7 SUMMARY OF MANAGEMENT MEASURES

Cormorant-fishery conflicts are complex — they are seen in different ways by different stakeholders, and they affect a range of fishery sectors across a variety of aquatic habitats. Moreover, conflicts are also subject to change because of the population dynamics of both birds and fish; seasonal and annual variations in external factors (notably, weather conditions); alterations to the perception of the nature and severity of the conflicts; and the efficacy of management measures.

Managing such conflicts is also complex and influenced by wide-ranging factors, making it impossible to provide specific recommendations for different sectors or habitats, or to recommend a list of actions that could instantly solve any particular problem.

It should also be recognised that potential management tools will not always work to the satisfaction of any or all of those involved in a conflict. That said, there are numerous tools available and ample evidence that these can prove effective in some places at some times. Identifying the most appropriate deterrents or other mitigation techniques will require careful consideration by individual stakeholders, as will the decision on whether or not efforts may need to be coordinated over a wider area. In any event, those faced with addressing conflicts are strongly encouraged to experiment with different techniques and to be creative in devising mitigation programmes to best suit their individual needs.

Many of the available techniques work by persuading cormorants to leave a particular feeding site and move elsewhere. The birds' willingness to move will depend on both the severity of the persuasion to leave a site but also, and perhaps most importantly, on the relative attractiveness of alternative feeding/breeding sites in the area. Thus, the effective deployment of mitigation techniques at a specific location may depend on a good knowledge of a much wider area. Understanding the nature and extent of the problem being addressed will therefore be central to devising an appropriate mitigation programme.

Key issues to be considered will include:

- The size of the site to be protected and whether actions are to be local and site-specific or coordinated over a wider area.
- The nature and size of the problem being addressed (including the type of fishery, time of year, number of birds/ fish involved, trends in bird/fish numbers, etc.).
- The behaviour of the cormorants (e.g. breeding, roosting, resident, migrating) and the availability of alternative foraging sites.
- The time that can be devoted to addressing the problem (deploying deterrents, coordinating actions, etc.)
- The associated costs (manpower and equipment) that can be devoted to addressing the problem viewed against expected fish losses (i.e. some sort of simple cost-benefit analysis).
- Awareness and adherence to local, national and international legislation on the use (or otherwise) of particular techniques, and the need to operate safely.
- Possible constraints on deterrent use such as: the proximity of human habitation and sensitive sites (e.g. airfields); the availability of electrical power; the security of unattended devices against possible theft and vandalism; accessibility to the land or water areas where deterrents could be deployed; and wider conservation concerns (e.g. any designated nature conservation status of a site and the potential impact upon other wildlife).

Individual managers will probably also need to consider the timescale over which management measures might need to be applied. Relatively few techniques offer potential one-off solutions to cormorant conflicts that might be effective in the long-term (years).

The two principle techniques that might provide such long term benefits appear to be:

1. The erection or installation of bird-proof barriers (typically on fish farms and perhaps small stillwaters) — techniques include netting enclosures, overhead wires and submerged, anti-predator nets.
2. Improvements to fish habitat in stillwaters and rivers — commonly, these may be the result of water quality improvements and general fishery management activities, although this might also include the use of artificial fish refuges at some smaller sites.

In contrast, a much larger number of techniques are effective at deterring cormorants in the short term, but they will probably require regular repetition, reinforcement and alteration to remain effective in the longer term. These include many of the deterrent techniques listed, as well as local reductions in cormorant populations, such as through shooting or the use of management measures at roosting or nesting sites. With many deterrents, their impact is likely to diminish with time as habituation tends to occur with any scaring technique that is not reinforced by a demonstration of actual danger. Thus, to be effective over longer periods, it is advisable to constantly change the appearance and location of devices, and to use combinations of harassment techniques in a rigorously applied, integrated control strategy. Shooting, too, is thought to be most effective where it is used in combination with other deterrent measures.

Techniques that require human presence are commonly regarded as the most effective deterrents, and those that carry biological significance and mimic threats known to birds tend to prove more effective and longer-lived than other novelty devices, although this should not deter experimentation and creativity in devising mitigation programmes. The frequency with which deterrents might need to be applied will also depend on the local situation. More frequent use will be required where there is a high degree of turnover of birds, to reinforce the scaring effect on birds newly arrived at the site and where there are fewer alternative feeding sites available for the birds.

