SHRINKAGE OF SPOTTED SEATROUT HELD IN ICE

by

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ABSTRACT

Icing is a common form of preservation for recreationally landed spotted seatrout (Cynoscion nebulosus). Due to past and current regulations requiring minimum size limits on the recreational catch of spotted seatrout, changes in fish length when held on ice after capture has become a law enforcement issue. A small (mean = 3 mm) amount of shrinkage in length of spotted seatrout occurred when fish were placed in ice for 24 h, and thus shrinkage should not create a law enforcement problem. Maximum reductions in length of individual spotted seatrout ranged from 2 to 5 mm for the 24 h. Shrinkage was not found to be related to size of fish. Fifty-six percent of estimated shrinkage occurred during the first hour the fish were on ice.

INTRODUCTION

Size limits are frequently used to manage fisheries, and enforcement of size limits ignores change in size that occurs between capture and landing. Preservation methods are known to affect the length of finfish. Icing is a common form of preservation for recreationally landed spotted seatrout (Cynoscion nebulosus) in Texas. Studies addressing effects of preservation by icing and freezing are limited (Lux 1960, Halliday and Roscoe 1969, Jones and Green 1977). There are also published studies on the effects of preservation using formalin and alcohol (Shetter 1936, Parker 1963, Stobo 1972, Yeh and Hodson 1975, Jones and Geen 1977, Theilacker 1980). No study has determined the effect of icing on length of spotted seatrout. The purpose of this study was to determine the shrinkage expected when spotted seatrout are held in ice and to determine if percent of shrinkage is significantly affected by length of fish or length of time the fish are held in ice.

METHODS

Ten spotted seatrout (range 296-427 mm TL) were collected using rod and reel on 23 April 1986 from the lower Laguna Madre, Texas system. All spotted seatrout were maintained alive in holding nets. Each fish was allowed to die in a holding net, measured (nearest mm TL), then placed within a bed of crushed ice. TL was the perpendicular distance from the tip of the snout to the extreme tip of the caudal fin with the fish lying on its side and the jaw closed; the caudal fin was flat and spread in a normal swimming position. A uniquely numbered internal anchor tag was inserted under the operculum of each fish for identification purposes. Individual fish were removed from the ice and TL measured on each subsequent hour for 24 h. Each fish was identified by its tag number and repacked in ice. Identity was determined only after lengths were recorded to eliminate recognition bias. All measurements were conducted by one individual using one measuring board to further minimize bias.

It was hypothesized that fish on ice would shrink, but no apriori information was available to suggest the relationships between the amount of shrinkage and the TL of the fish or the amount of shrinkage and the time on ice. A second hypothesis was that if the fish were held for a long enough period, the shrinkage would stop; but again, there was no specific estimate of when the shrinkage would cease. A visual examination of the data indicated that a nonlinear function would be appropriate. The nonlinear model also approximates the argument that the amount of shrinkage will decline to zero after some length of time. Finally, the relationship between total shrinkage (mm) and the beginning length of fish is examined using linear regression to determine if there is a significant relationship based on beginning length of fish, and total shrinkage.

The hypothesized relationship between shrinkage and time on ice was fit as a negative exponential function as shown below:

$$Y = B_0(1-e^{-B_1X_1}) \qquad [1]$$

where: Y = value of shrinkage (mm)
B_0 = standardized coefficient
B_1 = coefficient
X_1 = time, 1 to 24 h
e = approx. 2.718

RESULTS

The primary result of this research is that the length reduction for individual fish held in ice for 24 h ranged from 2 to 5 mm TL (0.3 to 1.4% TL) with a mean of 3 mm or 0.8% TL (Table 1 and Figures 1). The data as shown in Figure 2 and the estimated model (Figure 3) indicate that the majority of shrinkage (56%) on average occurred during the first hour the fish were on ice, with the remaining shrinkage occurring over the next 23 hours.

The estimated nonlinear model and the standard error of the coefficients is presented below:

$$Y = \underset{(0.07)}{2.76}(1-e^{\underset{(0.08)}{-0.47}X_1}) \qquad [2]$$

The mean square of the residuals for the model is 0.794 and the asymptotic 95% confidence intervals for each coefficient in the full model is respectively, $(2.62 \leq B_0 \leq 2.89)$ and $(.32 \leq B_1 \leq .61)$. The model chosen was based on minimizing the mean square of the residuals. The normal tests of significance, the F and t values, and R-squared values could not be utilized due to assumptions in the nonlinear estimation.

