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Short Communication

Selected population characteristics of the non-native catfish *Hoplosternum littorale* (Hancock, 1828) in central Florida, USA

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Abstract: This study reports the length-weight relationship (LWR), Fulton's condition factor (*K*), and sex ratio of the non-native catfish *Hoplosternum littorale* (Hancock, 1828) in Florida for the first time. Sampling was conducted from November 2013 to April 2014 in Tosohatchee Wildlife Management Area in Christmas, Florida. A total of 477 specimens were caught (6.4-13.5 cm TL). The allometric coefficient *b* of the LWR was greater than the isometric value (*b*=3.11), suggesting positive allometric growth. The average value for Fulton's condition factor (*K*) was 1.396, with no significant differences between juvenile and adult size classes. The results present certain disparities from data recorded from the fishes' native range, suggesting that this freshwater invasive may be flourishing in Florida. In addition, a new maximum total length of the species is reported.

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Introduction

In 1995, an established population of *Hoplosternum littorale* (Hancock, 1828) (Siluriformes, Callichthyidae) was detected in the Indian River Lagoon in central Florida (Nico et al., 1996). This Neotropical species is a microphagous scavenger commonly found throughout much of tropical South America and Trinidad (Winemiller, 1987). The species has since spread over much of peninsular Florida, possibly constituting an invasive threat to the freshwater ecosystem (Duxbury et al., 2010) and creating a new small-scale commercial fishery (Gestring et al., 2009).

The present work provides the first data on the length-weight relationships (LWR), Fulton's condition factor (*K*), and sex ratio of this species from Florida. LWRs and Fulton's condition factor are biological parameters commonly used to measure the physiological welfare of fish populations and are an effective means to assess the general productivity of a population (Froese, 2006). The information herein may be applied for population dynamic models in comparing native and introduced populations as well as population structure across the state of Florida.

Materials and Methods

From November 2013 to April 2014, the samples were collected from sites throughout Tosohatchee Wildlife Management Area (c. 28°29'56"N, 80°55'1"W), a protected area of the middle St. Johns River Basin spanning 12,424.25 hectares. Sampling efforts focused on Tosohatchee Creek, the St. Johns River, and large ditches connecting the former two water bodies, all rich with various aquatic macrophytes. Fish were captured using a 1.524 m radius cast net with 0.9525 cm nylon mesh. Species identification was confirmed according to Reis (1997). Samples were transported on ice to the laboratory where they were fixed in 10% buffered formalin and counted and measured for total length (TL) and weight (g). Lengths were measured to the

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Table 1. Minimum and maximum length range, regression parameters, and 95% confidence intervals for *Hoplosternum littorale* in central Florida.

N	Total Length (cm)		Total Weight (g)		Regression Parameters				
	Min	Max	Min	Max	log(a)	b	95% CI (a)	95% CI (b)	r^2
477	6.4	13.5	3.6	37	-1.98	3.11	(-2.05)-(-1.90)	3.03-3.19	0.93

nearest 0.1 cm using a digital caliper and weights to the nearest 0.1 g with a digital balance. LWR was calculated using the formula according Le Cren (1951) as follows: $W = \alpha L^b$

Where, W is the total body weight (g), L is the total length (cm), α is the intercept of the regression and b is the regression coefficient (i.e. growth rate). The parameters α and b were estimated using the least-square linear regression method (Froese, 2006) after log-transforming the above equation as follows: $\log W = \alpha + b \log L$

The regression coefficient provides information on fish growth. Growth is isometric if b = 3 and allometric if $b \neq 3$; negative allometry (fish becomes relatively slender as it grows) is noted if $b<3$ and positive allometry (fish becomes relatively fatter or deeper-bodied as it grows) is noted if $b>3$ (Froese, 2006). The 95% confidence intervals for b were calculated to determine if the predicted value of isometry (3.0) fitted between these intervals (Froese, 2006). Fulton's condition factor was derived using the relationship: $K = 100\,W/L^3$,

Where, W = weight of the fish in grams, L = total length of the fish in centimeters, and 3 is the length coefficient to allow the K values to tend towards one. Condition factor was evaluated by size classes (6.0-9.9 cm and 10.0-13.9 cm) to evaluate physiological differences through ontogeny) and by overall population. Size classes divided juvenile and adult individuals as suggested by Hahn et al. (1997) and Hostache and Mol (1998). Sex ratio was determined from 100 haphazardly subsampled individuals. Those individuals were dissected and their gonads inspected to determine their sex.

Results and Discussion

A total of 477 *H. littorale* individuals were caught ranging in size from 6.4-13.5 cm and weight from 3.6-37 g. The results of LWR are summarized in Table 1. The value of b was significantly different than the isometric value of 3 (b = 3.11 ± 0.075, $P<0.05$, student's t-test) suggesting slight positive allometric growth. The average condition factor for the population was K=1.396 and did not vary significantly between length classes ($P<0.05$).

