Louisiana’s alligator ranching programme: a review and analysis of releases of captive-raised juveniles

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The Louisiana Department of Wildlife and Fisheries regulates an experimental alligator (Alligator mississippiensis) egg collection programme which requires the return of a portion of juvenile alligators to the wild to ensure recruitment and maintain populations. Numerous studies have been and are currently being conducted by Department personnel to evaluate the success of this programme. Farm-released juvenile alligators are able to forage for food after release to the wild. Growth rates are equal to or higher in juveniles released from farms than native wild alligators matched for size and sex. The accelerated growth is maintained for several years after release. An extensive tag and release programme of farm-released juvenile alligators was evaluated by analysis of later harvest of recaptured sub-adult and adult alligators. Results suggest fairly high survival rates of farm-released alligators. No differences were found in stress hormone levels between farm-releases later caught in the wild and native-wild alligators. Farm-released juvenile alligators have attained sexual maturity and successfully nested in the wild. Numerous parameters suggest egg ranching and subsequent return of a portion of juvenile alligators to those wetlands is a successful management tool that uses a resource that would otherwise be lost to high natural mortality. A brief review of release programmes for other crocodilians is provided.

Key words: Alligator, Growth, Survival, Reproduction, Reintroduction.

INTRODUCTION

WILDLIFE resource management programmes involving raising crocodilians in captivity for commercial and conservation purposes have been successful for numerous species around the world (Webb et al. 1987; Joanen and McNease 1990; Hutton and Webb 1992). Research on the ecology, reproductive biology, and captive propagation of Alligator mississippiensis was initiated in 1964 by the Louisiana Department of Wildlife and Fisheries (LDWF). Methods for egg incubation, post-hatching culture, and juvenile and adult alligator culture were developed and refined (Joanen and McNease 1987). Alligators have been shown to breed in captivity (Joanen and McNease 1987), but success has been limited and emphasis shifted to “ranching” programmes, which allow the collection of eggs from privately owned wetlands.

LDWF personnel conduct coastwide annual nesting surveys, and after populations and habitat suitability are reviewed conservative egg harvest quotas are set. Because natural mortality rates of alligator eggs and young alligators are very high, egg ranching allows utilization of a segment of the population which would otherwise be lost. Thus, management of alligator populations through egg collection programmes may lead to greater population increases than if no such programme is in place (Nichols et al. 1976; Staton 1989). The programme in Louisiana has been successful and provides a strong economic incentive for landowners to conserve and manage their wetlands. Sustained utilization of the alligators and their eggs is recognized as an effective management practice and a tool to conserve wetlands (Joanen et al. 1997). Because adult alligators are harvested annually (in addition to egg ranching from the same wetlands), the LDWF requires that a portion of the juveniles raised from ranched eggs be returned to the collection site, to ensure population recruitment. As part of this experimental programme, the alligator rancher must release healthy alligators between 36" and 60" (0.92 m–1.52 m) back to the wild, representing a calculated percentage of his annual hatch rate based on estimated mortality/survivorship curves for wild alligators from data available at the time this project was initiated (Taylor and Neal 1984).

Growth rates in wild alligator populations in several habitats have been documented, including Louisiana, Florida, Georgia, Texas, North Carolina, and South Carolina (see Elsey et al. 1992a for review). Limited data exist on growth rates and survival of crocodilians.
returned to the wild from captivity, or on the success rate of relocation, repatriation, and translocation efforts in crocodilians (Dodd and Siegel 1991), although numerous studies on translocations in birds and mammals have been recently reviewed (Wolf et al. 1996). Blake and Loveridge suggested (1975) that captive released crocodilians might not thrive, possibly as a result of having to learn to hunt for food and adapt to a new environment. The purpose of this overview is to summarize prior and ongoing studies by the LDWF on the survival, growth rates, reproduction, and dispersal of alligators raised in captivity and released back to the wild. These data may be used to refine management recommendations and more precisely determine appropriate return rates (if needed) of ranched crocodilians to the wild to maintain populations. Portions of this document have been previously published by us in the scientific literature as cited herein.

LDWF'S RANCHING/RELEASE PROGRAMME

Louisiana’s alligator farming/ranching programme increased dramatically between 1986 and 1990 and has been described in detail (Elsey et al. 1992a). Prior to 1986 the farming programme was small due to limitations with stock procurement. The initial few farmers were supplied hatchlings from eggs collected from state-owned lands, and incubated and hatched by department personnel. The alligators fared well in captivity and could reach market size in one-two years. This led to such a rapid expansion of the programme that the demand for hatchlings for this new industry could not be met from agency resources. The LDWF then developed guidelines and strict quotas whereby potential ranchers might obtain eggs from suitable private wetlands, which historically have been shown to support substantial populations of alligators.

The LDWF initially required a quantity of juvenile alligators equal to 17% of the eggs hatched by the rancher be returned to the wild within two years of hatching. In the first three years of the release programme (1988–1990) returns were limited to fewer than 15,000 alligators. Sizes at release were generally small, and averaged 91–97 cm. In 1991, a variable return rate was established based on the estimated 17% survival from hatching to 48” (121.9 cm) predicted for wild juvenile alligators. Using the relationship of survival between size classes as specified in Taylor and Neal (1984), we extrapolated return rates based on expected survival rates for alligators from 36” (91.4 cm) to 60” (152.4 cm). For example, more alligators must be returned if the average total length is smaller and fewer animals are required if the average length is larger [example 18% at 47 inches (119.4 cm) average and 14% at a 58 inch (146.6 cm) average]. Alligators must be at least 36” (91.4 cm) and are usually less than 60” (152.4 cm) at release and must be free of disease or deformities to be acceptable for release (Elsey et al. 1992a, 1998).

Releases are made from 15 March to 30 September if the weather is suitably warm. LDWF personnel supervise each release, and the juvenile alligators are marked individually with serially numbered monel web tags. One or more tail scutes are removed and length to the nearest inch (2.54 cm) is recorded. Sex is determined by visual examination of the penis/clitoris after opening the cloaca with a nasal speculum. The tagged alligators are then placed in burlap sacks, and transported to the wetlands from which the eggs were collected one or two years earlier. The alligator rancher and/or landowner are responsible for releasing the alligators in appropriate juvenile habitat, consisting of shallow ponds in the marsh interior.

