CHAPTER 5

The Management of Alligators in Florida, USA

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ALTHOUGH the development of Florida's alligator management programme began in an atmosphere of debate and differing views, it was apparent that any successful scheme would have to be both biologically sound and politically acceptable in the most socially diverse State within the alligator's range. We felt that such a programme would be possible if we could successfully integrate three major components:

1. an effective nuisance alligator programme;
2. a long-term research commitment to gain further insight into alligator population dynamics and the effects of harvests; and,
3. an underlying philosphy that would be acceptable to people with a broad range of views towards alligator management and conservation.

The idea of exploiting wildlife on a sustained-yield basis was supported from the beginning by the Florida Game and Fresh Water Fish Commission (GFC). But beyond the general conclusions that sustained-yield harvesting was possible, and perhaps desirable, little consideration was given initially to how the concept might be applied to alligators. The basic premise was that if a harvest was implemented, it would be conducted at a level that would not initiate a long-term decline in the population. In addition, the idea was embraced that some of the money generated by exploiting alligators should be returned to the conservation and management of both alligators and their habitats.

FLORIDA'S EARLY PROGRAMME

In the late 1960's Florida's wildlife managers were first confronted with the nuisance alligator problem. In the early to mid-1970's, offices of the GFC were receiving annually in excess of 5000 complaints from the public concerning nuisance alligators. To establish its philosophical position clearly, the GFC decided that whenever an alligator was killed, the commercial value would be realized. With this basic policy as a guideline, a method to handle nuisance alligators was tested and implemented in the mid-1970's. Private hunters were contracted to take nuisance animals identified by a GFC biologist. Under this programme, the hunters were, and still are, allowed to sell the meat and they receive 70% of the value of the skin, which is sold by the State. The State receives 30% of the skin revenues, which go towards administering the programmme (Hines and Woodward 1980). The 5000 complaints a year are currently resulting in an annual take of about 2000 alligators.

A research programme was instituted in 1975 to study the life history and population dynamics of alligators. The principal objective was to develop an alligator population model that would enable the GFC to set specific harvest quotas which would approach the maximum sustainable yield in terms of dollars. Particular projects include, among other things, two experimental harvest studies: one which tests the effects of harvesting animals 1.2 m or greater than in length; and, another which investigates the effects of removing eggs and hatchlings.

PRESENT STATUS OF RESEARCH AND MANAGEMENT

One of the most obvious characteristics of the alligator's life history is that they are demographically different from most of the traditional game species. For example, a single season over-harvest of white-tailed deer will typically not be detectable one or two years later — a one year's over-harvest with crocodilians may alter a wild population for a much longer period.

This perceived fragility, plus the desire for maximum revenue payback for the conservation of wetlands, helped reshape our early objective of generating specific sustained-yield harvest quotas. As years have gone by, we have not abandoned the goal of a quantitative management model, but have pushed it much further into the future. In the short-term we have begun to concentrate less on specific quotas and more on pragmatic strategies.

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When private landowners or wildlife administrators consider an alligator exploitation programme, the first thing they generally want to know is how many animals can be harvested. It would be nice if we could give them a number. But consider the research required for any such determination. Figure 1 is a hypothetical knowledge-returned-per-unit-of-research curve. Obviously, neither the precise shape nor the exact location of particular tasks is accurate, but the essential form is familiar to most researchers. Its practical significance is all too clear. Some basic information is relatively cheap. But then the hard questions come and costs rise in a non-linear fashion. The problem is particularly acute when one attempts to create a model that can establish specific harvest quotas. Demographers traditionally attack such a problem with a highly modified Leslie matrix. For this, they demand information on age-specific survival rates and age-specific natality (birth) rates, in terms of daughters, for all relevant age classes. Furthermore, they want to know these rates very accurately.

