

Draft Waterfowl Strategy for the Auckland/Waikato Region

Introduction

This paper considers the main issues affecting waterfowl numbers in the Auckland/Waikato Region. For each issue, a brief introduction is given on how waterfowl are affected, the current management actions by Fish & Game, and the proposed options for future management.

Population estimates for mallard in the Auckland/Waikato are currently at the lowest they have been since the banding programme started in 2002 with numbers declining from approximately one million birds in 2005 to 500,000 birds in 2012. Much of this decline appears to have occurred since 2009, albeit the perception of experienced hunters is that bird numbers have gradually declined since the mid-1980s.

The majority of hunters supported council's decision to reduce the dabbling duck bag limits to six for the 2010 and 2011 game bird seasons and the reduction in season length in 2013, but Council acknowledges that regulating harvest is but one part of the equation for increasing waterfowl numbers and that other factors that will increase productivity are equally as important.

There is considerable potential in the Region for enhancing waterfowl habitat, especially with the increasing number of large environmental Trusts providing funds for river, lake and wetland restoration. Auckland/Waikato Fish & Game has substantial expertise among both staff and councillors in waterfowl habitat restoration, and there is considerable scope for taking further advantage of the opportunities offered.

The purpose of developing a waterfowl strategy is to provide clear policies that will guide Council to achieve the goal of increasing the Region's waterfowl population.

1. Issue - Habitat decline, wetlands

1.1. Introduction

The Region's wetlands continue to decline in both quality and extent. While most large wetlands are now protected by rules in regional plans from direct drainage, they still face a wide range of other threats. Land-use practices in contributing catchments are increasing nutrient and sediment loading in wetlands. Water loss continues to be an issue as wetlands become perched through subsidence in the surrounding farmland and increasing drainage gradients. Drainage schemes that once relied on natural gradients are now being pumped, increasing drainage efficiency and reducing wetland habitat. Furthermore, many of the Waikato's large wetlands are managed by the Waikato Regional Council as sites for flood storage during winter and as a source of irrigation water in summer. Often little thought is given to the environmental and ecological implications of these management regimes.

Small wetlands, including ephemeral wetlands, should be safeguarded under the Resource Management Act (RMA) but in practice there is little being done to stop wetlands being modified, drained and converted to pasture in an on-going drive to maximise farm production. Ephemeral wetlands, which are wetlands that are only seasonally wet, are often the most productive wetland areas that remain in our Region and are also the most vulnerable to drainage.

1.2. What is Fish & Game currently doing?

Fish & Game exerts considerable effort into RMA advocacy focused on reducing the impacts of drainage and irrigation schemes on the Region's wetlands. Ideally wetlands should be totally protected by rules in regional and district plans, but in practice the rules are often inadequate or not correctly applied and thus we are still forced to oppose individual consent applications. However, Auckland/Waikato is the only large fish & game council that does not employ a dedicated RMA expert, and this omission is affecting our ability to be successful wetland advocates.

Historically, Auckland/Waikato Fish & Game has protected wetlands by direct purchase followed by extensive rehabilitation projects and the development of ponds for licence holders. This strategy has been very successful and Fish & Game now owns approximately 1,700 hectares of wetland in the Auckland/Waikato Region that are used by at least 400 licence-holders each season. At present we

are carrying out a large restoration project in our Eastern Whangamarino Wetland. A primary objective of these restoration projects has been to enhance licence-holder opportunities by providing places to hunt, with a secondary objective of producing ducks. We have always carried out restoration projects with the clear belief that if you get the hydrology right, the rest largely looks after itself. Unfortunately this paradigm is not shared by other agencies in the Region, whose wetland ecologists are now almost solely focused on plant ecology.

There are still options available for wetland purchase/restoration. For example, we recently lodged a funding application to the Waikato River Authority to purchase a large tract of land at Hampton Downs but unfortunately the application was rejected. The project would have re-created 55ha of high quality wetland habitat. This is size and scale of habitat creation that we need to aim for.

Fish & Game is also working on a number of restoration projects on both public and private land. The emphasis is on creating shallow, ephemeral wetlands that are hydrological separated from existing waterbodies in order to minimise the chance of pest fish infestation. Good examples on public land are the extensive wetland projects along the margins of Lake Waikare and the shallow ponds excavated in the Whangamarino Wetland parallel to Coalfields Road.