Finally, of the 100 individuals evaluated for sex, 51 were males and 49 were females, emulating an approximately normal (i.e. 1:1) ratio.

The b parameter of the LWR from this study is significantly larger than those provided in former studies (b=2.84 (Oliva-Paterna et al., 2009) and b=2.72 (do Nascimento et al., 2013)). Also, the maximum condition factor calculated by do Nascimento et al. (2013) was significantly lower than in this study (K=1.15 versus K=1.396, respectively; $P<0.05$). These data suggest that *H. littorale* populations are obtaining greater relative weights in Florida in comparison to their native range (e.g. Brazil in the case of Oliva-Paterna et al., 2009 and do Nascimento et al., 2013). Such success could be contributed to access to more or novel resources, parasite or predator release, reduced competition than is found in the native range of *H. littorale*, or a combination thereof. Supporting the above notion, the central Florida population demonstrated a pattern of positive allometric growth whereas the former two studies noted negative allometry. The calculated LWR and condition factor for Florida will be useful for understanding the population dynamics of this invasive fish and further investigations on its growth in the region.

The 1:1 sex ratio is congruent with that in wild populations of *H. littorale* in Trinidad (Singh, 1978), but differs from the ratio (1.2:0.8) noted in northeastern Brazil by do Nascimento et al. (2013). The former study consisted of multi-year field

sampling of hundreds of fishes. The 2013 study by do Nascimento et al. (2013) inspected only 70 fishes and was conducted solely during breeding season. This sampling regime may explain the male bias given that males aggressively protect their nests, making them much easier to catch. The present study sampled fish during the entirety of the non-reproductive season for *H. littorale* in Florida, ensuring that the sex ratio is not biased by guarding males (Nico et al., 2004).

As an additional note, while searching for specimens of *H. littorale* in the University of Central Florida Department of Biology ichthyology collection, the author found two notably large male specimens of 25 cm TL and 26.3 cm TL, respectively. The latter length represents the new maximum length of the species; the former maximum length was 25.4 cm TL as reported by Antonetti et al. (2013). The two specimens noted here were collected in March 2001 in the St. Johns River in central Florida at approximately 29°10'3"N, 81°31'23"W by an unknown collector and are currently stored in 70% ethanol.

To date, the LWR, condition factor, and sex ratio of this species have not been reported from Florida. Thus, this work provides the first data available for the region. The population characteristics noted here may be applied in population dynamic modeling to aid in conservation efforts. Likewise, the disparity of LWR and condition factor in native and non-native ranges provide incentive to investigate deeper the mechanisms of success for this species in Florida. Ultimately, the data provided here are a useful metric in measuring the success of a freshwater non-native species in Florida. The baseline information herein could help to influence necessary management strategies of *H. littorale* in the state.

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چکیده فارسی

ویژگی‌های جمعیت انتخاب شده گربه‌ماهی غیربومی *Hoplosternum littorale* (Hancock, 1828) از فلوریدا مرکزی، ایالت متحده آمریکا

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چکیده:
این مطالعه رابطه طول-وزن (LWR)، فاکتور وضعیت فولتون (K) و نسبت جنسی گربه ماهی غیر بومی *Hoplosternum littorale* (Hancock, 1828) را در فلوریدا آمریکا برای اولین بار گزارش می‌کند. نمونه‌برداری از نوامبر سال ۲۰۱۳ الی آوریل ۲۰۱۴ در ناحیه مدیریت حیات وحش Tosohatchee در کریسمس فلوریدا انجام شد. در مجموع ۴۷۷ نمونه با دامنه طول کل ۱۳/۵-۶/۴ سانتی‌متر صید شدند. ضریب آلومتریک b رابطه طول-وزن بیشتر از مقدار مورد انتظار برای رشد ایزومتریک بود (b=۳/۱۱) که بیانگر الگوی رشد آلومتریک مثبت این گونه می‌باشد. مقدار میانگین فاکتور وضعیت فولتون (K) ۱/۳۹۶ بود و تفاوت معنی‌داری بین کلاس‌های طولی نوجوان و بالغ وجود نداشت. نتایج اختلاف بارزی را نسبت به داده‌های ثبت شده این گونه در محدوده بومی پراکنش آن نشان داد که بیانگر این موضوع می‌تواند باشد که این گونه مهاجم آب شیرین در حال گسترش در فلوریدا است. به‌علاوه یک ثبت جدید از حداکثر طول کل این گونه نیز در این مطالعه گزارش می‌شود.

کلمات کلیدی: *Hoplosternum*، رابطه طول-وزن، فاکتور وضعیت فولتون، نسبت جنسی.