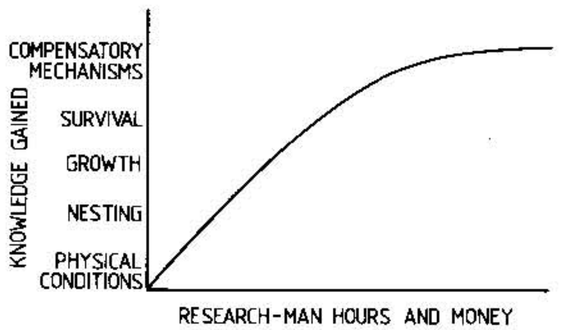

Fig. 1. The hypothetical relationship between knowledge returned and research effort in terms of both hours of work and total costs.

Clearly, estimates of most demographic parameters of a crocodilian population are exceedingly expensive to obtain. For example, five years of costly research into alligator mortality in Florida have thus far generated useful survival estimates — but only for the hatchling age class. Even if we assume that we have somehow obtained precise information on the two dozen or more demographic parameters that define a crocodilian population — even then a model cannot give you a straight-forward *number* of how many animals you can harvest on a sustained-yield basis. Instead, you are usually presented with a new information demand: you must be able to say how the residual population responds to the alterations in density that occurred as a result of the harvest. Until density-dependent compensatory mechanisms are programmed into a model, demographic models will project sustained-yield harvests of exactly zero in a stable population.

Thus far our search for compensatory factors has produced some tantalizing information but no formally definable mechanisms. On Orange Lake, a 5000 hectare wetland in north-central Florida, we have removed 900 alligators, at least 1.2 m long, and have not yet detected any change in growth or in the physical condition of any size class within the population. Beginning in 1978 (with what we presume was a stable population), total nest numbers have been monitored annually. After the 1981 nesting season, an experimental harvest was initiated which has resulted in 93 adult females (total length >1.8 m) being removed over three years (Fig. 2). Before the harvest, the average annual number of nests was 71.3; the post-harvest average is 88.7. Environmental factors such as weather clearly complicate the interpretation of these data, but we can certainly say with confidence that although a substantial number of adult female alligators have been removed from the population, nesting has not decreased. Initially, we believed that competition for nesting space might be a density-dependent mechanism, but such does not appear to be the case (Woodward *et al.* 1984). Other explanations have been offered, but at present they are only guesses. So investigation continues.

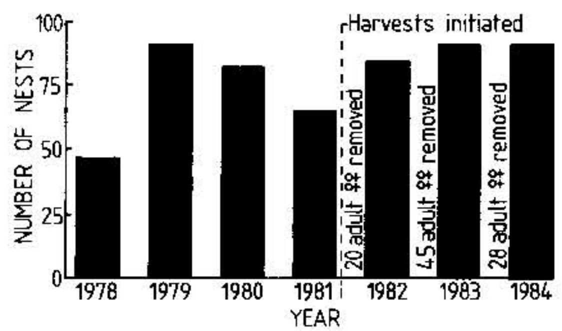

Fig. 2. The number of *Alligator mississippiensis* nests recorded in Orange Lake, Florida, between 1978 and 1984. The removal of 93 adult females between 1982 and 1984 did not reduce total nesting effort.

Our search for the density-dependent mechanisms which operate in alligator populations has extended beyond the adult females. Since 1981 we have attempted to remove 50% of the egg or hatchling production from each of three central Florida lakes. Despite substantial logistical difficulties, we have at least approached our removal goals each year; between 1981 and 1984, 11,115 hatchlings and/or eggs have been collected. As you may suspect, we have not succeeded in obtaining an estimate of the survival rate of animals not collected, but we have been able to monitor their growth rates. They appear unaffected by the reductions in density for at least the first two years of life.

Our failure to discover density-dependent mechanisms in young alligators does not imply logically that such mechanisms are absent. However, it does lead us to suspect that any effect of compensatory factors may be delayed. These suspicions are reinforced by hints from our field data. During a study of alligator food habits, Delany (in prep.) discovered the tags used to mark hatchling alligators in 10% of the stomachs of alligators larger than 2.1 m. By examination of mark-recapture records, we were able to determine that the young alligators had not usually been eaten as hatchlings, but rather when they had grown to the one metre long size class. Thus, if cannibalism is density-dependent (Nichols *et al.* 1976), it may act predominantly on the larger juveniles.

