

## Original Research Article

# Salinity tolerance of *Dormitator lebretonis* (Pisces: Eleotridae: Steindachner, 1870) reared in water tanks: Implications for coastal wetlands and swamps valorization

### ABSTRACT

*Dormitator lebretonis* (Eleotridae: Steindachner, 1870) is a fish species of high fisheries and commercial potential that inhabits West African coastal environments from Senegal to Angola. In particular, this eleotrid is widespread in Benin coastal waters and wetlands. The current rearing experiment aimed to determine the salinity levels that favor the survival and growth factors of this squeaker. Six (6) treatments corresponding to six (6) salinity levels (0‰, 5‰, 10‰, 15‰, 20‰, 25‰) and three replicates with 15 individuals of *D. lebretonis* per replicate were considered for the experiment. Appropriate salinity levels were obtained from a mixture of sea water and fresh water. Overall, within each six (6) treatments, physicochemical features showed insignificant ( $P>0.05$ ) variations. Regardless of rearing salinity (0‰ - 25‰), *D. lebretonis* displayed high survival ranging between 86.66% (salinity: 0‰) and 100% (salinities: 5‰ - 20‰). Percent weight gained (PWG:  $7.94\pm 0.01\%$  -  $14.39\pm 0.02\%$ ) were moderate and significantly ( $P<0.05$ ) varied with treatment. Also, significant ( $P<0.05$ ) variations in the condition factors (K) were recorded, with means ranging between  $1.68\pm 0.04$  and  $1.92\pm 0.01$ . Nevertheless, specific growth rate (SGR) did not show any significant ( $F_{5,18}=0.328$ ;  $P=0.890$ ) variations across treatments. These findings could serve as reference data for an extensive aquacultural valorization of *D. lebretonis* in numerous Benin coastal wetlands and swamps.

**Keywords:** Coastal waters, Eleotridae, growth performances, Salinity, Valorization

### 1. INTRODUCTION

Salinity is one of the top key factors that affect the water quality and the biological resources of aquatic ecosystems. In particular, in polyhaline waters such as lagoons and estuaries, salinity displays a wide range of effects such as food intake, locomotion activity, metabolism, spawning, growth and survival of fishes [1,2,3,4]. In such brackish waters, fishes are permanently under osmoregulation pressure in order to manage periodic changes in water salinity that greatly influences directly or indirectly the physiological condition and bioenergetics of fishes [5]. Many studies point out the impacts of water salinity variations on shellfisheries, fisheries and the survival of various fish species in aquaculture industries [6,7]. Salinity variations affects the competitive interactions between organisms and can even serves as physical barriers in the distribution and abundance of a wide array of marine and brackish water animals [8,9,10].

In the Benin coastal waters, recent ichthyological surveys indicated that *Dormitator lebretonis* (Pisces: Eleotridae: Steindachner, 1870) is of high commercial and economic value and heavily exploited in artisanal fisheries [11]. The species inhabits brackish areas, estuaries, lagoons and mangroves that stand as preferred habitats, but can also be found occasionally in typically freshwater habitats and mainly in swamps and aquatic vegetation habitats [12,11]. In Benin, *D. lebretonis* are prominent and abundant in coastal waters such as Lake Nokoué, Porto-Novo Lagoon, Lake Ahémé and the Coastal Lagoon, and constitutes in these ecosystems, an important fisheries component [10,11]. Because *D. lebretonis* anatomically possess accessory respiration structures, this eleotrid seems tolerate a wide range of salinities [13,14]. Recent studies on feeding ecology indicated that in the wild, the species ingests detritus, insects and shrimps that dominate the diet. With regards to spawning, after hatching, the larvae reach the sea and the juveniles recolonize estuaries and other surrounding brackish water bodies [15]. *Dormitator lebretonis* is consumed fried or smoked with corn meal, rice, yam, potato etc. and widely used for sauce

seasoning in replacement of shrimps that have become very expensive because of stocks decreases [16,11].