On private lands, there is an extensive network of Fish & Game supporters who are passionate about wetland creation. Success breeds success and in a number of catchments one project has led to another on adjoining properties. There are some benefits to creating wetlands on private land as the projects usually involve damming gullies rather than pure excavation and hence costs are reduced. Providing that landowners are willing to enter into agreements and add covenants onto their titles to safeguard the sites then wetland creation on private land should be encouraged further. Currently some of the projects have been relatively small scale and the challenge remains to create large wetlands that will enhance waterfowl numbers on a regional level. By contrast, most small wetlands will produce a net deficit of ducks as more birds are harvested than produced.

We have had some success assisting other agencies in developing small wetlands, including working on projects with the Waikato Regional Council (WRC) and Waahi Whanui Trust. However, at present aiding others is proving to be as labour intensive as doing the projects ourselves.

1.3 Future management options for Fish & Game

- We should continue to advocate for wetlands through the RMA process.
- Employment of a dedicated RMA expert should be considered in the Auckland/Waikato Region.
- More emphasis should be given to working in partnership with other agencies and iwi groups to create the large wetlands that will significantly boost regional waterfowl populations. It is unlikely that Fish & Game alone will receive the grants and sponsorship required to achieve this objective.
- Future Fish & Game projects should have the primary objective of producing ducks, rather than increasing hunting opportunities (a secondary objective).
- More emphasis should be given to working with other agencies and iwi groups in order to educate and encourage them to conduct their own projects. Ideally Fish & Game would act in an advisory role.
- Wetland creation on private land should be encouraged by providing free advice on construction and funding opportunities.
- We should identify properties on the market suitable for wetland creation and encourage private interest groups or syndicates to purchase the land. We could then put together wetland restoration plans and assist with the implementation of the project.

2. Issue - Habitat decline, lakes.

2.1 Introduction

Nearly all of the shallow lakes in Auckland/Waikato Region have collapsed resulting in the loss of their submerged weed beds, dominance by algal blooms, and considerable loss of waterfowl habitat. The consequences for waterfowl have been catastrophic with massive declines in abundance, especially in the large shallow lakes in the lower Waikato. Despite considerable efforts by other agencies, including DoC and regional councils, restoration efforts have rarely been successful. Much effort, in particular, has been spent on pest fish removal (section 4), which in most instances appears to have had no effect. Unfortunately it must be acknowledged that once a lake collapses then restoration using current methods is very difficult. Lake restoration (improving water quality, re-introducing submerged plants and increasing waterfowl productivity) is not going to be feasible in all situations. Therefore, effort should be focused on preserving those lakes in the Region that have not collapsed, and restoring marginal land adjacent to degraded lakes into high quality wetlands.

2.2 What is Fish & Game doing?

The primary focus for Fish & Game is to maintain and enhance water quality in the Region's lakes. To achieve this objective we need to work with other agencies. For example, we are an active member of the Waipa Peat Lakes and Wetlands Accord. The Accord is an interagency agreement between the Waikato Regional Council, Department of Conservation, Waipa District Council and Fish & Game. The purpose is to work co-operatively with landowners, iwi and interest groups for the restoration and enhancement of the peat lakes. We are also a lead agency in the Waikato Lakes and Wetlands Group (Waikato District) and the South Waikato Environmental Initiatives Fund (South Waikato District).

These groups have managed to acquire a number of revenue streams. For example, the Waikato Lakes and Wetlands Group has recently obtained \$180,000 from the Waikato River Authority to fund restoration initiatives at Lake Areare.

We have also used our advocacy role under the RMA role to full effect in order to avoid or mitigate any further degradation of lakes in our Region. We have been instrumental in the creation of treatment wetlands as part of mitigation packages on a number of peat lakes and the inclusion of

long term monitoring plans to ensure that mitigation measures are adequate. For example, last year we obtained funding of \$70,000 to mitigate for the adverse effects of the Ngaruawahia bypass on Lake Areare

Some of the Fish & Game clubs in the Waikato have been very active in lake restoration, especially the Hamilton Fish and Game Association. We have provided assistance to these clubs when required.