In a similar vein, our mark-recapture studies indicate that alligator growth rates slow appreciably as animals approach 0.6-1.2 m in total length. But then, between 1.2 and 1.4 m, at least some individuals show a renewed growth spurt. It is almost as if they had gained access to a new food source and thereby broken-out of a highly competitive "growth-bottleneck".

The purpose of this discussion is not to explain what density-dependent compensatory mechanisms may be, but rather to highlight the fact that they may be complex and very difficult to quantify. Research aimed at defining them should be expected to be both protracted and expensive — far to the right on the research-cost curve (Fig. 1). Therefore, at least in the forseeable future, we may not be able to direct harvest programmes through sustained-yield computer models. Rather, we may have to seek more modest strategies.

CURRENT MANAGEMENT STRATEGIES

The experience gained from the alligator harvest in Louisiana, together with some of our own experimental work in Florida, has demonstrated that biologically and economically sound harvest programmes can be developed without a complete knowledge of the relevant demographic processes. If indeed pragmatic safe strategies can be properly implemented, they offer two major advantages: they can provide an immediate economic payoff and they generate useful information in a learn-as-you-go framework.

But what, specifically, have we learned about safe, economically viable strategies? Foremost, that the most appropriate strategy can vary from place to place and that on-the-ground biological evaluation is necessary to discover the specific harvest opportunities offered in a particular locality. For instance, on one of the private landholdings that we evaluated, alligators nest annually but survival to hatching, and of hatchlings, appears to be virtually nil. We cannot, with confidence, tell this landowner that he can harvest say 7.5% of his total alligator population, but we *can* suggest that he take 100% of eggs and hatchlings: they will very likely not survive in any case.

For a much more impressive example, we might consider the case of the Louisiana harvest. By "fishing" with baited hooks set at a prescribed height, and by harvesting only the canals, Louisiana has implemented a harvest system that very specifically targets males and quiescent females — the reproductively irrelevant members of the adult population (Joanen and McNease, Chapter 4).

Within Florida, "male" and "female" alligator habitats are not as discrete as they are in Louisiana. A "fishing" scheme appears demographically more risky than a carefully regulated airboat-and-harpoon strategy which allows wariness to develop in the hunted populations. But the point is made. Specific-number harvest models have, on paper, an appealing generality. Truly feasible harvest strategies generally require on-site evaluation both before and after the harvest.

Besides the lesson of site-specificity, there are other insights we have gained into the question of viable harvest strategies. We have learned that although our alligator demographic information is quite limited, it is valuable none-the-less. For example, we have been able to address the question of relative demographic value, by size class (Abercrombie *et al.* 1984). It appears that one can harvest at least fifty hatchling alligators for the same "demographic cost" as removing one randomly-selected animal of approximately 2 m in length.

Similarly, there may be other research directions that will yield relevant management information and be worth the cost of investigation. Consider a research project presently being conducted by Mike Jennings, of the U.S. Fish and Wildlife Service, Florida Co-operative Wildlife Research Unit. He is attempting to determine if demographically "free" nests — those that will not contribute to the population — can be identified from the air. Nests scheduled for removal of eggs are generally spotted from an aircraft, and from the air one can easily determine several nest characteristics: how much of the nest is in full or partial shade; how far it is from water; how high is it above water level; is an adult in attendance? A quick evaluation of these characteristics might enable an airborne observer to estimate, perhaps by means of a discriminating formula derived from previous research, the probability that the eggs in a nest will hatch — or perhaps even the proportion of hatchlings that are likely to be female because of the temperature regime within the nest (Ferguson and Joanen 1983). Given that only a proportion of located nests would be removed, perhaps collectors on the ground could be steered away from the demographically valuable nests.