As a general guide, it is likely that a cormorant management programme will need to be applied consistently and aggressively to be successful. Management measures should be started when birds first arrive, before they establish feeding habits at the water bodies to be protected. Thus, on waters that typically experience cormorant depredation in winter, a scaring programme should start in the autumn when the first birds arrive. Evidence suggests that cormorants stop visiting some water bodies for a month or more after initial aggressive scaring efforts and, since birds arriving later in the season often follow birds that are already present to feeding areas, conditioning the early birds to avoid certain waters should help to reduce damage by later arrivals. However, control measures may have to be applied consistently throughout the season at water bodies located on major daily flight paths, migration routes or near large roosting areas.

The application of management measures should also be timed to coincide as far as possible with the daily patterns of cormorant use at a site. Typically, birds feed at first light and this is likely to be the key period for applying deterrents, so that birds can be scared away from a site before they start to feed and begin to establish habitual feeding patterns. However, birds can feed at other times of day and may use a site for other purposes such as roosting or loafing. Regular patrols to monitor a site are therefore vital in targeting measures most effectively. When the potential for bird predation is at its worst, measures may need to be reinforced at regular intervals throughout the day from first light to dusk to be most effective. When birds only visit water bodies for certain periods of the day, such as morning and evening, employing scaring efforts only during those periods may be sufficient.

Managing conflicts is also likely to require striking an appropriate balance between the use of non-lethal deterrents and, where they are justifiable and approved, lethal measures. As noted previously, killing cormorants is very attractive to some stakeholders and commonly seen as taking positive action towards solving cormorant-fishery conflicts — one dead cormorant represents one less bird capable of eating fish. In practice, however, such killing may not deliver the anticipated 'instant solution' or the expected benefits. As a number of the case studies illustrate, shot birds can be replaced rapidly by birds from elsewhere, especially at attractive feeding sites or on migration routes, and large-scale shooting can prompt birds to become more widely distributed, thereby increasing the number of sites affected.

The Cormorant's mobility — between foraging sites and between wintering and breeding areas — and the species' flexibility — in nesting, roosting and foraging sites — means that protecting a fishery from them is very often not easy and may sometimes be impossible. Photograph — Shutterstock.

Even at a local scale, the success of shooting depends to a large extent on the nature of the local cormorant population, particularly the level of site fidelity and rate of turnover, but is also influenced by factors such as the site characteristics, the shooting strategy and the availability of alternative sites to which the birds can move. Both shooting and egg destruction can reduce the size of cormorant populations in an area, but the level of any reduction can vary, the results can be unpredictable and, where a reduction is seen, this can last for widely differing periods. Typically, effects are manifest over the longest term where a local population is relatively discrete, with limited turnover.

The concept of some form of pan-European cormorant population control is also attractive to some stakeholders. However, while the use of lethal control measures to address localised or short-term conflict issues is commonly seen as a necessary and acceptable management option, with general support from most stakeholder groups, large-scale population control at a national or pan-European scale is much more contentious. Although this is advocated by some stakeholders it is strongly contested by others. In reality, the complexities of shooting are likely to increase progressively as the scale of the shooting increases. Thus, the likelihood of achieving a successful, pre-determined outcome is progressively less likely.

Modelling suggests that some form of pan-European population control might be feasible, in principle. In practice, however, there are many biological reasons why attempts to reduce the continental cormorant population, and manage this around some lower 'acceptable' level, would be extremely difficult on such a broad scale. For example, the large territory, widespread breeding populations and further mixing and dispersing of the birds in winter means that there will be no simple relationship between management actions in breeding areas (e.g. in one country) and the consequences of these actions in wintering areas, or vice versa. Further, since numbers and distribution patterns of the birds are partly determined by density-dependent factors operating both within and outside the breeding season, the population as a whole has considerable potential to compensate for reductions in numbers.