2.3 Future management options for Fish & Game

- The main emphasis should be on working in partnership with other agencies in the Region, including actively participating in interagency groups/forums that are dedicated to lake restoration.
- We should continue to advocate for lakes through the RMA process.
- We should continue to advocate for changes to current restoration initiatives. In recent times we have championed the need for radical restoration initiatives and acknowledge that current attempts at lake restoration are failing and will continue to do so under current paradigms.
- We should continue to support Fish & Game clubs that are actively involved in lake enhancement/protection

3. Issue - Habitat decline, rivers

3.1 Introduction

Large scale catchment schemes have devastated waterfowl habitat on many of the Region's rivers with the extensive removal of willows and poplars from riparian margins. Riparian vegetation, especially willows, provides cover for mallard nesting, brood-rearing, and loafing (a safe place to sit and relax). The removal of willows and poplars has also increased erosion leading to slumping and eroding banks, and the release of sediment as channels readjust. Furthermore, the removal of cover will increase light and water temperatures which together with high nutrient levels may result in excessive algae growth and consequential declines in invertebrate productivity.

In the lower Waikato, many hunters are concerned over the "*collateral damage*" from the alligator weed control programme carried out by the Waikato Regional Council. The concerns of hunters are that many other plants, for instance willows planted by local residents to stop erosion, are being killed by the spraying, and that the boats and helicopters used in the programme disturb the duck population immediately prior to and during the hunting season.

3.2 What is Fish & Game doing?

Fish & Game is a strong advocate under the RMA for the avoidance and/or mitigation of any further degradation of river habitat.

When flood catchment schemes seek consent renewals we have advocated successfully for mitigation packages involving extensive riparian re-vegetation programmes. For example, we were successful in getting buffer zones created when the consents for the Waihou, Piako, and Waikato/Waipā flood schemes were recently reviewed. These planted areas will create huge tracts of nesting cover for dabbling ducks.

We are also actively working with the Waikato Regional Council to implement re-vegetation programmes after willow/poplar removal schemes in the upper Waihou catchment. The objective is to produce re-vegetation programmes that are affordable, flexible and can be readily implemented by landowners.

In past years we have actively worked with individual landowners on riparian re-vegetation projects. Results have been mixed with projects often failing due to changes in land ownership. Some joint-work with landowners is still being undertaken but only when there is a strong commitment by the landowner and ideally the work should be protected by a covenant.

In regards to the alligator weed spraying programme, Fish & Game has advocated for better communications between the Waikato Regional Council and hunters, the cessation of weed spraying for at least two weeks before the Opening Weekend (one month in the Waikato Delta), and no spray activity in the hunting season. The recent consent granted to the Waikato Regional Council states that *Where a boat and/or aerial spray activity is proposed within an operational area during the duck shooting season then at least three weeks prior to the first spray activity occurring the Consent Holders shall ensure that written notification is made to each license holder within the Auckland/Waikato Fish and Game Region.*

3.3 Future management options for Fish & Game

- We should continue to advocate for riparian re-vegetation through the RMA process.
- We should continue working with the Waikato Regional Council to implement re-vegetation programmes after willow/poplar removal schemes.
- Projects with individual landowners should be considered on a case-by-case basis.
- We should continue to advocate on behalf of hunters regarding the impacts of spray activity for the control of alligator weed.

4. Issue - Pest fish

4.1 Introduction

Pest fish including *Gambusia*, goldfish, catfish and koi carp are now established in most rivers and wetlands in the Auckland/Waikato Region due to illegal introductions and migrations through the drainage networks. The direct impact of pest fish on waterfowl production is not well understood in New Zealand but has been thoroughly studied overseas. Common carp (identical to koi carp but feral colouration) in particular have been directly linked to huge reductions in waterfowl production similar to what has been observed in the Auckland/Waikato Region over the past couple of decades. Common carp are known to reduce water quality, increase algal blooms, eliminate aquatic plants and directly compete with ducks for food resulting in reduced duck production (ducks surviving to fledging stage).

Koi carp now dominate most water bodies in the Lower Waikato River drainage and often persist in very high numbers (more than 600 fish/ha). Once carp numbers are high (above 200 fish/ha) aquatic plants die off and waterfowl use can decline by more than 90%. For example, the establishment of koi carp in Lake Whangape in the late 1980's resulted in a decline in black swan from 12,000 (1977 population estimate) to less than 200 in 2012.

