Spatial and Temporal Trends in River Otter Harvest in Louisiana

Daniel G. Scognamillo, *School of Renewable Natural Resources, Louisiana State University Agricultural Center, Baton Rouge, LA 70803*

Michael J. Chamberlain, *School of Renewable Natural Resources, Louisiana State University Agricultural Center, Baton Rouge, LA 70803*

Greg Linscombe, *Louisiana Department of Wildlife and Fisheries, New Iberia, LA 70560*

Abstract: Louisiana is the leading state in number of river otters *(Lontra canadensis)* used in reintroduction programs in other states and in the production of pelts. However, habitat loss and degradation have prompted concern about the status of otter populations. We analyzed harvesting records maintained by the Louisiana Department of Wildlife and Fisheries during 1983–2001 to identify spatial and temporal trends in otter harvesting activity. To summarize temporal trends, we estimated mean number of otters harvested and trappers, correlation coefficients for number otters trapped and number of trappers, and harvest rate (otters/trapper) for each trapping season. We used the geostatistics mean center, weighted by the number of otters harvested in each parish, to identify spatial trends in otter harvest distribution. Our results suggest that in Louisiana river otter harvest has changed over the last 20 years in mean number of otters harvested per year, which is most likely related to declines in number of trappers during the period analyzed. We also documented changes in otter harvest distribution with proportionally more otters being harvested in upland habitat in recent years. We offer some possible explanations for these changes and suggest directions for future otter research in Louisiana.

Key words: river otter, *Lontra canadensis*, harvest, Louisiana

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Louisiana leads the United States as a source for river otters *(Lontra canadensis)* to be used in re-introduction projects (Raelsy 2001) and in the production of river otter pelts (Ensminger and Linscombe 1980, Linscombe and Kinler 1985, Shirley et al. 1988). Since these facts could be indicators that the species is heavily harvested in Louisiana, some concerns exist about the status of otter populations. River otters were ranked in 2003 as S4 by NatureServe (NatureServe 2003), meaning that the species is uncommon but not rare, with statewide distribution, yet there remains concern about conservation over the long-term.

Some early concerns about river otter population status in Louisiana also were

aroused in the 1970s (Lowery 1974). At that point, forested wetlands in northeastern parishes being drained, cleared, or converted to croplands (Lowery 1974, National Research Council 1982) were among major reasons for concern. In coastal areas, the loss of wetlands and marshes as a consequence of the generalized process of coastal erosion (Boesch et al. 1994) could be seen as a potential source of negative effect on otter populations. Water pollution by pesticides and heavy metals have been identified as potentially important agents in river otter habitat degradation in Louisiana (Beck 1977, Fleming et al. 1985). Despite these concerns, no studies have been conducted on otters in Louisiana for almost 20 years and, consequently, the status of its population remains unknown.

We analyzed harvesting records maintained by the Louisiana Department of Wildlife and Fisheries (LDWF) for the period 1983–2001 to identify spatial and temporal trends in otter harvest in Louisiana. Our findings could be used as a starting line for future research, particularly in developing hypotheses and research questions. These data have been collected by LDWF since 1977 when they began requiring fur buyers and dealers to record direct from trappers the species, approximate date, and parishes for all furbearer animals trapped. Every season buyers and dealers report to LDWF the number of otters caught, trapper's name and license number, date, and parish where each otter was captured. We analyzed this data set to identify local and regional patterns in space and time in number of otters caught (i.e., otters/parish, otters/coastal and otters/upland areas), number of trappers (i.e., trappers/parish, trappers/coastal and trappers/upland areas), and mean pelt price per season. Identifying these trends may represent a tool used to prioritize future research topics and target potential study areas.

Methods

We divided the data set into two categories: coastal parishes and upland parishes. Coastal parishes were further divided into four regions based on marsh and lowland types (Linscombe and Kinler 1985): Chenier Plain, Inactive Delta, Atchafalaya Basin, and Southeast Swamp. Twenty-one parishes were categorized as coastal. The Chenier Plain was represented by Cameron, Calcasieu, and Vermillion parishes. The Inactive Delta included Iberia, St. Mary, Terrebonne, Lafourche, St. Charles, Jefferson, Plaquemines, St. Bernard, Orleans, and St. Tammany parishes. Iberville and St. Martin parishes delineated the Atchafalaya Basin, and Assumption, Tangipahoa, Livingston, Ascension, St. John, and St. James comprised the Southeast Swamp.