MAGNITUDE OF THE PROGRAMME

NUMBER OF EGGS COLLECTED AND ALLIGATORS RELEASED

The number of alligator eggs permitted, collected, and hatched from 1986 to 1998 is shown in Table 1. Over 2.5 million eggs have been collected and 2,136,375 hatched (88.2%). Limited egg collection (ranching) was first permitted on private wetlands in 1986, thus the first “returns” were made in 1988, two years later. In the early phase of this programme, small numbers of alligators were released. In 1989 and 1990 egg collections increased dramatically. Thus, the first large number of releases were made in 1991, with over 44,000 alligators released that year. Fewer eggs were collected in 1992 and 1993, probably due to market fluctuations. As can be seen in Table 1, only 55–60% of eggs permitted were collected during 1991–1993. A stronger market led to higher egg collections in 1994 and 1995, with many new landowners requesting egg collection permits. Egg collection peaked in 1997, with 377,636 collected, which was 79.3% of the eggs permitted. In 1996 and 1998 severe droughts limited alligator nesting in some regions and often precluded access to the nests that were available; only 59.7% of eggs permitted were collected in 1996, and only 52.1% of those permitted were collected in 1998.
The number of alligators returned to the wild is summarized in Table 2. The sex ratio and average length of those released are listed. Of note, 54.8% of the releases through 1996 were females, and 41.7% were males (3.5% unknown). This is an important factor to consider, because the September season harvests select for males (70-75% of the harvest is male), whereas only 41.7% of the releases are male. Thus, the harvest method (while protecting breeding females) selects against catching farm-released females, which are released at a higher rate. It may be advantageous to release slightly more females than males to increase numbers of potential nesting females as one adult male can mate with several females during the breeding period.

### NIGHT WORK PROGRAMME/TAGGING AND RECAPTURE METHODS

To compare growth rates and survival of released alligators to wild populations, LDWF personnel caught and marked numerous wild alligators in the 3'-5' (91.4 cm-152.4 cm) size classes to facilitate comparison to the farm releases. Alligators were captured on privately-owned wetlands involved in the egg collection and release programme and on which alligator harvests occur in the annual September season, and on state-owned wetlands which have experimental annual harvests. The private wetlands tagging sites are owned by Amoco Production Company, Fina Oil and Chemical Company (Mecom Ranch), Miami Corporation, and Vermilion Corporation; all located in southwestern Louisiana.

Wild alligators were caught at night from airboats after locating eye-shines with a “Q-Beam” spotlight. Smaller alligators were caught by hand, larger ones by a small self-locking cable snare (“Coon-catchers”, Southeastern Outdoor Supplies, Inc., Bassett, Virginia). Wild alligators were marked, tagged, sexed, and measured in a similar fashion to farm-releases, and released at the capture site. Growth data could be obtained from farm-releases or native-wild alligators when

### Table 2. Sex ratio and average total length (inches) of juvenile alligators released from farms in Louisiana, 1988–1997.

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
<th>Unknown</th>
<th>Total</th>
<th>Ave.Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>74</td>
<td>362</td>
<td>1244</td>
<td>1680</td>
<td>48.21*</td>
</tr>
<tr>
<td>1989</td>
<td>2863</td>
<td>2565</td>
<td>1650</td>
<td>7078</td>
<td>36.77*</td>
</tr>
<tr>
<td>1990</td>
<td>1915</td>
<td>2000</td>
<td>2173</td>
<td>6088</td>
<td>37.96*</td>
</tr>
<tr>
<td>1991</td>
<td>17100</td>
<td>26790</td>
<td>325</td>
<td>44415</td>
<td>45.05*</td>
</tr>
<tr>
<td>1992</td>
<td>13748</td>
<td>20127</td>
<td>1356</td>
<td>35251</td>
<td>43.07*</td>
</tr>
<tr>
<td>1993</td>
<td>9306</td>
<td>19702</td>
<td>7</td>
<td>29015</td>
<td>44.89*</td>
</tr>
<tr>
<td>1994</td>
<td>9549</td>
<td>12026</td>
<td>257</td>
<td>21632</td>
<td>47.62*</td>
</tr>
<tr>
<td>1995</td>
<td>11005</td>
<td>9784</td>
<td>6</td>
<td>20795</td>
<td>46.25*</td>
</tr>
<tr>
<td>1996</td>
<td>20879</td>
<td>20027</td>
<td>13</td>
<td>40919</td>
<td>47.54*</td>
</tr>
<tr>
<td>1997</td>
<td>26681</td>
<td>21404</td>
<td>86</td>
<td>48171</td>
<td>48.61*</td>
</tr>
<tr>
<td>Total</td>
<td>112920</td>
<td>134787</td>
<td>7317</td>
<td>255024</td>
<td></td>
</tr>
</tbody>
</table>
recaptured later by LDWF personnel or when harvested as subadults or adults in the annual September harvest.

The number of alligators caught during "night-work" tag and release efforts is shown in Table 3. The sex ratio of these alligators is shown in Table 4. Forty-three nights were worked, with two or three boats per night for a total of 102 "boat-nights". Usually two persons worked in each boat; occasionally three staff members were in a boat. A total of 5,669 alligators were caught; 495 were farm retraps, 308 were wild retraps, and the rest were native wild alligators. Obviously, the first time a new site was worked, no native wild retraps were possible. We attempted not to work areas soon after a farm release was made, such that interval growth data would be meaningful.

Night work efforts were centred in southwestern Louisiana for logistical reasons (proximity to staff and airboats at Rockefeller). Also, these landowners (Amoco, Fina, Miami, Vermillion Corporation) frequently sell their September harvest alligators as a unit to a single buyer and the entire lot is processed at one location. This facilitated staff members in collecting data from these farm and wild retraps which might be caught in annual September harvests.

While catching alligators at night, we noticed tag loss to be a problem. In 1991 we caught many "C" notched alligators on Vermillion Corporation with no web tags. Thus, in 1992 we began using two size #3 monel tags for all farm releases, rather than a single web tag. Tag loss continued to be a problem in September harvests; thus in late 1994 we switched to using two #4 monel tags, which are larger. This has also aided in accurate tag numbers being reported by trappers as the numbers are larger and easier to read. The tail notch regime used is listed in Table 5.