The ability for koi carp to thrive in the Auckland/Waikato Region is directly linked to increased nutrients in lakes from intensive agriculture and the extensive drainage systems used to convert former wetlands into farmland. Koi carp require algal blooms to survive the first year of life and the traditional method for increasing the survival of koi carp in ornamental ponds is to add cow manure. Runoff from excessive fertilizer use and poor stock management has led to ideal conditions for juvenile koi carp survival in many lakes and ponds within the Region.

Gambusia (mosquito fish) are also prevalent throughout the Auckland/Waikato Region and have the potential to decimate aquatic insects that are vital to the survival of ducklings. It comes as no major surprise that those Waikato's wetlands that hold pest fish, particularly *Gambusia*, routinely rank the lowest in the country for macro-invertebrate productivity. Controlling *Gambusia* has a large human factor because the fish are commonly spread by misguided individuals attempting to control mosquito populations.

It is important to keep in mind that no established common carp population has ever been permanently eradicated in a large water body despite hundreds of attempts worldwide. Restoring

water bodies impacted by pest fish requires three key factors: 1) removing existing pest fish, 2) preventing pest fish from re-entering (including human introduction) and 3) removing enough nutrients to allow for regeneration of aquatic plants that can support good duck production. The University of Waikato has investigated removing pest fish from lakes using electrofishing, netting and trapping. In five attempts, success ranged from 15-60% removal but there was no significant improvement in water quality. The most successful pest fish removal project to date was conducted at Lake Ohinewai and was led by Dr. Adam Daniel (subsequently appointed as Fisheries Manager for the Auckland/Waikato Fish & Game Region. Over 2,000 kg of pest fish were removed from Lake Ohinewai over a two year period at a cost of over \$40,000 with no significant improvement in water quality. This research has shown that complete removal of pest fish would likely be necessary to improve duck production.

Unfortunately management options that would completely eliminate pest fish are limited. The most cost effective technique is the complete drainage and drying of affected water bodies, but this technique is only effective when a pest fish barrier can be installed that will prevent fish reintroduction, especially reintroduction during flood events, and thus ruling out most existing wetlands. Fish screens can be used in floodplain or wetland areas and these have been trialled extensively in Australia. However, a review of these structures was recently conducted and found that nearly all had failed due to clogging or lack of maintenance resulting in costly repairs and reintroduction of pest fish. Additionally, fish screens will block access to migratory native fish and thus they are unlikely to be a viable option in the Auckland/Waikato Region.

The use of poisons (rotenone) to eradicate pest fish is an option commonly used overseas. However, three major issues prevent the widespread use of rotenone in New Zealand: 1) rotenone will kill fish including natives, 2) permitting is extremely costly due to the lengthy process and 3) DoC is the only organisation currently legislated to apply rotenone. The same issues of reintroduction and screening mentioned above also apply removing rotenone as a management option for most lowland water bodies such as wetlands in the lower Waikato River system.

Even if pest fish can be removed and kept out, agricultural pollution (fertilizer and effluent runoff) may still prevent the recovery of aquatic plants and water quality at many locations within the Auckland/Waikato Region.

Fish traps and one-way fish barriers are an option currently being used on Lake Waikare and Lake Ohinewai. The Waikato Regional Council fish trap recently installed at the Lake Waikare fish pass has proven to be highly effective removing up to 1,500 kg of fish a day. Although the trap will definitely reduce the number pest fish in Lake Waikare it will not improve water quality or duck shooting on the lake. Likewise the one-way barrier installed at Lake Ohinewai in 2011 has reduced pest fish numbers in the lake but not to a level that has improved the duck hunting or duck production.

In summary, pest fish removal is a noble goal but until cost effective and long term eradication techniques can be developed our funds will be better spent creating and improving wetlands that are pest fish free.

4.2 What is Fish & Game doing?

Fish & Game is supportive of continued research into pest fish eradication tools and effective fish barriers being developed by DoC, The University of Waikato and NIWA. The addition of Dr. Adam Daniel to the Auckland/Waikato Region Fish & Game team adds over half a decade of pest fish removal research experience, specifically focused on restoring shallow Waikato lakes, and will provide on-going connections with state-of-the-art pest fish removal tools.