Notwithstanding the relatively high commercial and economic value of *D. lebretonis* in Benin, habitats are being degraded causing major threats to the species that led to high depletion of the stocks. Hence, there is a need for the valorization of the multitude of freshwaters and brackish water wetlands through the farming of this squeaker. Consequently, knowledge on the behavior and growth performance of *D. lebretonis* reared in different levels of salinities are needed to assess survival and growth rates in the perspective of fish farming in freshwaters and brackish water wetlands. The current study investigates the growth performance and survival of *D. lebretonis* reared in different ranges of salinity in order to contribute to a better understanding of the optimal conditions for rearing the species in wetlands.

## 2. MATERIAL AND METHODS

### 2.1. Sampling, acclimatization and experiment set-up

**Sampling of *Dormitator lebretonis*:** Live individuals of *D. lebretonis* (Fig.1) were collected at Lake Nokoué in Ganvié village located between 6°28'30.74" N and 2°23'22.3 "E. Samplings were made in aquatic vegetation/swamps and in open water using a seine (80 cm x 71 cm x 94 cm). Once caught, they were held in oxygenated plastic packages (1 m x 42 cm) containing water from sampling site. Packaged fish samples were then transported to the experimental site of AFRICA PRO FISH located at Ouidah town where rearing disposal was set.



**Fig.1.** Individual of *Dormitator lebretonis* captured in Lake Nokoué

**Acclimatization technique:** Once transported to the experimental site, the 412 individuals of *D. lebretonis* collected were stored in 3 water tanks of 1 m<sup>3</sup> (1m x1m x1m) each and acclimatized for two weeks in a water of 10‰ - salinity brought from *D. lebretonis* sampling sites. The water was renewed every three (3) days and the salinity was readjusted using a stock of 35‰ - sea water. An aerator of 110 l/min of capacity ensured a permanent availability of dissolved oxygen which mean value was about 6.7 mg/l. Also, during this acclimatization phase, water temperature approximated 28.7°C, ammonium 0.1mg/l, nitrite 0.06mg/l, nitrate 0.71mg/l and pH 6.8. Fish were fed daily *ad libitum* with a Skretting brand feed of 30% protein content.

**Experiment set-up and treatments:** A total of eighteen (18) tanks of 1m<sup>3</sup> (1m x1m x1m) each were used for the rearing experiment (Fig. 2). Because *D. lebretonis* prefers habitat with low water level (Sonon *et al.*, 2021) [11], the tanks were filled with water to a height of 25 cm, making a water volume of 250 l per

tank. All the tanks were placed under a shed to reduce sun influence. A tank of 2 m<sup>3</sup> was used to store the seawater collected from Atlantic Ocean at Ouidah seashore (Fig 2) while the fresh water was obtained from a borehole dug located in the experimentation site. Six (6) levels (0‰, 5 ‰, 10‰, 15‰, 20‰, 25‰) of salinities were considered in the current experiment. These brackish waters were obtained by mixing the seawater and the freshwater until getting the appropriate salinity. A refract meter (VISTA model) was used to measure the water salinity. Six (6) treatments T1, T2, T3, T4, T5 and T6 with 3 replicates per treatment were considered for the experiment and corresponded to salinities 0‰, 5‰, 10‰, 15‰, 20‰, and 25‰, respectively. A total of 270 individuals of *D. lebretonis* was used for the whole experiment and 45 individuals were assigned to each treatment. Thus, fifteen (15) individuals were placed per tank/replicate. The 45 individuals of *D. lebretonis* used per treatment for the experimentation were submitted to ANOVA test that revealed that initial mean weights (2.77±0.11 g - 2.94±0.05g) through treatments were not significantly different ( $F_{5,264} = 0.892$ ,  $p=0.487$ ).

## 2.2. Water follow-up

**Water salinization, renewal and siphoning:** To obtain the appropriate salinities corresponding to each treatment, seawater (35‰) was mixed with fresh water from the borehole of the experimental site. A refract meter of salinity range between 0 and 100 ‰ was used to monitor and adjust the salinity until the desired value was obtained. Every day, the water in the tapeline tanks was partially renewed by evacuating 10% of the rearing water and replaced by a mixture of fresh and sea water. The salinity of the tanks was thus readjusted using a refract meter. The waste products from the leftover feed and fish feces are highly toxic and can cause mortality. For this reason, they were siphoned from the tanks every day during the experiment using a siphon.