The number of alligators captured at night annually varied with number of available personnel and frequent difficulties budgeting time due to concurrent farm releases, hide validations and inspections, September and experimental harvests, etc. severely limiting time available for this project. The drought of 1996 limited access to sites for much of the season.

It should be noted that many wild retraps were of small alligators <36" (91.4 cm); often one clutch of hatchlings may have been caught and notched one year at 18-21" (45.7-53.3 cm), and subsequently some were recaptured the following year in the same pod at a larger size. Farm releases must be at least 36" (91.4 cm) to be released, the average size
Table 4. Sex ratio of juvenile alligators caught in night spotlighting trips in south-west Louisiana, 1990 to 1996.

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>133</td>
<td>45</td>
<td>5</td>
<td>183</td>
</tr>
<tr>
<td>1991</td>
<td>439</td>
<td>489</td>
<td>76</td>
<td>1002</td>
</tr>
<tr>
<td>1992</td>
<td>151</td>
<td>144</td>
<td>4</td>
<td>299</td>
</tr>
<tr>
<td>1993</td>
<td>735</td>
<td>670</td>
<td>13</td>
<td>1418</td>
</tr>
<tr>
<td>1994</td>
<td>794</td>
<td>735</td>
<td>1</td>
<td>1530</td>
</tr>
<tr>
<td>1995</td>
<td>435</td>
<td>409</td>
<td>2</td>
<td>846</td>
</tr>
<tr>
<td>1996</td>
<td>197</td>
<td>193</td>
<td>1</td>
<td>391</td>
</tr>
<tr>
<td>Total</td>
<td>2884</td>
<td>2685</td>
<td>100</td>
<td>5669</td>
</tr>
</tbody>
</table>

Table 5. Tail notches used to mark wild and farm-released alligators in Louisiana, 1988–1998. An “A” notch is the first single tail scute, “B” is the second of the single scutes, etc.

<table>
<thead>
<tr>
<th>Year</th>
<th>Farm Releases</th>
<th>Wild (nightwork)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>varied*</td>
<td>—</td>
</tr>
<tr>
<td>1989</td>
<td>varied*</td>
<td>—</td>
</tr>
<tr>
<td>1990</td>
<td>varied*</td>
<td>AB</td>
</tr>
</tbody>
</table>
| 1991 | varied*       | A = smaller alligators (≤30")  
                 B = bigger alligators (>30")  |
| 1992 | A              | B                |
| 1993 | A              | B                |
| 1994 | AC             | B (midway through year change to "D" on Miami)  
                 B ("D" on Miami)  |
| 1995 | AD             | B                |
| 1996 | AE             | B                |
| 1997 | AF             | B                |
| 1998 | AG             | B                |

* Varied with how many years that rancher had that permit (i.e., A = first year that farmer had that land company, B = second year, C = third year, etc.).

is usually larger (Table 2). Above this size alligators are more difficult and dangerous to catch at night. We concluded that night work efforts were more useful for comparative growth data than for evaluation of survival of farm releases. Relative to the large number of farm alligators released we were only able to mark 1 000–1 500 wild alligators per year. This disparity in sample size made the few recoveries of wild alligators of little value to evaluate survival. Many farm releases rapidly grow to a size >60" (152 cm) and are caught less frequently at night for safety reasons. Also, farm alligators in the 60"–72" (152–183 cm) size range may be selected against in the September harvest, as trappers set lines higher to try to secure larger alligators. Thus, many farm-released alligators may be initially undetected in the harvest and night work programmes.

TAG RECOVERIES

Data on growth and survival of farm-released and wild alligators (tagged during night work) are obtained in many ways in addition to live recapture by staff members as discussed above. During September harvests, trappers are issued a form on which to report harvest of a marked (tail notched) alligator and asked to record the date harvested, length at harvest, web tag number (if present), etc. Few were obtained in the early years of the programme; in 1994 we began showing trappers (at the time of tag issuance) color photos of a tail notch and web tag in the alligator’s foot, and encouraged reporting “retrapped” alligators. Also, as farm alligators grew through time, more reached harvestable size around 1994. For example, the first significant number of releases were made in 1991 at a 45" (114.3 cm) average, and in 1992 at a 43" (109.2 cm) average. At an estimated growth of approximately 7" (18 cm) per year (Elsey et al. 1992a) these alligators would not reach the 60" (183 cm) size class (which is the average size harvested) until 1994 and 1995. The same principle applies as to when farm-released alligators might attain sexual maturity or begin nesting, which would not be expected for several years after release. Some 150 “mail-in” retraps were reported in the September 1994 season, and approximately 200–225 annually in the 1995–1997 September harvests.

Retraps were also obtained by having staff members available in processing sheds where trappers bring alligators for skinning and meat processing. These efforts were intensified in 1993, yet limited to the five or six persons statewide in the “attacker crew” as their schedules allowed. Nearly 850 retraps were recovered in September 1995 from alligator processing sheds. Over 600 retraps were recovered in 1996; some decline was due probably to one major processing shed being non-operational and in part due to lowered tag allotments in 1996 due to severe drought. Approximately 1450 “retraps” were harvested in September 1997 and 1750 in September 1998, as increasing numbers of farm-releases reached the targeted adult size classes.

Retraps are occasionally obtained by miscellaneous calls through the year from nuisance trappers or as road-kills. This accounts for numerous “retraps” annually.

Many retraps are obtained from experimental harvests at Marsh Island. Egg permits were obtained there on Iberia Parish School Board and later some “Rockefeller Supplement” alligators were released on Marsh Island for restocking and research purposes (dispersal/movement studies). A few farm releases are also harvested on Salvador WMA which migrated from adjacent land, or were released alligators previously released on Salvador. These data are useful for growth
studies. Survival rates must be analysed separately from the rest of the statewide farm release programme due to higher harvest regimes on Salvador and Marsh Island.

"GOOD" RETRAPs/"PROBLEM" RETRAPs

Many of the retraps we obtain have an incomplete data set for one of many reasons. A retrap is considered a "good" retrap if a complete web tag number is recorded and a total length at recapture is known. "Problem" retraps occur by several means. The most common problem is web tag loss on notched alligators. If the location is any site other than the few areas where night work has been conducted (by LDWF, USFWS personnel at Lacassine NWR, or LSU researchers at Golden Ranch) it is almost certainly a farm release, but still must be considered a "problem" retrap as the initial length and release date are unknown. A "release year" may be assigned from those with year-specific tail notches which were started in 1994 (i.e., AC = 1994 farm, AD = 1995 farm, AE = 1996 farm, etc.).