A significant relationship between shrinkage (mm) and length of fish placed in ice is not evident (Table 2). The F-statistic for the full regression model where shrinkage is the dependent variable as well as the t-statistic for the independent variable length are both insignificant. Additionally, examining the Pearson correlation coefficient ($r = -0.31$) between the millimeters of shrinkage and length of fish placed on ice, indicates there is very little correlation between the length of fish placed on ice and shrinkage (mm).

DISCUSSION

This study documents that spotted seatrout shrink while on ice, but, individual fish TL reductions over the 24 h period are small. These findings are similar to other species. Lux (1960) found mean length reduction for yellowtail flounder (Limanda ferruginea) (range = 269-455 mm TL) to be 5.1 mm or 1.5% after 54 h on ice. Halliday and Roscoe (1969) reported mean length reduction for Atlantic argentine (Argentina silus) (range = 220-370 mm SL) to be 0.5% (range 0.0 to 1.3%) after 24 h in ice. Findings in this study agree with those reported by Lux (1960) and Halliday and Roscoe (1969) who indicate that percentage of length lost does not vary with fish length.

The lack of fit that exists in the regression model is probably primarily due to the low level of precision of measurement relative to the small amount of shrinkage (average = 3 mm). For instance, it was very common (see Figures 1) for measurements to jump back and forth from hour to hour by as much as 1 or 2 millimeters, which is measurement error equal to approximately 50 to 75 percent of the total shrinkage that took place over the 24 hours. This is supported by the data presented by Green et al. (1983) where the mean of the differences between Texas Parks and Wildlife Department personnel and angler total length measurements for 53 available comparisons were 4 ± 5 mm (95% confidence interval). Thus, the estimated regression model is probably better than it appears, as the lack of fit is probably related to the lack of precision in measurement.

Even though mean TL differences through time were significant, the degree of shrinkage should not require adjustments in current spotted seatrout management techniques (e.g. length frequencies, weight-length relationships, coefficients of condition). Our findings may be most beneficial to the enforcement of spotted seatrout minimum size limits. A maximum shrinkage estimate of 5 mm with an average shrinkage of 3 mm for spotted seatrout held in ice up to 24 h should assist enforcement efforts. This means the maximum expected shrinkage that may occur is approximately 0.25 inches and that the majority of shrinkage will occur in the first hour after being placed on ice.

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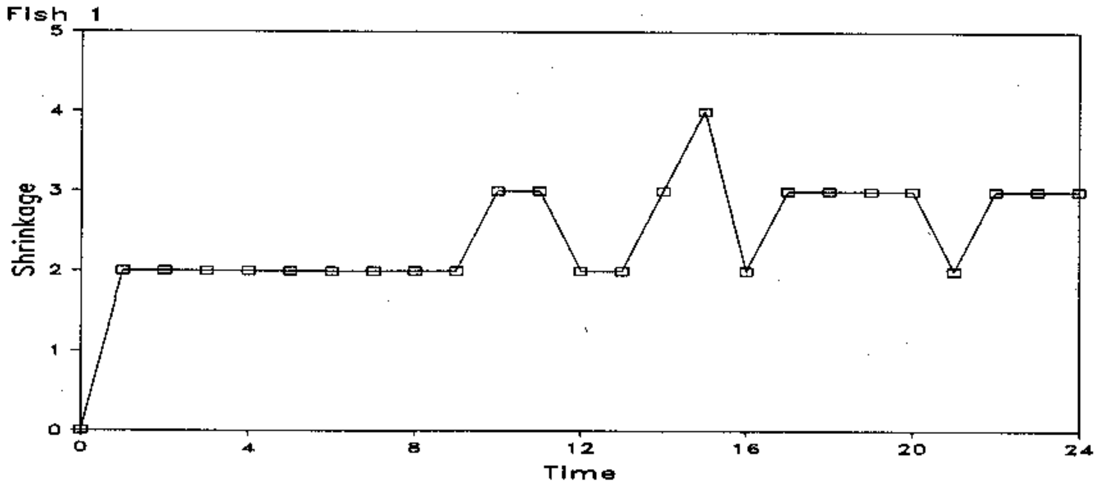
Table 1. Total length (mm) of 10 spotted seatrout before and after their 24 h ice preservation, and the respective (mm and %) in length.