Fish & Game has been facilitating research and proposals for commercial operations by minimising bureaucratic obstructions, including agreeing to capture techniques that may involve a limited bycatch of sports fish.

David Klee (Southern Game Bird Manager) has recently secured WCEET funding to investigate the impact of pest fish on waterfowl production to guide future investments in wetland construction. Constructed wetlands with and without pest fish will be surveyed to evaluate how detrimental pest fish are to duckling survival and production in the Auckland/Waikato Region. The study will also be used to identify important physical parameters of wetlands (e.g., overhead cover, nesting habitat, depth, aquatic plants and wetland size etc.).

4.3 Future management options for Fish & Game

- We should continue to advise other agencies on pest fish eradication techniques.
- All new wetland restoration projects conducted in areas impacted by pest fish should be designed to be pest fish free and have mechanisms in place that allows for pest fish removal if infestation were to occur. Water control and manipulation is an integral part of wetland management and can allow for complete drainage of wetlands to remove pest fish. For example the wetlands adjoining Lake Waikare that were constructed by Fish & Game, in conjunction with DoC, dried this summer eliminating pest fish that had invaded some of the wetlands.
- We should continue to facilitate research and proposed commercial operations by minimising bureaucratic obstructions, including agreeing to capture techniques that may involve a limited bycatch of sports fish. Nevertheless we should promote and provide advice on techniques that have a minimal bycatch of sports fish.

5. Issue - Predation

5.1 Introduction

There is a lot of conjecture about predators and what role they play in the productivity of waterfowl in New Zealand. Studies have shown that intensive predator control can enhance the productivity of endangered waterfowl, albeit little research has been carried out in New Zealand on the impact of predation on mallards.

Practical methods to minimise predation can be grouped into three broad categories: (1) physically separating waterfowl from predators; (2) physically concealing waterfowl from predators; and (3) lethal methods.

Physically separating waterfowl from predation using predator-proof fencing is clearly expensive but has to a limited extent been carried out on some properties in the Waikato, such as the Maungakawa Scenic Reserve, and is now proposed for Lake Serpentine. However the impact on waterfowl productivity is highly localised and the potential for more exclusion areas is limited due to the considerable expense. Another technique to exclude predators is to construct nesting islands on lakes and wetlands. North American studies have shown that such islands can enhance waterfowl productivity. However New Zealand has comparatively high numbers of predators that are competent swimmers (Norwegian rat, stoats) and thus nesting islands are less likely to be successful.

Physically concealing waterfowl from predators may simply involve leaving extensive areas of rank grass next to waterbodies to provide cover. A lack of quality nesting cover is a significant issue in the Waikato. Walk around wetlands in spring and you will often find evidence of well hidden ducks nests under sedges or hidden in gorse bushes. Come back the next year and those same gorse bushes have often been sprayed out of existence. Predators which formerly had to search through large areas of cover to find nests can now much more effectively search the much smaller cover areas. The reason so many ducks are seen prospecting for nests, (and often run over in the process), beside the road-edge is that this is often the only rank grass cover left in the entire area – and conveniently beside the last “wetland” left too, the roadside ditch. The American and British government use “set-aside” and similar programmes to pay farmers to leave pasture to grow rank and this can significantly boost game bird nesting success.

Elevated nesting boxes may have potential to increase mallard productivity in localised areas. This initiative is being trialled by some hunters on Fish & Game wetlands.

Lethal control of predators involves using either poison or traps. A recent study conducted in the North America found that the cost of producing one extra fledged mallard duck through utilising lethal control alone equated to \$74.29. It is likely that different predator/prey dynamics exist in New Zealand but the same bottom line principles apply. Predator control using lethal methods is labour intensive and must be done in a consistent manner to be effective. Most mustelid species (ferrets, stoats, & weasels) have large home ranges and therefore predator control should be conducted outside the immediate wetland of interest in order to be effective. Harrier hawks are likely to play a role in reducing pre-fledging survival of mallard ducks and despite the law regarding hawks having been relaxed (an Auckland/Waikato Fish & Game initiative), reducing their population to an extent where they no longer affect brood survival may not be politically acceptable.