**Follow-up of water quality:** Physico-chemical parameters such as dissolved oxygen (mg/l), temperature (°C) and pH were measured twice a day to the nearest 0.1 mg/l, 0.1°C and 0.1, respectively using the HANNA Multi-parameter (HI9829). Salinity was measured with a refract meter to the nearest 1‰. Also, ammonia (mg/l), nitrite (mg/l) and nitrate (mg/l) were measured twice a week with an Ammonia/nitrite and nitrate test Kit (SERA Test kit).



Fig. 2. Water tanks used for the experimentation.

## 2.3. Feeding and monitoring of growth/mortality

During the four (4) weeks-experiment, *D. lebretonis* individuals were fed twice a day (08:00 and 16:00) with commercially balanced feed for tilapia (Skretting®). Nutritional values of the food were as follow: protein (30%), fat (8%), crude fiber (3%), moisture (10%), ash (8%) and humidity (12%). To monitor growth and mortality, each tank was examined every day to check for dead fish individuals that were then removed immediately using a scoop net. Growth was assessed once a week through control fishing. This consisted of emptying the fish from the tapeline tanks and measuring morphometric parameters such as total length (TL), standard length (SL) and weight (W) of individual fish. TL and SL were measured to the nearest 0.1 cm with an ichthyometer and the weight was measured to the nearest 0.01g with an electric scale (Camry). At the end of the experiment, individual fish was weighed and their total body length was recorded.

## 2.4. Data analysis

Fish individual weight and length data were recorded in Excel spreadsheet 2016 (Ink; Microsoft office Professional Plus) and used for growth evaluation and to compute the condition factor (K). Survival rates (SR), weight gain (WG), specific growth rate (SGR) and condition factor (K) were evaluated through the following formulae [17,18]:

$$\text{Survival Rate (SR, \%)} = \frac{\text{Final number of fish}}{\text{Initial number of fish}} \times 100$$

$$\text{Percentage Weight Gain (PWG)} = \frac{\text{Final body weight} - \text{Initial body weight}}{\text{Initial body weight}} \times 100$$

$$\text{Specific Growth Rate (SGR, \%)} = \frac{\ln(\text{Final weight}) - \ln(\text{Initial weight})}{\text{Rearing period in days}} \times 100$$

$$\text{Fulton's Condition Factor (K)} = \frac{\text{Final body weight}}{(\text{Final standard length})^3} \times 100$$

Also statistical analysis such as ANOVA 1 test was performed on the physicochemical data and the mean value of each parameter was computed. The growth performance of the fish was analyzed by a one-way analysis of variance followed by the Tukey's multiple range test to compare differences among treatment means.

## 3. RESULTS

### 3.1. Water quality parameters

Table 1 shows mean  $\pm$  (SD) values of water quality parameters during the experimentation. Overall, regardless of treatment, the water quality was globally suitable for the survival and growth of *D. lebretonis* reared in tanks. With regards to the six (6) treatments, mean water temperature ranged between  $28.21 \pm 0.12$  °C and  $29.21 \pm 0.47$  °C, mean dissolved oxygen between  $4.21 \pm 0.45$  mg/l and  $4.86 \pm 0.68$  mg/l and mean pH between  $6.55 \pm 0.25$  and  $6.75 \pm 0.42$ . Also, mean ammonium varied from  $0.06 \pm 0.25$  mg/l to  $0.08 \pm 0.24$  mg/l, mean nitrite from  $0.06 \pm 0.03$  mg/l to  $0.08 \pm 0.02$  mg/l and mean nitrate from  $0.66 \pm 0.048$  mg/l to  $0.80 \pm 0.48$  mg/l. In general, for each six (6) treatments of salinities 0‰, 5‰, 10‰, 15‰, 20‰ and 25‰, respectively, One-way Anova run on physicochemical features failed to show significant difference ( $P > 0.05$ ) with statistics (F, P) ranging between  $F_{2,165} = 0.060$  and  $F_{2,165} = 0.343$  ( $p$ : 0.05 - 0.942) for temperature, between  $F_{2,165} = 0.265$  and  $F_{2,165} = 4.731$  ( $P$ : 0.058 - 0.951) for dissolved oxygen and between  $F_{2,165} = 0.135$  and  $F_{2,165} = 3.27$  ( $P$ : 0.058-0.874) for pH. Ammonia ( $F_{2,21} = 0.20$  -  $F_{2,21} = 4.60$  with  $P$ : 0.179 -