	Length		Reduction in length	
Fish	Before	After	mm	%
1	296	293	3	1.0
2	303	300	3	1.0
3	309	307	2	0.6
4	336	333	3	0.9
5	350	347	3	0.9
6	355	352	3	0.8
7	372	370	2	0.5
8	391	387	4	1.0
9	420	415	5	1.2
10	427	425	2	0.5
Mean	356	353	3	0.8

Table 2. The estimated relationship between beginning total length of fish and the amount of shrinkage when placed on ice.

Variable	Estimate	Std. Error	F value	R^2
Constant	-0.77	(2.43)	0.85	0.09
Length	-0.006	(0.006)		

Figure 1. Individual fish shrinkage (mm) per fish for the 24 hr. time period.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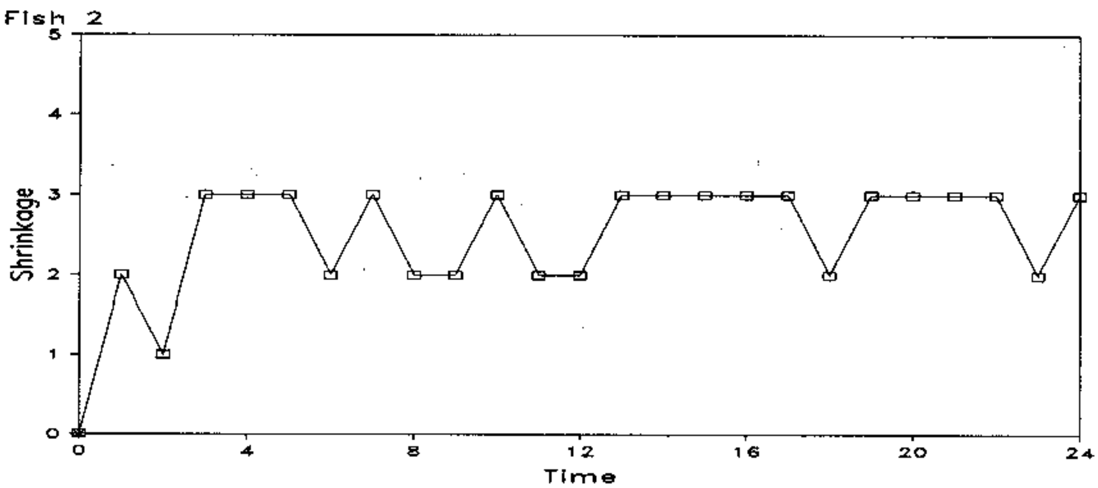