5.2 What is Fish & Game doing?

Creating adequate nesting cover is seen as a priority. We are actively restoring areas of marginal farmland around lakes and wetlands and then allowing the remnant grass areas to go rank, and when coupled with targeted planting programmes such activities can create many hectares of nesting habitat. We are also working with the Waikato Regional Councils and other agencies to restore riparian vegetation along rivers and lake margins (as detailed in previous sections).

We acknowledge that predator control programmes should be in place for each Fish & Game wetland. Therefore, we are setting up predator control programmes as part of the balloting process in all new Fish & Game wetland developments.

Over the last year, we have obtained, refurbished and then given away over a thousand Mark 4 Fenn Traps to licence holders. Doc are currently conducting a study in order to gauge the amount of trapping effort required to reduce predator numbers in the Whangamarino Wetland and we have offered some of our land to act as control sites as part of this study. This information couple with data (evaluating nest success and brood survival) that will be obtained from the upcoming telemetry study will help to focus trapping efforts in a concerted and targeted manner.

The recent relaxation of the hawk status is another example of how we are trying to change legislation in order to increase our ability to control predators. Through those changes it has become more likely that targeted hawk control in order to increase waterfowl productivity is becoming a realistic proposition. If we can obtain good quality scientific data which proves the effect Hawks have on our game bird species this will only strengthen our case.

5.3 Future management options for Fish & Game

- Opportunities exist to align ourselves with other agencies and organisations such as the waterfowl enhancement trust and develop projects based on newly developed best practice guidelines to ensure predator control in wetlands is conducted using appropriate and proven methods.
- Wetland Associations should be actively assisted in setting up predator control programmes.
- We should continue to advocate for the relaxation of legislation for the control of Harrier Hawks.
- We should continue to assist other agencies in researching more effective techniques to control predators on large wetlands.

6. Issue – Botulism

6.1 Introduction

Avian botulism, caused by the bacteria *Clostridium botulinum*, is the most destructive waterfowl disease worldwide and can have severe impacts on game birds populations. Spores can lie dormant for years in soils and are released when favourable environmental conditions are reached, leading to an outbreak with the potential to kill large numbers of waterfowl. Maggots living in dead animals are vectors for transmission of the bacteria. A single duck carcass can hold 9,000 to 10,000 maggots. The ingestion of as few as one or two toxic maggots can kill a duck, thereby perpetuating the botulism cycle.

Botulism was first detected in New Zealand in the late 1960's and since then there have been sporadic outbreaks in the Auckland/Waikato Region. Whilst difficult to quantify, the number and intensity of outbreaks appears to have increased in recent years. There may be an element of increasing public awareness through Fish & Game media releases and a spike in reporting from Waste Water Treatment Plants (WWTP) with the introduction of Botulism Management Plans. Despite this, botulism is likely to be the single largest cause of non-harvest (post-fledging) mortality in the Auckland/Waikato Region.

There are two main environmental variables, summer floods and summer droughts events, which have caused major botulism outbreaks in the Auckland/Waikato Region in recent years. During major flood events, the rise in water levels inundates large areas of lush vegetation in wetlands causing much of this vegetation to die and decay, reducing oxygen in the surrounding water and killing fish and invertebrates. Such events can provide optimal environmental conditions for botulism germination and growth. Similarly when we have extreme drought conditions, lakes and oxidation ponds at WWTPs often become anoxic and a parallel cycle eventuates.

6.2 What is Fish & Game doing?

Stopping botulism outbreaks is a major priority for Fish & Game. Over the last year, our efforts have been directed towards WWTPs that use old oxidation ponds as winter storage areas. During summer these ponds become stagnant, nutrient rich and oxygen-deprived, a perfect environment for botulism bacteria to flourish. In 2011, we lost over 1000 mallards on one such pond alone.

To stop outbreaks of botulism on oxidation ponds we have used our advocacy role under the RMA to full affect by pushing for the inclusion of Botulism Management Plans for all consent renewals for WWTPS. The plans deals with avoidance, early detection and remedial actions, especially the rapid disposal of dead birds to limit spread. We have had a very good buy-in from the territorial authorities, strong support from regional councils, and so the plans are being adopted widely.