0.833), nitrite ( $F_{2,21}=0.1 - F_{2,21}=3$  with  $P: 0.250 - 0.833$ ) and nitrate ( $F_{2,21}=0.000 - F_{2,21}=1.4$  with  $P: 0.417 - 1.00$ ) showed the same trends. Nevertheless, significant variations ( $P<0.05$ ) of water physicochemical parameters were recorded between different treatments during the experimental study with statistics  $F_{5,330}=3.054$ ,  $P=0.012$  for temperature;  $F_{5,330}= 44.61$ ,  $P=0.000$  for dissolved oxygen and  $F_{5,330}=5.111$ ,  $P=0.000$  for pH. Also, significant variations ( $P<0.05$ ) were recorded for ammonium with  $F_{5,42}=6.963$ ,  $P=0.000$ ; for nitrite ( $F_{5,42}=3.216$ ,  $P=0.023$ ) and for nitrate with  $F_{5,42}=4.547$ ,  $P=0.005$ .

**Table 1.** Mean ( $\pm$ SE) values of water quality parameters during the rearing of *Dormitator lebretonis* in water of different salinities (0‰, 5‰, 10‰, 15‰, 20‰, 25‰).

Parameters	Treatments					
	S1	S2	S3	S4	S5	S6
DO (mg/l)	4.35 $\pm$ 0.582	4.86 $\pm$ 0.213	4.21 $\pm$ 0.452	4.66 $\pm$ 0.363	4.36 $\pm$ 0.691	4.29 $\pm$ 0.843
Temp (T°C)	28.21 $\pm$ 0.12	28.31 $\pm$ 0.71	28.21 $\pm$ 0.12	28.38 $\pm$ 0.16	28.33 $\pm$ 0.23	29.21 $\pm$ 0.11
pH	6.55 $\pm$ 0.116	6.73 $\pm$ 0.137	6.68 $\pm$ 0.134	6.68 $\pm$ 0.083	6.75 $\pm$ 0.082	6.66 $\pm$ 0.075
Amm (mg/l)	0.08 $\pm$ 0.004	0.08 $\pm$ 0.006	0.06 $\pm$ 0.006	0.06 $\pm$ 0.006	0.07 $\pm$ 0.004	0.08 $\pm$ 0.004
Nitrite (mg/l)	0.07 $\pm$ 0.006	0.06 $\pm$ 0.004	0.08 $\pm$ 0.004	0.07 $\pm$ 0.004	0.06 $\pm$ 0.004	0.07 $\pm$ 0.003
Nitrate (mg/l)	0.72 $\pm$ 0.032	0.66 $\pm$ 0.048	0.8 $\pm$ 0.048	0.74 $\pm$ 0.048	0.66 $\pm$ 0.048	0.74 $\pm$ 0.048