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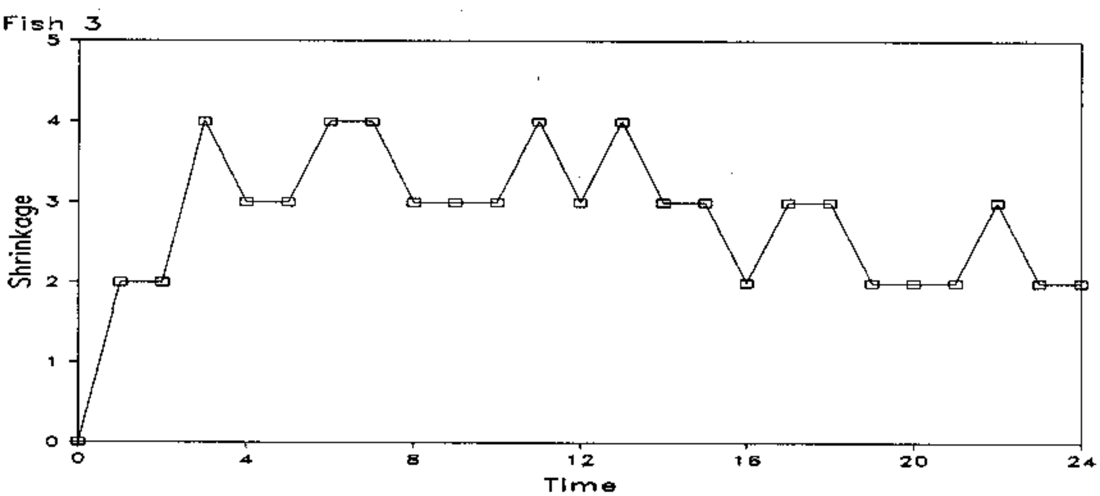
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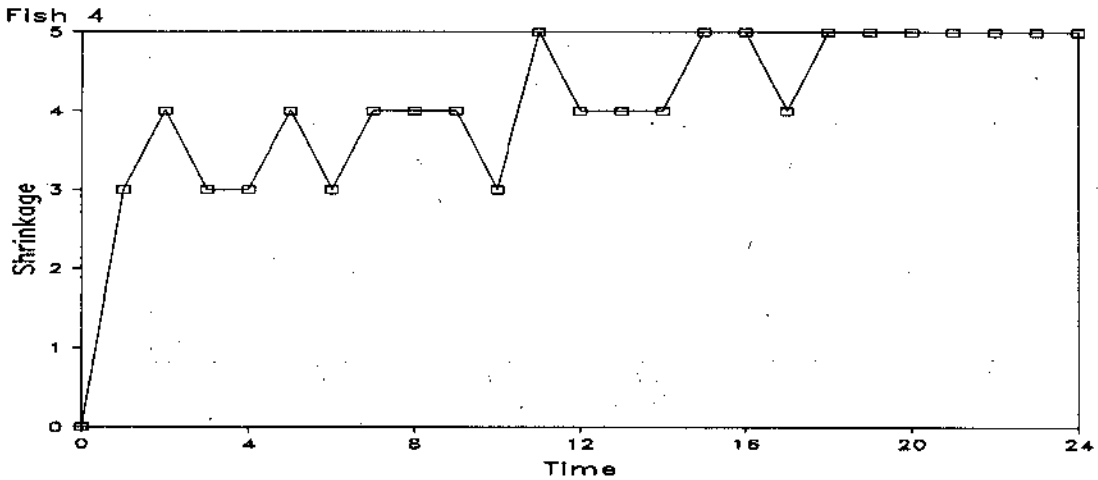
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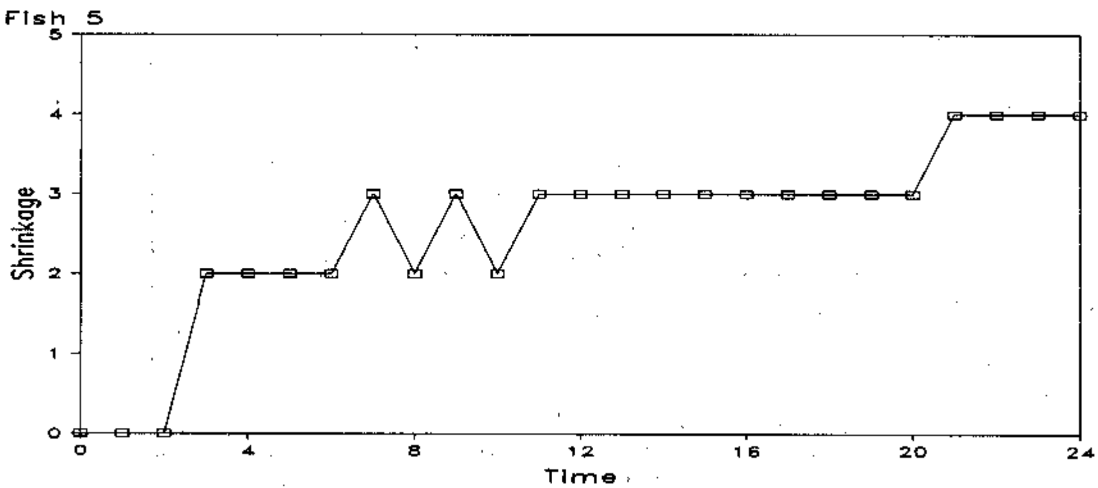