Other problems occur with mis-read or incomplete web tags being reported. The small lettering on size #3 metal tags is often misread; many trappers report only 4 or 5 digits of the 6-digit web tag number. Trappers occasionally report "6m" as the length, and do not recall if this meant 6'0" or up to 6'11". These cases cannot be used for growth data, but can be used to some degree for survival data, if the web tag is reported correctly. Road kills are frequently damaged such that accurate lengths cannot be reported.

Through the end of 1996, some 4,470 retraps were obtained, of which 2,954 (66%) were "good" retraps obtained in September and experimental harvests, night work, and miscellaneous other means. The majority (2,539) were farm-released origin (86%) and 415 (14%) were native wild (night work origin). The majority of the 415 native wild retraps were night work live recaptures (368), with only 47 "native-wild" being harvested in September seasons or reported as road-kills, boat-kills, "found dead", etc. In 1997, some 1,450 retraps were obtained in the September harvest; nearly all were farm-releases. Data from 1998 are still being analysed, but over 1,700 farm retraps were caught in the 1998 harvest. Table 6 shows the distribution of retraps obtained thus far from all sources.

Table 6. Number of "good" retraps for which a complete data set is available (web tag retained, recapture length available, etc.). Includes September and experimental harvests, nightwork retraps, and miscellaneous for years 1988-1996; 1997 numbers are from the September harvest only.

<table>
<thead>
<tr>
<th>Recovery Year</th>
<th># Farm Retraps (&quot;Good&quot;)</th>
<th># Wild Retraps (&quot;Good&quot;)</th>
<th>Total Retraps (&quot;Good&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1989</td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>1990</td>
<td>25</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>1991</td>
<td>130</td>
<td>0</td>
<td>130</td>
</tr>
<tr>
<td>1992</td>
<td>32</td>
<td>3</td>
<td>35</td>
</tr>
<tr>
<td>1993</td>
<td>356</td>
<td>118</td>
<td>474</td>
</tr>
<tr>
<td>1994</td>
<td>423</td>
<td>137</td>
<td>560</td>
</tr>
<tr>
<td>1995</td>
<td>747</td>
<td>61</td>
<td>808</td>
</tr>
<tr>
<td>1996</td>
<td>545</td>
<td>75</td>
<td>620</td>
</tr>
<tr>
<td>1997</td>
<td>565</td>
<td>12</td>
<td>577</td>
</tr>
<tr>
<td>Total</td>
<td>3,104</td>
<td>427</td>
<td>*5,531</td>
</tr>
</tbody>
</table>

* Note: over 2,300 "Problem" retraps are not included (web tag lost, recapture length unknown, etc.).

Although our night work data is useful for growth rate analysis of the <48" (121.9 cm)

Table 7. Number of "good" farm retraps (web tag retained, recapture length available) obtained in Louisiana's September harvests, 1988-1997. Many more are unreported or overlooked in processing sheds, also hundreds of "problem" retraps (with lost web tags) are not listed. Note the gradual increase in size with successive years.

<table>
<thead>
<tr>
<th>Recovery Year Sept. (&quot;Good&quot;)</th>
<th># Retraps</th>
<th># M</th>
<th># F</th>
<th>Average Size</th>
<th>Largest Retrap</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>48.50*</td>
<td>49&quot;</td>
</tr>
<tr>
<td>1989</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1990</td>
<td>11</td>
<td>2</td>
<td>8</td>
<td>52.91*</td>
<td>72&quot;</td>
</tr>
<tr>
<td>1991</td>
<td>13</td>
<td>5</td>
<td>8</td>
<td>62.31*</td>
<td>75&quot;</td>
</tr>
<tr>
<td>1992</td>
<td>75</td>
<td>34</td>
<td>39</td>
<td>65.46*</td>
<td>87&quot;</td>
</tr>
<tr>
<td>1993</td>
<td>151</td>
<td>61</td>
<td>89</td>
<td>66.49*</td>
<td>87&quot;</td>
</tr>
<tr>
<td>1994</td>
<td>277</td>
<td>126</td>
<td>150</td>
<td>69.56*</td>
<td>97&quot;</td>
</tr>
<tr>
<td>1995</td>
<td>559</td>
<td>260</td>
<td>298</td>
<td>71.84*</td>
<td>111&quot;</td>
</tr>
<tr>
<td>1996</td>
<td>410</td>
<td>183</td>
<td>226</td>
<td>73.63*</td>
<td>110&quot;</td>
</tr>
<tr>
<td>1997</td>
<td>565</td>
<td>327</td>
<td>237</td>
<td>72.23*</td>
<td>110&quot;</td>
</tr>
</tbody>
</table>

Total 2,061 1,000 1,055
wild alligators, it is of limited value thus far for comparative purposes to evaluate survival of farm-releases to wild alligators. As noted above we have thousands of farm releases/retraps, and very few retraps of native wild alligators in September harvests despite hundreds of man-hours in nighttime tag and release efforts. The LDWF will continue to try to intensify data collection in September season harvests as scheduling permits to use this data for long-term survival analysis.