We have assisted some district councils in implementing Botulism Management Plans by coordinating waterfowl disturbance programmes at WWTPs using gas bangers, fireworks and discharging shot guns. Much of this assistance is carried out by honorary rangers. Fish & Game field officers have also been regularly checking WWTPs to ensure the plans are being fully implemented.

So far the Botulism Management Plans are working and botulism wasn't a major killer on oxidation ponds over the 2012/13 summer.

Stopping botulism outbreaks in natural water bodies is much more difficult but the quick removal of carcasses can greatly help to prevent major outbreaks. Fish & Game field officers have coordinated clean-up operations for outbreaks in natural wetlands and lakes in conjunction with DoC and regional councils. In urban lakes, dead ducks are typically removed by city/district parks officers to minimise the potential for botulism outbreaks. Nevertheless, waterfowl populations will always be susceptible to a number of factors largely outside of our control and diseases such as botulism often fall into this category.

6.3 Future management options for Fish & Game

- We should continue to advocate using the RMA for the inclusion of botulism management plans for all WWTPs.
- We should continue to assist territorial authorities to implement botulism management plans on a cost recovery basis.
- We should quantify the impact that large scale outbreaks have on the viability of our waterfowl populations and factor this data into our population and harvest assessment models.

7. Issue – Harvest

7.1 Introduction

The impact of waterfowl hunting regulations on mallard harvest has attracted much attention and debate within Fish & Game, especially the consequences of setting different regulations and the subsequent impact on hunter effort, mallard harvest and annual survival (survival at the end of the year).

Research has been carried out on how hunter effort changes in response to hunting regulations. For example when the season length is reduced, hunters will compensate by hunting harder and thus the overall effort is not significantly reduced. In the Eastern Region, there appears to be a strong correlation between hunter effort and harvest. Furthermore, hunter effort can explain changes in the annual survival of mallards better than any other variable. This suggests that hunter effort is the most important variable determining mallard harvest in the Eastern Region.

However, within the Auckland/Waikato Region there appears to be no consistent relationship between mallard harvest and annual survival, and thus other factors such as climate or non-harvest mortality may be equally or more important.

7.2 What is Fish & Game doing?

Understanding the impact of changing hunting regulations on mallard harvest is seen as a priority by the National Mallard Research Committee. The research committee is also evaluating different techniques for monitoring waterfowl populations and assessing the potential for mallards to be managed by climatic zones rather than by arbitrary regional boundaries. This would require a huge shift in council's decision making process and greater inter-regional consensus when it comes to harvest regulation setting. The Auckland/Waikato climatic zone would encompass the Northland Region and would cut through the Waikato just south of Hamilton.

7.3 Future management options for Fish & Game

- 1 We should continue to take an active role in the National Mallard Research Committee.
- 2 The setting of harvest regulations should move towards an Adaptive Harvest Management process – a process of acknowledging that decisions are made with some degree of uncertainty, but with an aim of reducing uncertainty over time via close monitoring of outcomes.
- 3 Recent changes to harvest regulations in the Auckland/Waikato and Eastern Regions need to be critically evaluated to determine whether or not managers can decrease hunter effort through changing season regulations.

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8. Issue - Rearing and releasing programmes

8.1 Introduction

Rearing and releasing programmes are often viewed as a quick fix solution to creating more ducks. To date, both internationally and in the Waikato results have been mixed. In general harvest rates are low for captive-reared ducks released into the wild. In the Waikato results have varied from less than 1% in a wetland area to 22% on Matingarahi Station where a concerted effort was made to feed the birds and control predators. In addition, captive-reared mallards have typically been shot on the property where they were released, and thus the returns are highly localised.

Releasing programmes have been controversial in North America and the latest review conducted by U.S. Fish and Wildlife Service advocates for a tightening of conditions around the release of captive reared mallards in the U.S. The major concerns in the review relates to the potential for disease transmission, genetic introgression and compliance with harvest regulations. However, the wider issues pertaining to the release of captive-reared mallards are beyond the scope of this discussion paper.

8.2 What is Fish & Game doing?

Permits to release captive-reared waterfowl are the responsibility of the Department of Conservation, and thus there is no statutory requirement for Fish & Game to be involved with or even notified of any such releases.