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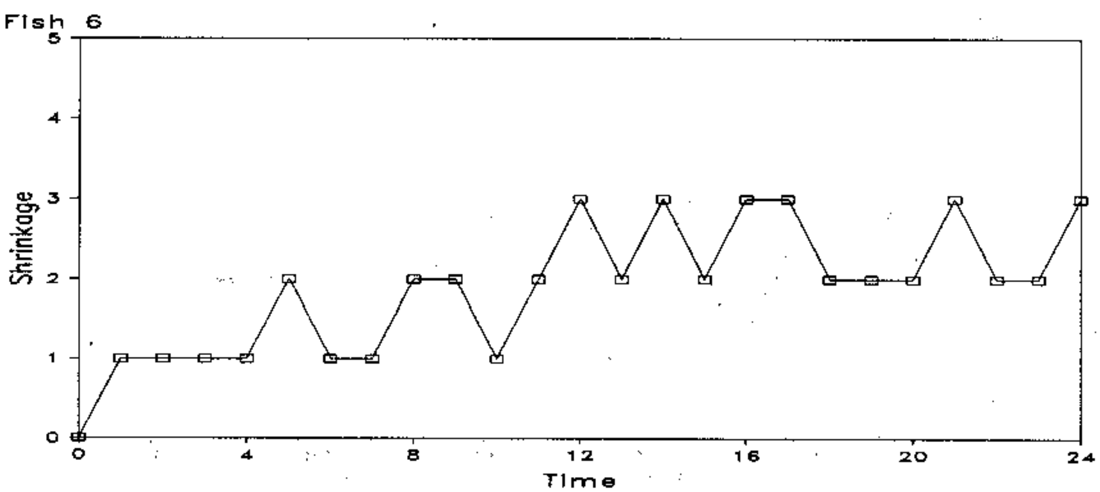
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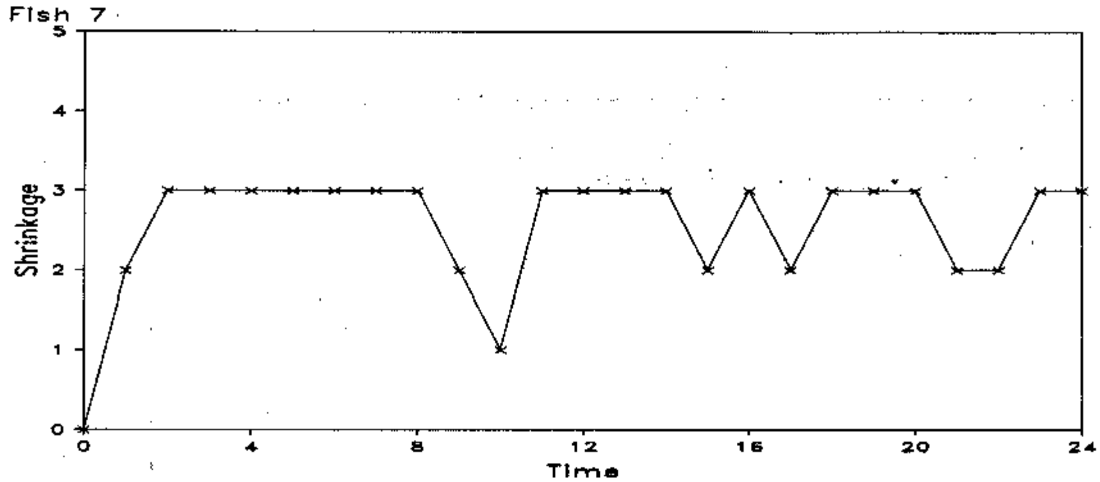
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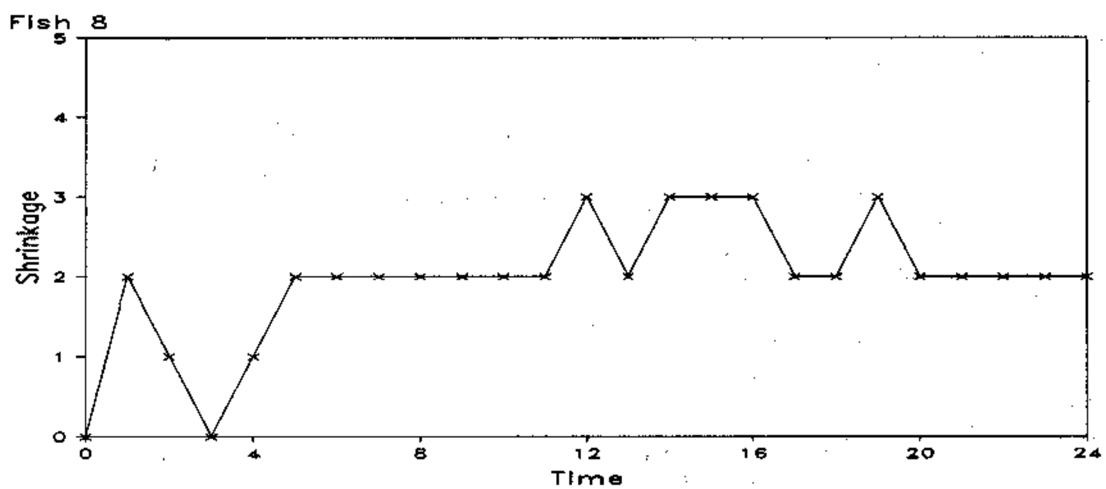
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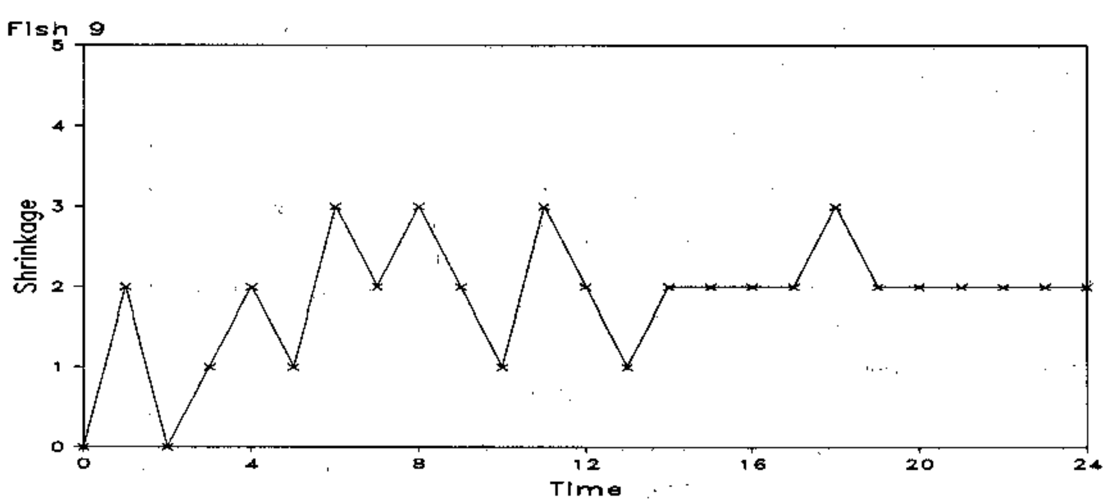