To summarize temporal trends, we estimated mean number of otters and trappers per trapping season, and number of otters in coastal and upland areas. We also estimated mean number and percentages of otters harvested and mean number of trappers for each of the four coastal regions. We calculated correlation coefficients for mean number of otters trapped and mean number of trappers to evaluate the association between these two variables. We also estimated harvesting rate (otters/trapper), by trapping season (year), for the whole state and for coastal and upland parishes.

We used geostatistics, such as weighted mean center (Shaw and Wheeler 1988),

to identify spatial trends in otter harvest for 1983–2001. The mean center is an extension of classic descriptive statistic for central tendency, but applied to two-dimensional data and used to summarize spatial distribution of point patterns.

From the geographical standpoint, data available for this study represented aggregated data; in other words, values of different variables were associated to a polygon (parish) instead of a point. Thus, to estimate mean center, we transformed aggregated data into point data by assigning values of each variable associated to a particular parish (polygon) to the centroid (point) of that parish. We defined centroid as the central location within a specified geographic area (e.g., parish). Then, we used all the parish centroids as the set of points from which to estimate the weighted mean center for each trapping season. In our particular case, we weighted each point involved in the mean center estimation by the number of river otters trapped in each parish.

The weighted mean center produces a different mean center than the unweighted mean. By using number of otters trapped in each parish each season as the weighting variable, we displaced the mean center toward areas with greater number of otters harvested. Mapping this mean center for each season allowed us to describe the spatial differentiation in the central tendency in number of otters harvested in Louisiana through time. We used CrimeStat 1.1 (Levine 2000) to estimate the mean center, and ArcView 3.3 (ESRI 2002, Spatial Analyst Extension) for centroid identification and graphical display of mappable results.

Results

We considered 11 trapping seasons during 1983–2001 for analysis. Seven seasons were not included because they were either incomplete or unavailable. A total of 41,046 otters were trapped during the 11 trapping seasons, and 40,788 otters were positively assigned to a parish and used for further analysis. Sixty-eight percent of otters were caught in coastal parishes, and 32% in upland parishes. Number of otters trapped was highly variable over time ($\bar{x}$ = 3708, SE = 1270) ranging from 1834 in 1992–1993 to 6448 during 1994–1995. A total of 6097 trappers were involved in trapping otters ($\bar{x}$ = 554, SE = 345; Table 1). Number of trappers exhibited an overall decline throughout the period analyzed, whereas average pelt price increased (Table 1). Correlation coefficient between mean number of otters harvested and mean number of trappers was not different from zero (r = 0.43, P = 0.18). The Inactive Delta and upland areas accounted for the greatest proportion of otters harvested, whereas most trappers used upland areas (Table 2). Number of otters captured per trapper showed an increasing trend over time throughout coastal and upland parishes (Fig. 1). The mean center, weighted by otters trapped, shifted location northwest over time (Fig. 2).

Discussion

River otters have always been considered a valuable furbearer species based on quality of and demand for its pelt. Consequently, overharvest during the nineteenth

Table 1. Total number of otters trapped, number of trappers, and mean pelt price during 11 trapping seasons from 1983–2001 in Louisiana.

Season	Otters trapped	Trappers	Pelt price (US$)
1983–1984	3709	746	12.00
1985–1986	3630	812	10.00
1986–1987	4936	1288	10.00
1987–1988	3535	903	12.40
1992–1993	1834	203	16.60
1993–1994	3616	336	30.00
1994–1995	6448	538	30.00
1997–1998	3483	467	28.45
1998–1999	2313	253	27.20
1999–2000	2761	292	37.30
2000–2001	4523	259	33.00
Total	40,788	6,097	

Table 2. Mean number and percentages of otters and trappers for regions in the state of Louisiana for 11 trapping seasons during 1982–2001.

Region	Otters	%	Trappers	%
Chenier Plain	706	19	80	14
Inactive Delta	1246	34	124	22
Atchafalaya Basin	299	8	49	9
Southeastern Swamp	264	7	37	7
Upland parishes	1193	32	264	48
Total	3708	100	554	100

century may have led to the extirpation of river otter populations in part of its historical range (Armstrong 1972). In more recent years, and despite federal and state regulations, more than 50,000 river otters were legally harvested during the late 1970s and early 1980s in North America (Melquist and Dronkert 1987).