8.1 Future management options for Fish & Game

- 1 Fish & Game should support the banding of captive reared birds by offering to band all captive-reared ducks at no cost. In future year's survival and harvest rates information can be used to draw sound conclusions surrounding the effectiveness of such programmes which can help determine future management actions. At this juncture large scale releases of captive-reared mallards into the wild do not appear to be a cost effective tool for increasing hunter harvest.

Summary of Proposed Management Options

Research

- 1 An active role should continue to be taken in the National Mallard Research Committee.
- 2 Other agencies should be assisted in researching more effective techniques to control predators on large wetlands.
- 3 Research on pest fish should be encouraged by minimising bureaucratic obstructions, including agreeing to capture techniques that may involve a limited bycatch of sports fish.

Working with other agencies

- 1 Working with other agencies in the Region should continue to be a priority, including:
 - actively participating in interagency groups/forums that are dedicated to lake restoration,
 - working in partnership with other agencies and iwi groups to create the large wetlands that will significantly boost regional waterfowl populations,
 - working with the Waikato Regional Council to implement re-vegetation programmes after willow/poplar removal schemes,
 - advising other agencies on pest fish eradication techniques,
 - educating and encouraging other agencies, including iwi groups, to conduct their own wetland restoration projects. Ideally Fish & Game would act in an advisory role,
 - advising other agencies and organisations such as the Waterfowl Enhancement Trust to ensure predator control in wetlands is conducted using appropriate and proven methods.
- 2 Territorial authorities should be assisted in implementing botulism management plans for Waste Water Treatment Plants on a cost recovery basis.

Restoration of ecosystems

- 1 Advocacy should continue on the need to change current restoration initiatives for freshwater ecosystems in the Waikato. In recent times Fish & Game has championed the need for radical restoration initiatives and acknowledge that current attempts at lake restoration are failing and will continue to do so under current paradigms.
- 2 Support should continue to be given to Fish & Game clubs that are actively involved in lake enhancement/protection
- 3 Projects with individual landowners should be considered on a case-by-case basis.
- 4 All new wetland restoration projects conducted in areas impacted by pest fish should be designed to be pest fish free and have mechanisms in place that allows for pest fish removal if infestation were to occur.

- 5 More emphasis should be given to working with other agencies and iwi groups to create the large wetlands that will significantly boost regional waterfowl populations. It is unlikely that Fish & Game alone will receive the grants and sponsorship required to achieve this objective.
- 6 Future Fish & Game projects should have the primary objective of producing ducks, rather than increasing hunting opportunities (a secondary objective).
- 7 Wetland creation on private land should be encouraged by providing free advice on construction and funding opportunities.
- 8 Properties on the market should be identified that are suitable for wetland creation, and private interest groups or syndicates should be encouraged to purchase the land. Fish & Game could then put together wetland restoration plans and assist with the implementation of the project.

Harvest assessment and regulations

- 1 The setting of harvest regulations should move towards an Adaptive Harvest Management process – a process of acknowledging that decisions are made with some degree of uncertainty, but with an aim of reducing uncertainty over time via close monitoring of outcomes.
- 2 Recent changes to harvest regulations in the Auckland/Waikato and Eastern Regions need to be critically evaluated to determine whether or not managers can decrease hunter effort through changing season regulations.
- 3 The impact that large scale botulism outbreaks have on the viability of our waterfowl populations should be quantified and this data factored into our population and harvest assessment models.

Resource Management Act

- 1 Employment of a dedicated RMA expert should be considered in the Auckland/Waikato Region.
- 2 Fish & Game should continue to take an active role in the RMA process including:
 - actively advocating for lakes, wetlands, and riparian re-vegetation,
 - advocating on behalf of hunters regarding the impacts of spray activity for the control of alligator weed,
 - advocating for the inclusion of botulism management plans for all Waste Water Treatment Plants.

Predator control

- 1 Wetland Associations should be actively assisted in setting up predator control programmes.
- 2 Advocacy should continue for the relaxation of legislation for the control of Harrier Hawks.

Captive reared mallards

- 1 Fish & Game should support the banding of captive reared birds by offering to band all captive-reared ducks at no cost. In future year's survival and harvest rates information can be used to draw sound conclusions surrounding the effectiveness of such programmes which can help determine future management actions. At this juncture large scale releases of captive-reared mallards into the wild do not appear to be a cost effective tool for increasing hunter harvest.