FOOD HABITS
FARM-RELEASED VS. NATIVE WILD

A study was conducted in 1991–1992 to evaluate stomach contents of juvenile alligators to determine if alligators hatched and raised in captivity then released to the wild would be capable of foraging successfully for food (Elsey et al. 1992b). We were concerned that farm-raised alligators (which are provided food in captivity, often as a dry pelleted feed) may not be proficient at recognizing and capturing live prey. During the 1991 annual alligator hunt on Marsh Island Wildlife Refuge, 78 farm-reared, post-released alligators and 30 native wild alligators of comparable size class were selected and stomach contents examined. A z-test was used to compare differences in the frequency of occurrence of prey item types, and t-tests were used to compare average prey item mass, and the percent of individual prey items of total prey mass. Farm-released and native alligators generally had similar food habits, with no differences in total prey mass, total mass of stomach contents, or number of empty stomachs (Elsey et al. 1992b). We found crustaceans to be the most important prey item among alligators, and blue crabs (Callinectes sapidus) were the most frequently occurring item. Fish and mollusks were seen more frequently in wild alligator stomachs. Farm-released alligators consumed more large prey items such as birds and mammals; usually mammals are not taken in wild alligators until they are subadults (see review in Elsey et al. 1992b). Endohelminths occurred more frequently (P < 0.05) in native alligators than farm-released (83.3% vs. 47.4%), and were present in significantly larger numbers per stomach in native than in farm-released alligators (13.1 ± 3.8 wild; 2.1 ± 0.5 farm-released, P < 0.05). Lateral fat bodies were significantly heavier (P < 0.05) in farm-released alligators (10.1 ± 0.7 g) than native wild alligators (4.1 ± 0.5 g). This fat reserve may be advantageous to the farm-released alligator during initial acclimatization to the wild. These data suggest that juvenile alligators raised entirely in captivity (where they are provided food ad libitum), then released into the wild, are able to forage and hunt for food as successfully as native wild alligators (Elsey et al. 1992b).

GROWTH (PRELIMINARY STUDY) AND BODY CONDITION

A preliminary analysis of growth and body condition from alligators collected through 1991 was published (Elsey et al. 1992a) based on the first few hundred retraps obtained. We used mark-recapture methods for 274 “retrap” alligators over a four-year period. Alligators were paired by sex, size class, source (farm-released or native wild), and as to whether they had overwintered or not, and data between paired groups were compared using Student’s t-tests. In most groups, the farm-released alligators grew significantly better than wild alligators matched for sex and size. In the remaining groups the post-release alligators grew as well as their counterparts, though not better. As expected, overwintering tended to slow growth rates in both groups. However, farm-released juvenile alligators still demonstrated accelerated growth over native wild alligators even after overwintering. Males tended to grow faster than females, although not always significantly so. Females did not grow faster than males for any matched group. As has been seen in prior studies (see review in Elsey et al. 1992a), growth rates slowed with increasing size in native wild alligators (smaller alligators grew faster), but growth rates of farm-released alligators remained superior to wild juveniles even at the larger size classes. Growth curves were constructed using three growth models (von Bertalanffy, Gompertz, and logistic); the calculated maximum attainable length and growth parameters were significantly larger (likelihood ratio tests, p < 0.01) for farm-released alligators than wild using all three models. Condition factors were not different in post-released alligators than native wild alligators (Elsey et al. 1992a). Although heavier when initially released, the farm alligators later attain a body habitus similar to native wild alligators.

GROWTH — UPDATED THROUGH 1996

The study described above is an ongoing project and data collection continues. Through 1996 a total of 2,866 “good” retraps were available for growth rate analysis over an eight year period and comparison between farm-released and native wild are shown in Figures 1 and 2. Results from this large series closely paralleled those in our initial study. In all but one group that overwintered, the farm-released alligators grew better than wild alligators matched for sex and size; in the remaining
group the post-release alligators grew as well as their counterparts, though not better (Fig. 1). Growth was faster prior to the first overwintering period (Fig. 2) than after overwintering. Males still tended to grow faster than females, though this trend was not always significantly greater. Again, in no matched group did females grow faster than males. As in the preliminary study, growth rates diminished with increasing size in native wild alligators (smaller alligators grew faster), but growth rates of farm-released alligators remained accelerated even at the larger size classes.

The average number of days the overwintered alligators have been in the marsh since release was 951.9 ± 10.5 days (through 1996). Thus these superior growth rates in farm released alligators have been maintained even after several winters. The "head-start" afforded these alligators seems to persist and may be due to accelerated growth rates seen post-hatching when alligator eggs are incubated at optimum temperatures (Joanen et al. 1987). We believe the accelerated growth rates and rapidity in which the released alligators learn to forage for food after release would enhance their survival rates.

**STRESS HORMONE LEVELS**

A series of blood samples were collected in the summer of 1995 during our "night work" tag and release work on native wild and farm released alligators. These data were analysed by radioimmunoassay courtesy of Dr. Valentine Lance. No differences were seen in plasma...
corticosterone (stress hormone) levels in farm-released juveniles \((2.89 \pm 1.29 \text{ ng/ml, } n = 19)\) and native wild juveniles \((3.02 \pm 2.14 \text{ ng/ml, } n = 10)\). Most of the farm releases had been released two-four years prior to sampling, three had been released one year prior and four were recent releases. This is another indicator of the wellbeing of the juvenile alligators after release.

**SURVIVAL OF FARM RELEASES**

As mentioned above, our nighthawks “tag and release” provided large amounts of data to compare growth rates between wild and farm released alligators (Elsey et al. 1992a). However, long-term survival of farm releases is better evaluated by recoveries of marked alligators harvested in the annual September harvests after the juvenile farm releases have grown to adult sizes. These data have recently been published (Elsey et al. 1998) and will be reviewed below.

Various alligator programme participants are encouraged by department personnel to provide tag return data to the agency (refer to the “tag recoveries” section above) if a marked alligator is taken during the annual wild alligator harvest. As mentioned above, as this programme developed, it became apparent that having LDWF staff members present in alligator processing sheds greatly increased tag recovery rates. This improved data collection (i.e., correct tag numbers being recorded, accurate lengths obtained, etc.).
However, many tag recoveries are undoubtedly missed, as some of the numerous processing sheds often operate 24 hours daily during the first several days of the alligator harvest, and logistically cannot all be covered by the available staff.

We chose three large land companies as study areas for a preliminary analysis, selected due to several years of participation in egg ranching/returns, proximity to a field office, and a history of having the majority of their alligators which were harvested processed at an accessible skinning facility. These areas are described in detail (Elsey et al. 1998) and collectively total approximately 165,000 ha in southwestern Louisiana, and comprise 20–30% of the entire wetlands participating in the statewide alligator egg ranching programme.

In this study, we began the analysis with the 1990 releases; 42,319 alligators were released to these wetlands from 1990 through 1997. The released alligators are juveniles, and at growth rates as described above do not approach the normal harvestable size class (182 cm) until several years after release.

