fish & Game
Donehower	Christina	Oregon Dept. of Fish & Wildlife
Dorr	Brian	USDA-WS-NWRC
Driscoll	Jamey	Arizona Game & Fish Department
Elicker	Roy	U.S. Fish and Wildlife Service
Fredericks	Jim	Idaho Fish & Game
Gardner	Eric	Washington Dept. of Fish & Wildlife
Gurtin	Scott	Arizona Game & Fish Department
Hahn	Matt	Wyoming Game & Fish Department
Hebert	Shannon	USDA APHIS-Wildlife Services
Kennedy	Ben	U.S. Fish and Wildlife Service
Lawonn	James	Oregon Dept. of Fish & Wildlife
Mendoza	Dionne	USDA APHIS-Wildlife Services
Parker	Blaine	Columbia River Inter-Tribal Fish Commission
Penne	Chris	Utah Division Wildlife Resources
Reinecker	Scott	Idaho Fish & Game
Schaefer	John	Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians
Sjoberg	Jon	Nevada Department of Wildlife
Tomlinson	Cris	Nevada Department of Wildlife
Tweit	Bill	Washington Dept. of Fish & Wildlife
Williams	Dave	USDA APHIS-Wildlife Services

Dave Case, DJ Case & Associates

Rick Clawson, DJ Case & Associates