For example, our knowledge of cormorant population dynamics indicates that a reduction in breeding birds in an area often leads to an increase in the numbers of young birds per nest that are fledged successfully. This is thought to be a consequence of the reduced competition among cormorants for food and the greater availability of fish with which they can feed their offspring. It is likely that the greater the (downwards) 'pressure' that is applied to reduce bird numbers, the stronger will be the (upwards) compensatory mechanisms that will operate to re-build population sizes.

One way of avoiding the problem of constantly fighting these compensatory mechanisms would be to work with density dependence and adopt a management approach whereby birds are restricted to a particular area and their expansion to other surrounding areas is controlled. In such a scenario, population size in the 'permitted' area would, in effect, become regulated by the available resources (e.g. food and breeding sites) and numbers would be expected to oscillate about some equilibrium or carrying capacity level. Active measures would be required outside this area — for example, preventing new roosts establishing and the use of active deterrents at feeding sites — in order to restrict expansion. Of course, preventing such expansion of the population would not be easy, particularly at a larger scale. Nonetheless, such an approach may have applications in certain situations.

Even if successful, any reduction and stabilisation of the cormorant population at a lower level would reduce the overall impact of the birds on fish stocks and fisheries — fewer cormorants across Europe would eat fewer fish. However, it is highly unlikely that this would result in an even decline in the pressure on fisheries, as birds are likely to continue to favour high quality habitats that offer the best foraging potential. As fisheries that offer cormorants the best feeding opportunities are often those that are most valuable or desirable to fisheries stakeholders, there may be little diminution in conflicts even following a substantial reduction in cormorant numbers. Thus, although fewer birds should mean fewer fisheries with problems, conflicts are likely to persist at many sites, particularly the 'best' ones, unless a major reduction in cormorant numbers is achieved.

Aside from the biological issues, population reduction through culling, nest destruction or egg oiling raises practical, economical, political and ethical issues. Lethal measures are manpower intensive and costly, and there are practical issues to address over who funds any culling and who actually carries it out. This is of particular relevance because conflicts tend to occur at bird foraging sites where shooting is the only practical lethal control measure, whereas the control of cormorant populations at nesting sites is commonly required in countries other than where the conflicts actually occur. Control at nesting sites can also be problematic because these may be in inaccessible areas or on nature reserves; there may also be insurmountable, practical difficulties — egg oiling is not possible where the birds nest in trees, for example.

There are also concerns that should unregulated control be permitted, this could lead to sustained decline and possibly local extinction of cormorants. A coordinated, and appropriately regulated, pan-European population control plan might allay such concerns. However, the killing of any wildlife on a large scale will inevitably attract criticism and may not be publicly acceptable, and some governments are unlikely to allow such lethal measures to be initiated or extended in their countries. This would increase the cormorant quota that would have to be met by participating countries.

Regardless of any future initiative in relation to a possible pan-European plan, there will be an ongoing need to manage cormorant-fishery conflicts over various temporal and spatial scales. This, in turn, will require the use of appropriate management tools. It is therefore hoped that this **INTERCAFE Toolbox** will prove useful to stakeholders and managers in addressing such conflicts. It is recognised, of course, that the **Toolbox** in no way provides the definitive answer to these conflict issues.

It is anticipated that existing tools will be refined in the light of experience and that new tools and techniques will emerge. As noted at the outset of this summary, experimentation and innovation are likely to be the key drivers in developing techniques and management strategies for use in different situations. Continuing information exchange will also be vital in communicating findings and spreading good practice. In this context, it is hoped that the **INTERCAFE** website (www.intercafeproject.net) and a planned new cormorant web site hosted by the European Commission will provide an effective mechanism for exchanging ideas and experiences and ensuring ongoing, constructive dialogue between stakeholder groups.

Finally, it is important to remember that because cormorants feed on fish, the presence of any birds at a particular site has the potential to generate conflict between stakeholder groups. This **Toolbox** describes and evaluates the wide variety of techniques that are available to reduce the impact of cormorants on fish communities. It will help provide the means by which impacts can be reduced, but — ultimately — the resolution of conflict relies on the willingness of stakeholders to engage in that process. A range of stakeholders may have legitimate interests, particularly where conflicts occur at large fisheries or over extensive areas. The initiation and continuation of dialogue, and an appreciation and understanding among stakeholders of others' aspirations and concerns, are pre-requisites to resolving conflicts.