Web tag loss can preclude identification of some individuals for growth data, but year-specific tail notches were used starting in 1994 (and occasionally before) as mentioned above and as listed in Table 5. Thus in many cases a retrapped alligator might be assigned to a cohort release year even if the foot web tag was missing, or in some cases a “conservative” release year was assigned to a recaptured alligator (details as per Elsey et al. 1998). When necessary, we assigned the later year possible as the release year; therefore survival rates calculated were minimum rates, as many may have survived longer than assumed by the conservative cohort year assigned (Elsey et al. 1998).

Several survival models were tested on the tag recovery data from the alligator harvests. The model with the best "goodness of fit" was the minimum known alive approach which was used to estimate the probability of surviving to a specified harvest season following release and then being caught. To estimate the survival probabilities, the survival-catchability estimate was divided by a catchability (harvest allocation) of 4%, based upon harvest quotas and population survey data.

Most alligator trappers attempt to catch larger alligators (which are more valuable) by scouting trapping sites and adjusting the height of the baited line. In contrast to most survival analyses or life tables, our results showed increasing numbers of recaptures in successive years, as the alligators grow to the targeted harvestable adult size. Most survival models on waterfowl and other species show decreasing band recoveries with successive years as the cohort gradually succumbs to various mortality factors.

Louisiana’s annual September harvest has a quota of approximately 4% of the population and adjusted survival estimates for the released alligators based on a 4% harvest rate suggest fairly high survival rates. The minimum known alive method estimated survival to four years post release to be 85.3%. Lower survival rates 5–6 years after release are likely due in part to the large number of “retraps” that have been captured 6 or 7 years after release and which had lost their foot web tags, and could not be identified as one from the study area. However, numerous quite large “retraps” are now being obtained. We are presently re-analysing our survival data using more precise size and sex specific “catchabilities”, rather than using the broad 4% harvest effort for both sexes and all size classes. The size distribution of farm recaptures from September 1997 for which lengths are known is shown in Figure 3. These show a size class frequency distribution comparable to native wild alligators harvested.

Numerous factors limit our ability to document all known retraps, and thus survival of the farm-released alligators is likely greater than we have estimated (Elsey et al. 1998).

Tag-reporting rates by trappers are probably low, as it is generally not considered a “trophy” and there is no particular incentive to trappers to invest time in recording data on harvested recaptures. The monel tags used often darken over time and are easily overlooked. Incomplete data are often reported by trappers (i.e., four or five digits of a six digit tag number reported), making the data of limited use. A study on marine turtles documented a probability of monel tags being lost approaching 100% after about ten years (Limpus 1992). Although not studied in detail, casual observations suggest tag retention is better in fresh marshes than the intermediate and brackish marshes.

Louisiana’s wild harvest is held in September, to protect the breeding females residing in the remote marsh interior at nest sites during this period (Joanen and McNease 1989). Trappers generally hunt large open water canals or lakes by outboards or mudboats and select larger adult males which typically comprise the majority of the harvest (Elsey et al. 1994). Through the 1994 release season, statewide juvenile alligator releases were 57.6% female, 37.4% male, and 5.0% unknown or unreported. Thus, since 57.6% of
the farm releases are female, the September season harvest (which strategically selects for adult males, to protect breeding females) will select against farm releases being caught. Survival of farm releases is likely higher than catch rates (which favour males) would indicate. The survival estimates calculated thus far are uncorrected for differential harvest between sexes or tag loss. Releasing a large percentage of females might enhance recruitment, as one male is able to mate with several females in a breeding season and therefore generate additional nesting efforts. A similar strategy has been suggested for conservation programmes that artificially incubate turtle eggs (Vogt 1994).

Many farm-released juvenile alligators undoubtedly succumb to the same mortality factors (road kills, propeller strikes, cannibalism, adverse weather events, etc.) that affect native wild alligators prior to reaching the adult harvestable size class. Some of this expected mortality may be averted due to the superior body condition and accelerated growth rates reported in farm-releases (Elsey et al. 1992a) as was discussed previously.

As seen in Table 1, the first large number of releases (statewide) were made in 1991 at a 45" (114 cm) average, and in 1992 at a 43" (109 cm) average. At an estimated growth of 7" (18 cm) per year (Elsey et al. 1992a) these alligators would not be expected to reach the targeted 6' (183 cm) size class until 1994 or 1995. Therefore, although the farm-releases began in 1988, the September season harvest recoveries were limited until recent years (Elsey et al. 1998). Of approximately 6,000 farm releases harvested statewide from 1988 through 1998, some 3,000 (nearly 50%) were recovered in the two most recent seasons. Analysis done prior to this would probably have underestimated the survival rate of farm-released alligators.

Studies of survival in native wild alligators have provided widely varying results (see review in Elsey et al. 1998). Many studies were short term and focused on a local population, and often involved hatchling and small juvenile alligators. Woodward et al. (1987) estimated survival to 1 year of alligators in a Florida lake to be 41%, and survival to 2 years to be 8%, using Jolly-Seber analysis of recapture data. Their results were much lower using minimum-known-alive (MKA) estimates, (46% of the Jolly-Seber estimate for one year survival), leading them to conclude that MKA methods underestimate survival. Brandt (1989) conducted a small study on a sparsely populated 1120 ha area thought to have a total population of only approximately 200 alligators in South Carolina. Hatchling survival was 63% survival for four clutches, with another clutch having only 17% first year survival. Of the five clutches combined, Brandt (1989) reported a two year survival rate of 37%, and 16% survival to three years. Another study (Deitz 1979) reported first year survival to be 30% in a lake habitat in Florida, and 17% in a shallow marsh (three pods only). Two year survival in a small sample (two pods of hatchlings) of lake habitat was 14%. Carbonneau (1987) estimated 83.6% of hatchlings were lost before reaching one year of age in a fresh marsh in Louisiana.
Other than our recent study (Elsey et al. 1998) we are not aware of any large scale, long-term studies on survival rates of larger juvenile alligators (>91–122 cm). This project is an experimental part of a statewide management programme on several million acres of alligator habitat. An unedited and unreviewed report (Chabreck et al. 1997) on a small intensive study site (4203 ha) in southeastern Louisiana suggested survival rates were much lower than we reported (Elsey et al. 1998). Poor selection of release sites in non-juvenile habitat probably adversely affected survival in that study (R. Moertle, pers. comm.), and dispersal off the small study area may have led the authors to incorrectly conclude the farm-released alligators did not survive (Chabreck et al. 1997), when many of these migrated to adjacent land areas and were harvested as adults in later years (LDWF data; see "dispersal" below). A telemetry study done concurrently in the same study area (Addison 1998) showed good survival of farm-releases, and found no difference between native-wild or farm-releases in seasonal or annual survival rates. Both groups survived slightly better than might have been estimated by Taylor and Neal's methods (1984).