DO: Dissolved oxygen, Temp: Temperature, Amm: Ammonium

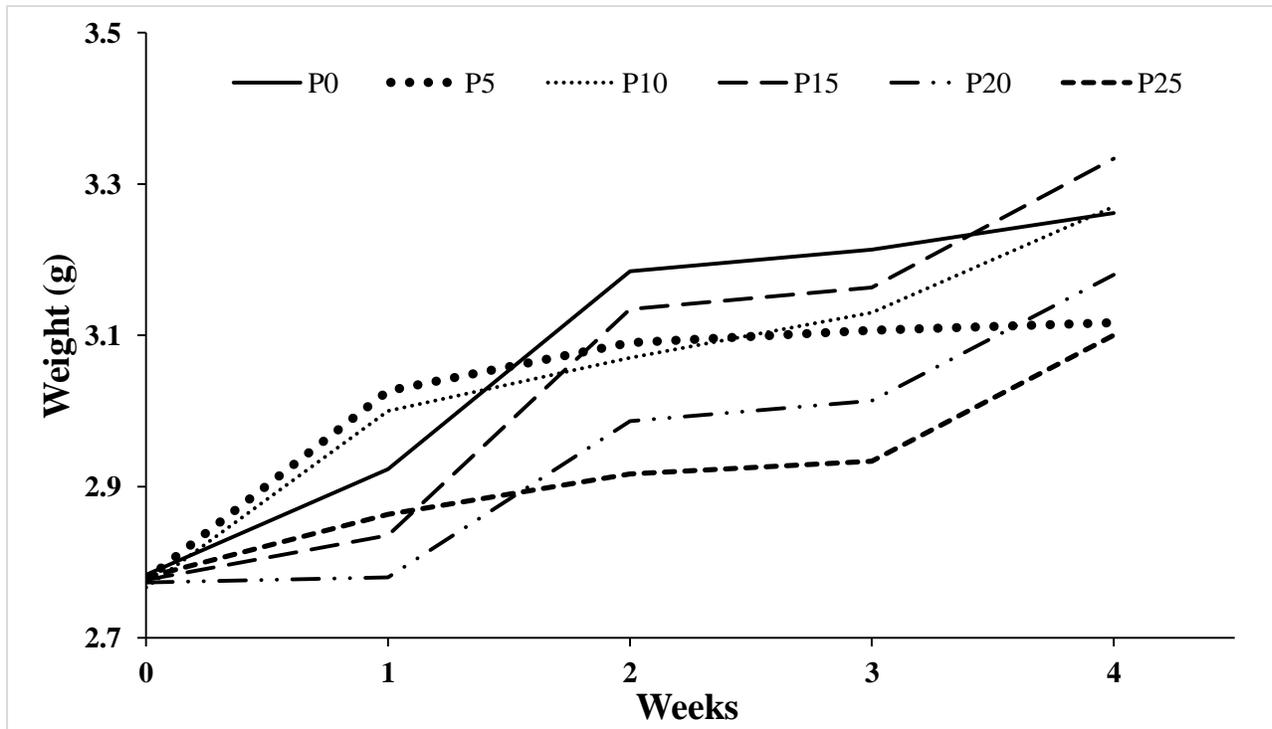
### 3.2. Survival rate and growth performance

Growth performance parameters such as initial weight (IW), final weight (FW), percent weight gain (PWG), specific growth rate (SGR), survival rate (SR) and condition factor (K) of *D. lebretonis* reared in different level of salinity were summarized in Table 2 and represented in Figures 3 and 4. Over the experimental period, survival were high and ranged between 86.66% (salinity: 0‰) to 100% (salinity: 5‰, 10‰, 15‰, 20‰). A survival of 96.66% was recorded for the highest salinity (25‰) tested. One-way ANOVA run on the survival and growth performances of *D. lebretonis* revealed that the survival rate varied significantly ( $F_{5,264}= 4.311$ ;  $P=0.006$ ) among treatments. Also, with regards to the six (6) treatments, there were significant ( $F_{5,264}=18.160$ ;  $P=0.000$ ) variations in the condition factors (K) with means ranging between  $K=1.68\pm 0.04$  (salinity: 15‰) and  $K=1.92\pm 0.01$  (salinity:10‰). In contrast, percent weight gained (PWG) weekly from different treatments did not show any significant ( $F_{5,18}=0.324$ ;  $P=0.892$ ) variations among treatments. Nevertheless the highest value (PWG=4.39 $\pm$ 0.02%) was recorded for salinity 20‰ and the lowest value (PWG=7.94 $\pm$ 0.01%) was recorded for salinity 25‰. Likewise, weekly specific growth rate (SGR) did not show any significant ( $F_{5,18}=0.328$ ;  $P=0.890$ ) variations among treatments. The highest SGR (0.65 $\pm$ 0.11%/day) was recorded for salinity 15‰ while the lowest value (0.27 $\pm$ 0.07) was recorded for salinity 25‰.