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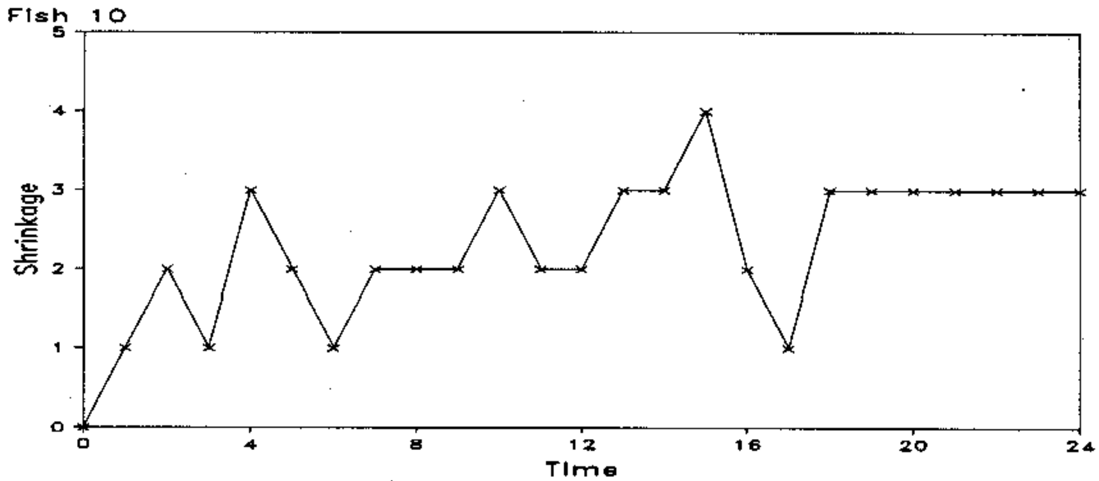
Fish 10
Shrinkage
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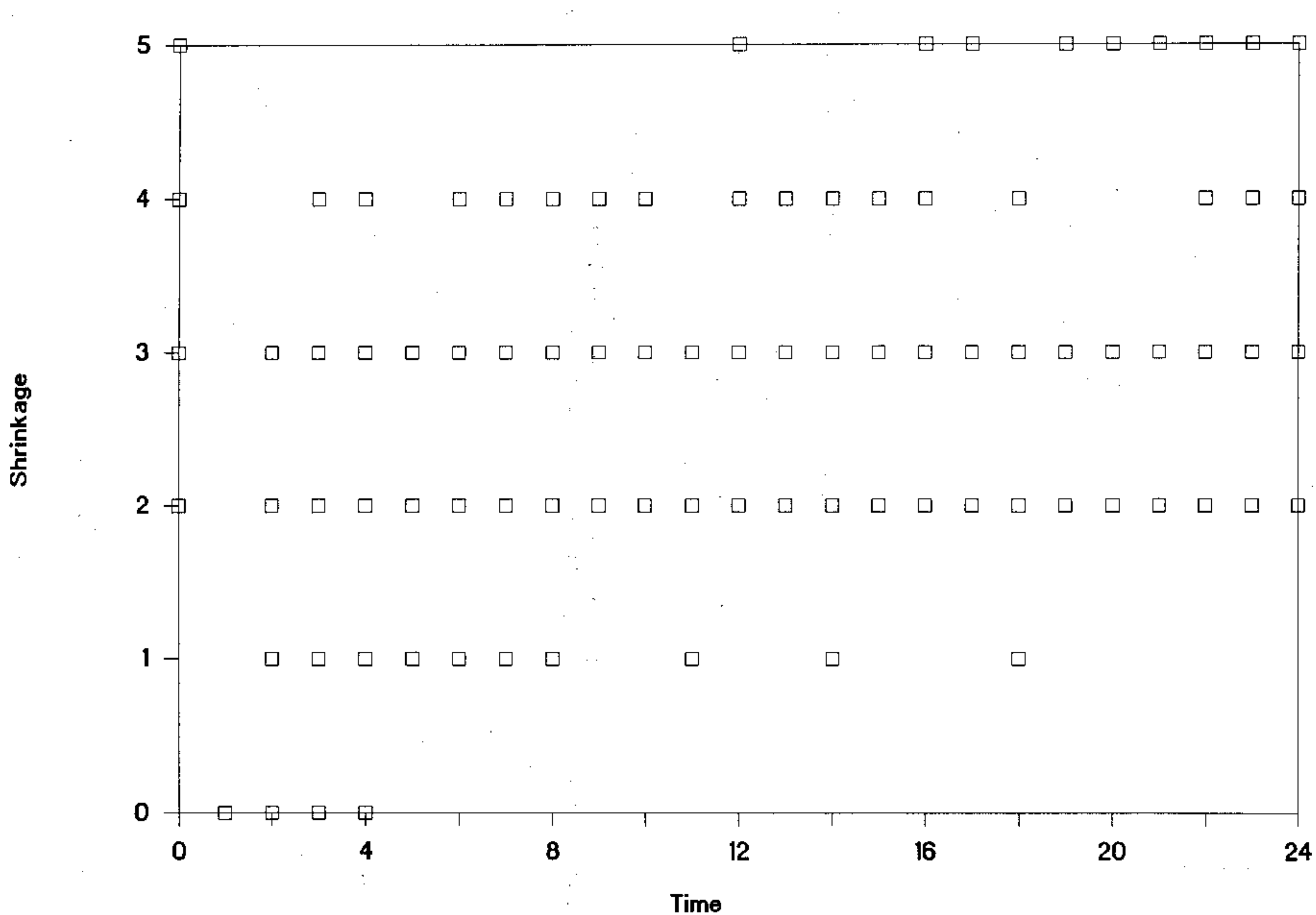
Figure 2. The amount of shrinkage per fish for each hour in the 24 h time period.