**DISPERSAL**

Another aspect of the release programme we hope to evaluate in the future is that of dispersal from the release site. Several prior telemetry studies have examined movement patterns of juvenile alligators, both wild and introduced (McNease and Joanen 1974; Taylor et al. 1976; Addison 1993). Taylor et al. (1976) found no difference in home range sizes between native wild alligators and wild alligators relocated from coastal marshes to lakes in north Louisiana. Addison (1993) found no difference in movement rates, dispersal, or home ranges between native-wild and farm-released juvenile alligators in southeastern Louisiana. Nearly all farm-released (96.15%) and wild (97.7%) alligators dispersed less than 5 km from the release site over his study period of approximately 18 months (Addison 1993). Using tag-recapture methods rather than telemetry, Chabreck (1965) found that 67% of wild alligators marked and released at the capture site moved over one mile from the release site if recaptured after three years. Chabreck noted that tagged alligators moved farther and farther from the capture site as time progressed.

We have observed that, over time, many farm-released alligators have moved significantly from their release sites. In several cases, alligators released in St. Mary Parish have been recovered on Marsh Island, having traversed several miles across Vermilion Bay. Also, over 70% of the 40 known tag recoveries from alligators released on Golden Ranch Plantation through 1997 were harvested on adjacent land companies, rather than "on" Golden Ranch. It may be that as the farm-releases approach maturity, they disperse more to find breeding opportunities or nest sites. We have often had recaptures of farm releases recovered on private wetlands or refuges, where returns to the wild have not been made. A detailed analysis of dispersal rates and approximate distances traveled will be analysed as a separate study.

**CROCODILIAN REINTRODUCTIONS — AN OVERVIEW**

Most young crocodilians have high mortality rates (Thorbjarnarson 1988; Webb and Manolis 1989), and to minimize these losses egg ranching has evolved as a conservation tool for many species (Hutton and Webb 1992). Numerous international wildlife management programmes have incorporated release of "head-start" captive raised crocodilians to enhance recruitment of natural populations or to restock depleted habitats.

A review of current crocodilian management programmes which utilize some conservation action involving a re-introduction component was recently undertaken (Sooare and Price 1998). In 16 of 23 species of crocodilians, one of three types of reintroduction components occurred (on-going releases, captive-breeding for release, or planned releases), and eight species have on-going release programmes (Sooare and Price 1998). Concerns listed in the review for crocodiles releases were acclimatization to the release site, locating food, avoidance of predators (including cannibalism) release of a single size class, fitness of individuals to be released, and disease introduction (Sooare and Price 1998).

One of the most successful supplement programmes has been that of gharial released into the National Chambal Sanctuary in India. Suggested reasons for this have been ideal habitat conditions, abundant prey base, minimal disturbance due to remote/inaccessible locations, and management inputs such as a total ban on fishing and patrols by sanctuary staff (Rao 1995).

Kar and Bustard (1990) also discussed the importance of the selection of the release site, timing of the release, and the selection of crocodiles (size) to be released for success of release programmes. Rao (1995) suggested to accustom animals to a flowing water habitat while still in captivity, if they are to be released in such a habitat.
The number of crocodilians to be released is usually expressed as a percentage of eggs or hatchlings collected. Some management programmes (as part of the collecting permits) suggest 5–10% of what was collected to be released as juveniles to replace natural recruitment (Blake and Loveridge 1975; Child 1987). Some programmes recommended that this should not be mandated unless an impact on the population is seen, at which point the release could be implemented (Webb et al. 1987). Louisiana’s programme presently requires a higher return rate, however, in Louisiana both eggs and adults are harvested in high numbers on many wetlands. Experimental egg collections on Rockefeller Refuge where no adults were harvested had lesser return rates of 0–5%; and the population is stable after fifteen years of intensive egg collection.

Most crocodilian researchers/managers agree that the minimum size for released specimens should be 3'–4' (1.0–1.5 m, Singh et al. 1986; Child 1987; Messel and Vorlick 1987; Kar and Burstard 1990). Other programmes recommend certain age groups should be released. Whitaker (1982) recommended two to four year old crocodilians are strong enough for release; Webb et al. (1987) suggested three year olds would be an appropriate age. Note that alligators grow exceptionally well in captivity, and can reach 1 m length before one year of age. Webb et al. (1987) suggested restocking with small juveniles could be a cosmetic (rather than an effective management) strategy. They suggested (as in our programme) that this problem can be overcome by increasing the age/size of released animals, and reducing the quantity released (Webb et al. 1987); they also suggested the possibility of a rotational system where individual areas are harvested on alternate years. It has been suggested that the release of hatchlings can be wasteful due to their high mortality (Blake and Loveridge 1975; Magnusson 1981).

Release locations have been suggested by numerous authors, and juvenile habitat is obviously important (Elsey et al. 1998). Messel and Vorlick (1987) suggested releases of C. porosus should not be made in fresh water systems, which have high densities of breeding C. porosus; the more saline environments have less dense populations, especially of the larger breeders. Magnusson (1981) found better survival of hatchling C. porosus released in turbid downstream water/mangrove forests than in clear upstream freshwater vegetation systems.

Several models have been tested to examine varying rates of egg or hatchling collection, some with or without adult harvests, and some with or without release programmes of varying ages of juveniles (Nichols et al. 1976; Smith and Webb 1985; Rice 1996). Actual field testing of these models would be of great interest.

Some of the species and locations in which crocodilians have successfully been released after “head start” rearing include Crocodylus niloticus in Rhodesia (now Zimbabwe, Blake and Loveridge 1975; Child 1987) Gavialis gangeticus in India (Whitaker 1982, 1987), Crocodylus palustris and C. porosus in India (Whitaker 1982), C. johnstoni in Australia (Smith and Webb 1985), C. intermedius in Venezuela (Thorbjarnarson 1993), C. acutus in Venezuela (Arteaga 1997), and C. rhombifer in Cuba (Soberton et al. 1996).