When designing the most appropriate strategy for a safe, valuable harvest, socio-economic research can be just as important as the more traditional biological research. For example, managers who are aware of market conditions may take advantage of the demand for a specific size class to direct pressures away from the more demographically valuable animals. In Florida, we have developed a relatively lucrative meat market. Since large (>3.0 m) animals are therefore very valuable, hunter attention is focused away from the medium size classes, which are dominated by females, and is centred on the more demographically irrelevant adult males — animals that would normally be too scarce to target for hunting unless the important meat market existed.

Market conditions can also direct hunting towards the smaller size classes, which are also demographically "inexpensive". When reviewing the records of skin buyers that dealt illegally in alligator skins in the late 1960's, we discovered that 1.2 to 1.5 m animals consistently made up 60% of the kill (Hines 1979). Chris Plott (pers. comm.) paid premium prices for skins of this size in order to satisfy Japanese markets. The deleterious effects of this illegal trade were probably minimised by the structure of the harvest.

VALUE ADDED CONSERVATION

An integral part of Florida's alligator management programme has been the concept that the commercial worth of alligators should be channelled into helping the conservation of both themselves and their habitats. This idea has been discussed by several authors (Palmisano *et al.* 1973; Rose 1982; Anon 1982), but the relationship between commercial exploitation and conservation is still not entirely clear. Be that as it may, we have demonstrated on a small scale that considerable revenue can be generated back to the State for both research and management. At present, the State takes 30% of the value of the skins from both the nuisance alligator programme and the experimental harvest programme. During the last two years, this take has amounted to US$ 221,767 from 6586 skins. Since the first harvest of nuisance animals in 1977, there have been 15,892 skins sold; the State's share of these revenues has been approximately US$ 532,000.

At some future date the contract sale system will probably be replaced by a more traditional licence structure. Although the licence will probably generate less money "per skin" than the present 30% of market price, the expanded harvest will compensate, ensuring that monies are available for the conservation of both alligators and their habitats.

The current management plan for alligators recognises explicitly the value added concept; it specifies that the returns derived by the State from commercial alligator exploitation shall be used as a source of funding for the continued mangement of the wild resource. This feedback can be direct (i.e. supporting research or habitat preservation and enhancement) or indirect (i.e. providing landowners with economic incentives to preserve their wetlands). In addition, all users — whether commercial hunters, sport hunters, ranchers or even hide and meat dealers — have a vested interest in assuring that wetland systems are maintained and managed. This has immediate benefits for alligators, but ultimately will benefit all the wildlife that depend on wetlands.

CONCLUSIONS

In Florida we have been deeply involved in an alligator research effort for over ten years. In the beginning, we hoped to construct a population model that would allow us to establish very specific harvest quotas. Also, we wished to divert a portion of the alligator's commercial value back to research, management and habitat preservation.

We still affirm the objective of developing a population model to set harvest quotas, and perhaps ongoing research will, in the long-term, provide data that will enable us to include compensatory responses in such a model. But we have found that the data needed are both difficult and expensive to obtain. Meanwhile, it has become apparent that more modest exploitation strategies, developed from our growing knowledge of alligator demographics and with consideration of cultural and economic forces, will permit a sustainable harvest. Our present programme recognizes this, and forthcoming management research will exphasize the formulation of "safe" strategies such as removing hatchlings, harvesting in marginal habitats, and targeting individuals of specific size classes. Such an approach will provide additional biological data as well as revenue which can be redirected to alligator research and management.

We believe one of the most important aspects of any crocodilian exploitation programme should be to use harvest-derived revenues to support the conservation of an exploited species and its habitat. Although the recent harvest of Florida alligators has been quite limited, half a million dollars have been returned to the State by alligator programmes over the past eight years. These modest revenues have paid significant dividends in terms of public and legislative support for our research and management programmes. In addition, alligator farmers have provided approximately US$ 13,000 per year over the past four years to finance research into the effects of hatchling removal. In other words, we have employed alligator harvest revenue to support the conservation and management of alligator populations. This demonstrates in a small way that commercial exploitation can benefit the target species. As our programme expands, we hope its conservation impact will grow to be even more susbstantial.

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