Louisiana leads the United States as a source of river otter pelts. It has been estimated that in Louisiana an average of 7,518 otters were harvested per year during 1977–1982 (Linscombe and Kinler 1985). However, our results indicate that changes have occurred in otter harvesting activity in Louisiana during 1983–2001 when compared to 1977–1982. We estimated a decline of 49% in the mean number of otters harvested per trapping season (3,708 otters/year) for the period 1983–2001 when compared to 1977–1982. We suggest that this decline in otter harvested is most likely related to decreasing numbers of trappers during 1983–2001.

The decline in number of trappers catching otters in Louisiana is concurrent

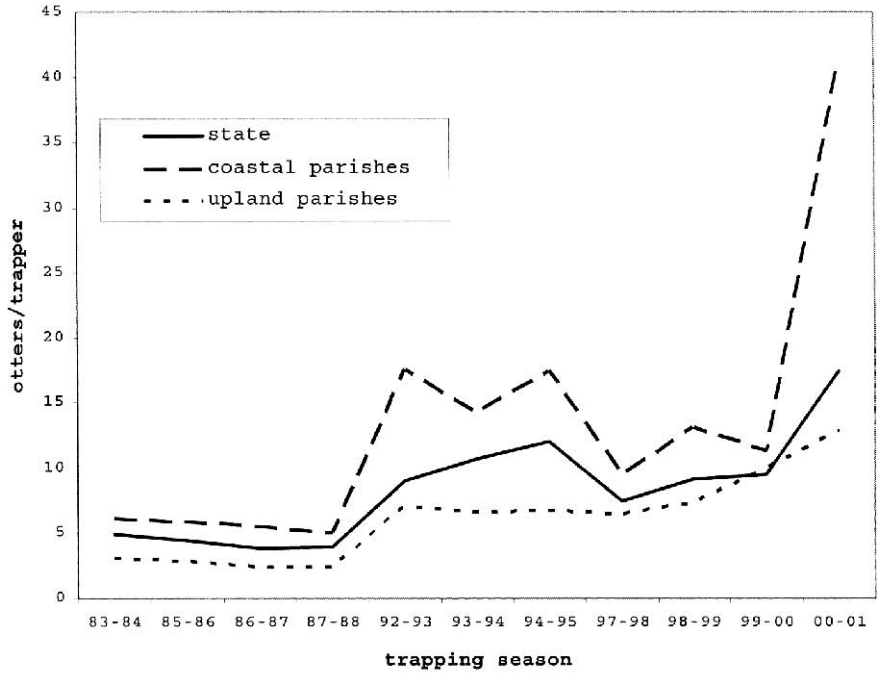

Figure 1. Number of otters caught per trapper in Louisiana during 11 trapping seasons for period 1983–2001.

with a nationwide decline in number of people involved in furbearer trapping. This nationwide decline has been related to lack of trapper recruitment, reduced pelt prices, and an increase in anti-trapping sentiment (Armstrong and Rossi 2000). In Louisiana we documented a general increase in prices of otter pelts during 1983–2001. If this pelt price increase is paralleled to the steady decrease in numbers of trappers participating in trapping otters, it suggests that factors such as trapper recruitment are likely more responsible for declines in trapper population exploiting river otters in Louisiana than otter pelt price. In fact, higher otter pelt price also may have encouraged active trappers to focus more on otters, leading to the increasing harvest rate observed during 1983–2001. Assuming that harvesting rate is trapper-dependent, we offer that an increasing harvesting rate also could be observed if the less skilled trappers quit the trapping activity, leaving the best trappers and their higher individual harvest to estimate mean harvesting rate. However, a reduction in number of trappers has been attributed to increasing furbearer populations through reductions in harvest of furbearers (Lovell et al. 1998). If this were the case in Louisiana, an increase in the harvesting rate during 1983–2001 also could be suggesting more abundant otter populations.