However, reintroductions are not always successful and in some habitats or for certain species may not be appropriate, and should not be mandated as part of every sustained utilization programme. For example, a recent study has shown high mortality of released Nile crocodiles (R. Ferguson, pers. comm.). This may be due in part to limited habitat available (i.e., a river and its fringes) with no separation of adult and juvenile habitat, leading to high intraspecific competition. Graham (1968) noted that in C. niloticus, where habitat (bare shoreline) is unsuitable for juveniles, mortality may be nearly 100%. One study of gharial releases found low survival due to intensive fishing activity by local people, and some losses when rainy season high currents swept gharial out to sea (Kar 1994). In coastal Louisiana, vast wetlands with separate juvenile and adult habitat may promote survival of released juvenile alligators due to extensive habitat available for dispersal.

We have suggested that tropical habitats with distinct wet and dry seasons (and no separation of juvenile and adult habitat) may not be suitable for release of some crocodilian species (Elsey et al. 1998). Density dependent mortality and intraspecific competition may be accentuated when the available habitat shrinks during the prolonged dry season. Woodward et al. (1987) stated cannibalism would be expected to be high in drought years as alligators are concentrated in remaining water.

**CANNIBALISM**

Many studies have documented that cannibalism is a major mortality factor in wild alligators (Rootes 1989; Rootes and Chabreck 1993). An unpublished study (Addison 1993) on a small densely populated marsh suggested cannibalism rates were higher for farm-released alligators than for native wild alligators. However, several biases were
inherent in this study, notably wild juveniles were tagged only in a small 4 203 ha intensive study area, while farm released alligators were released on the entire area (20 285 ha). Stomachs from adults harvested on the entire area in September seasons might contain tags from farm alligators released over the entire area whereas only stomachs from adults harvested in the intensive study area could potentially reveal a tag from a wild juvenile. Also, most wild juveniles were not tagged, and therefore undetectable if cannibalized. Clearly there was an error in the models used as the total predation estimates exceeded the number released (Addison 1995).

To further evaluate the question of cannibalism in wild and farm released alligators, we collected stomachs from alligators harvested in September 1994 from private wetlands in Cameron Parish where we had previously tagged numerous wild juveniles for night work studies. Six thousand and sixty-two farm releases had been made in the areas, and 2 179 wild juveniles were tagged. It must be noted that each farm release had web tags placed, (as did the wild juveniles caught for night work studies), but it is unknown how many wild, untagged alligators were on the areas. These untagged wild juveniles may undergo cannibalism and be undetected, whereas every farm alligator has tags and could be detected by tags retained in the predator alligator’s stomach. We noted tags from 62 farm alligators in the 285 stomachs examined, and evidence of 16 wild alligators (tags or body parts). This rate of cannibalism (62 of 6 062 or 1.02%) in the farm-releases was lower than that seen in Addison’s study (60 of 3 341, or 1.80%). Tag retention times vary greatly and can affect interpretation of the data; Rootes and Chabreck (1993) suggested tag retention time in stomachs is very brief (20.7% lost in 59.7 days), whereas studies in Florida suggest tag retention times of 8.0 years (Delaney et al., in prep. as cited in Woodward et al. 1992). We often saw multiple tags in one predator stomach; we encourage land managers to release juvenile farm alligators in small groups in isolated remote juvenile pond habitats to enhance survival.

In addition to the above study, we have tagged hundreds of wild juvenile alligators on Salvador WMA in southeastern Louisiana in recent years. To get additional data on wild juvenile cannibalism rates, we collected over 350 stomachs from alligators harvested in the July 1994 experimental harvest on Salvador. Lab work is approximately 85% complete on this project and should be completed in the next year, and prepared for publication.

REPRODUCTION IN FARM-RELEASED ALLIGATORS

Efforts have been made in recent September harvests to attempt to document evidence of reproductive maturity/nesting in farm-released alligators which are harvested in September. We were concerned that the rapid growth seen in farm alligators raised in heated sheds year round may have an adverse effect on normal reproductive development. As noted above, releases of juvenile alligators in substantial numbers did not occur until 1991, thus these would not approach the 6' (182.9 cm) size class (adult) until 1994–1995. We were able to recover 3 samples in September 1994 of adult females (farm-released) that had attained sexual maturity (Elsey et al. 2000). During September 1995–1997, we collected reproductive tracts from farm-released females ≥6' (182.9 cm) in length, and have documented over 35 cases of farm-released females having attained sexual maturity and ovulated. These findings are important, because our September harvest selects against breeding females, and thus data are rare as we attempt not to harvest breeding females. However, these findings were vitally needed for the success of the release programme, to ensure that juveniles released to the wild will later breed and maintain population recruitment.

CONCLUSIONS

Our results to date suggest that farm-released alligators grow at least as well as and often superior to native wild counterparts matched for size and sex (Elsey et al. 1992a and as above). They are able to hunt for food and capture prey successfully after release, despite having been raised entirely in captivity prior to release (Elsey et al. 1992b). Chabreck (1971) stated “pen-reared alligators responded similarly to wild alligators when transferred to new locations and released.”

These results suggest the “release to the wild” programme appears successful thus far (Elsey et al. 1998). Close monitoring will continue for many years by department personnel. Nesting surveys (McNease et al. 1994; LDWF, unpubl. data) show a significant increase in nesting/population in coastal Louisiana through 1997, despite the harvest of over 2.5 million eggs since 1986 and some 27 000 or more adults annually. After utilization of alligator egg resources, supplementing natural wild recruitment of alligator populations with release of a percentage of juvenile alligators appears to be a valuable management tool for this species. Accelerated growth rates of released alligators may be a factor enhancing survival to sexual
maturity. It should be noted that while our reintroduction programme appears successful, reintroductions may not be indicated or needed under other management practices. For example, the state of Florida has less intensive egg ranching programmes and adult harvest quotas, and does not require release of juveniles by ranchers. In Australia, *C. porosus* eggs are harvested intensively with no reintroduction of juvenile crocodiles, and the wild population continues to rise (Webb et al. 1994), although no adult crocodiles are harvested. Over the next several years we plan to collect additional data to further refine management practices for alligator ranching programmes. Future research will address techniques in selecting relocation sites, release season, optimum size at which to release alligators, and precise quotas needed for restocking to maintain wild alligator populations.

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