Shrinkage
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Time
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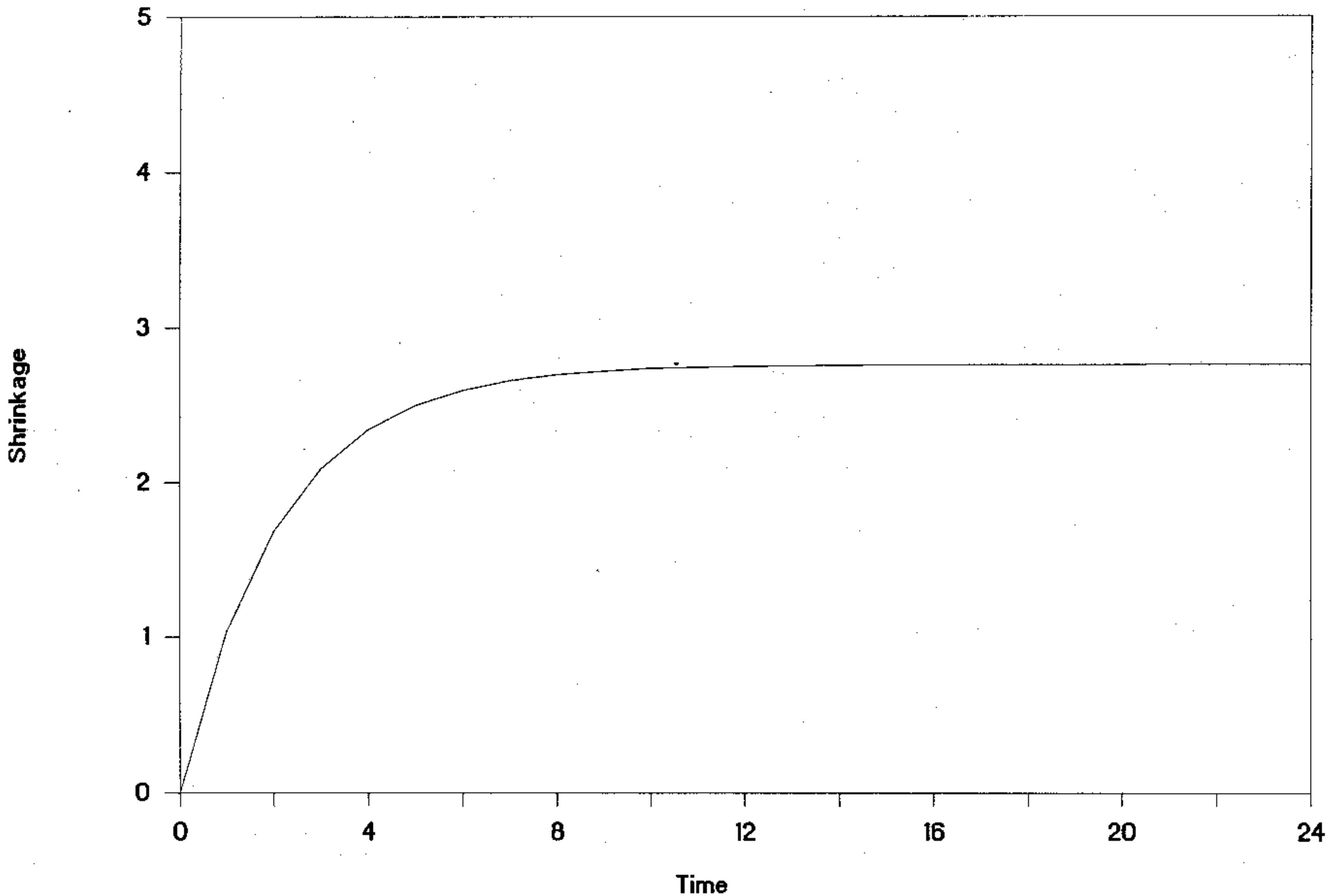
Figure 3. The estimated function to describe the shrinkage of spotted seatrout over the 24 hr. time period.



Shrinkage
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Time

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