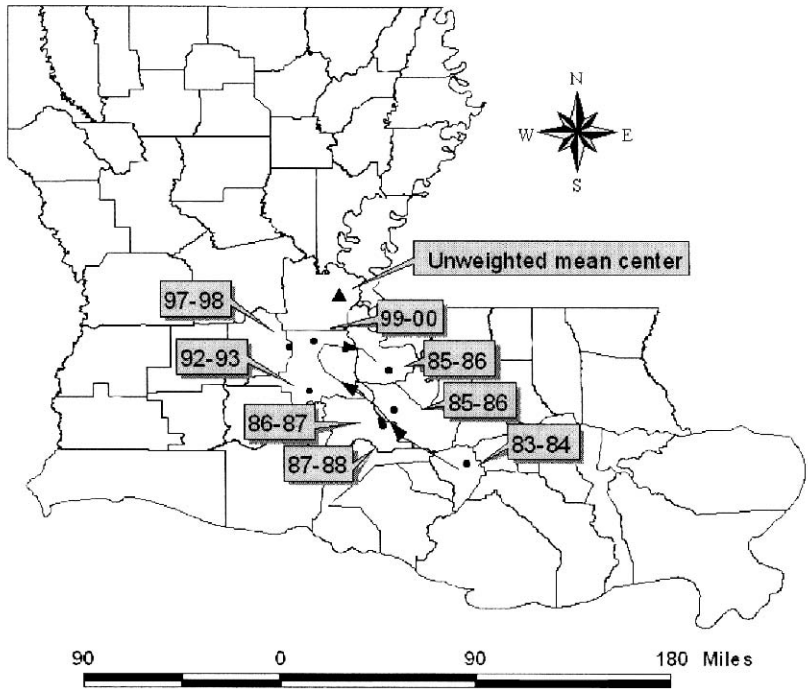

Figure 2. Location of unweighted mean center (▲) and seasonal weighted mean center (by number of otters harvested in each parish) (●) of Louisiana. Arrows indicate the trend in the displacement of the weighted mean center through time (1983–2001).

Percentages of number of otters harvested in coastal and upland areas also has changed during 1983–2001 when compared to the period analyzed by Linscombe and Kinler (1985). Linscombe and Kinler (1985) estimated that during 1977–1982, 85.6% and 14.4% of otters harvested were in coastal and upland areas, respectively. Our estimates for 1983–2001 indicate that 68% and 32% of the total number of otters were harvested in coastal and upland habitat respectively. Changes also occurred within coastal areas between 1977–1982 and 1983–2001, with relatively fewer otters being harvested in the Inactive Delta, and proportionally more in the Atchafalaya Basin during 1983–2001. Our spatial analysis indicates that this shift in harvesting activity has been gradual rather than abrupt. The analysis of Fig. 2 supports the suggestion that a gradual shift in otter harvest distribution has occurred over time, as shown by the displacement of the weighted mean center which has been moving northwest.

Multiple, and likely synergistic, mechanisms are potentially causal in the spatial shifts we observed in otter harvest distribution. We speculate that a parsimonious ex-

planation for this shift in otter harvest distribution could be offered by a greater interest of upland trappers in catching otters because of increasing otter pelt price and a decline in pelt price for other furbearers. However, pelt price increase may fail to explain the gradual shift in otter harvest distribution, since it is reasonable to assume that upland trappers will exhibit a generalized interest in river otters driven by otter pelt price.

A second explanation to the gradual shift in the weighted mean center of otter harvesting distribution may be the generalized coastal erosion process observed in Louisiana. Louisiana is experiencing the greatest coastal erosion rates in the United States (Duke and Kruczynski 1992, Boesch et al. 1994), which is characterized by the gradual conversion of coastal wetlands into open water rather than uplands. This gradual erosion could be causing a gradual and continuous reduction in otter habitat in coastal areas, which may result in redistribution of otters toward upland habitats.

Summary

Our results indicate an overall change in river otter harvest intensity and distribution in Louisiana for the period 1983–2001 when compared to previous years. We estimated that the mean number of otters harvested per year during 1983–2001 represents the 49% of the mean number of otters harvested per year during 1977–1982 (Linscombe and Kinler 1985). This decline may correspond with a decline in number of trappers. We also documented an increase in river otter harvesting rate (otters/trapper) during 1983–2001 that could be related to more successful trappers, and to an increased abundance of river otter populations.

Our findings also show a shift of the weighted mean center of otter harvest. We hypothesize that this shift could be related to increased interest of upland trappers in river otters or increased river otter abundance in upland habitats as a result of habitat loss in coastal areas. Research is needed before management plans can be developed for river otter in Louisiana.

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