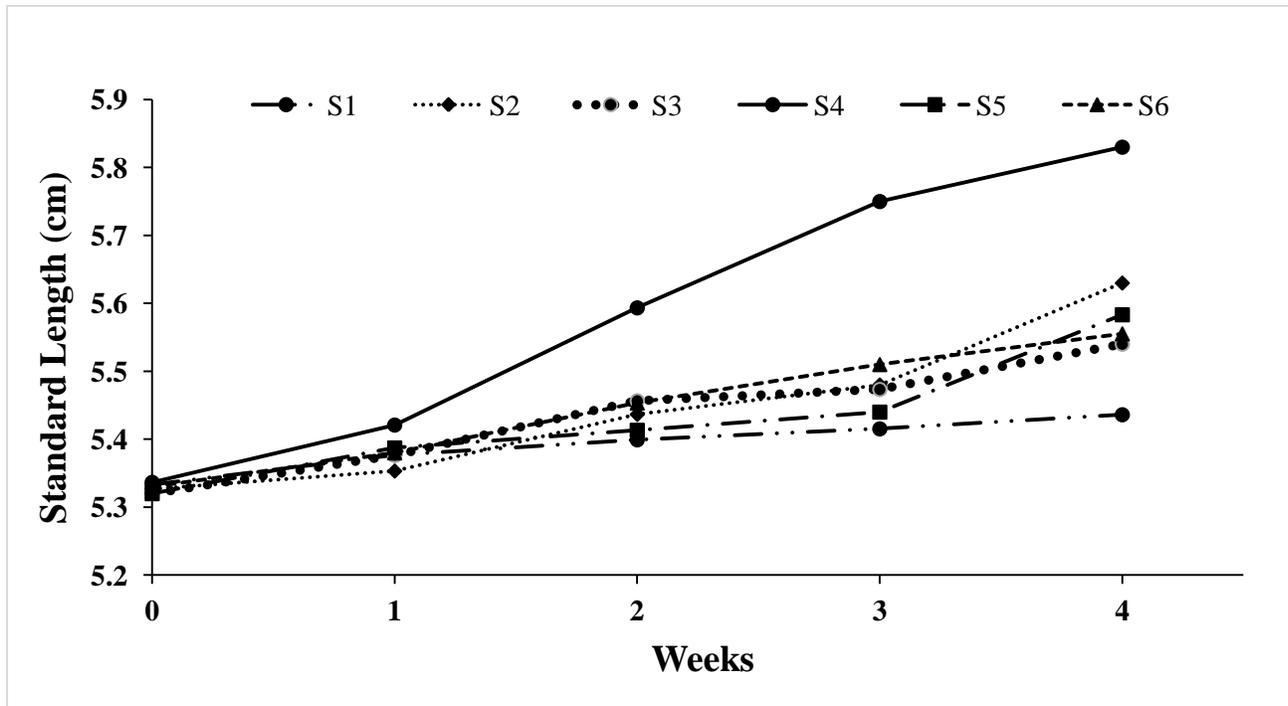
**Table 2.** Growth performance and survival (%) of *Dormitator lebretonis* reared in different water salinity (0‰, 5‰, 10‰, 15‰, 20‰, 25‰).

Parameters	Treatments					
	S1=0‰	S2=5‰	S3=10‰	S4=15‰	S5=20‰	S6=25‰
IW(g)	2.89 $\pm$ 0.09	2.88 $\pm$ 0.06	2.90 $\pm$ 0.14	2.94 $\pm$ 0.05	2.88 $\pm$ 0.07	2.77 $\pm$ 0.11
FW(g)	3.26 $\pm$ 0.10 <sup>b</sup>	3.11 $\pm$ 0.09 <sup>a</sup>	3.27 $\pm$ 0.12 <sup>b</sup>	3.33 $\pm$ 0.08 <sup>b</sup>	3.18 $\pm$ 0.18 <sup>b</sup>	2.99 $\pm$ 0.15 <sup>a</sup>
PWG (%)	10.38 $\pm$ 0.05 <sup>a</sup>	8.22 $\pm$ 0.03 <sup>b</sup>	9.66 $\pm$ 0.02 <sup>a</sup>	13.38 $\pm$ 0.03 <sup>c</sup>	14.39 $\pm$ 0.02 <sup>c</sup>	7.94 $\pm$ 0.01 <sup>b</sup>
SR (%)	86.66 $\pm$ 2.26 <sup>a</sup>	100 $\pm$ 0.00 <sup>b</sup>	100 $\pm$ 0.00 <sup>b</sup>	100 $\pm$ 0.00 <sup>b</sup>	100 $\pm$ 0.00 <sup>b</sup>	96.66 $\pm$ 0.66 <sup>ab</sup>
SGR (%. day <sup>-1</sup> )	0.56 $\pm$ 0.24 <sup>b</sup>	0.41 $\pm$ 0.15 <sup>b</sup>	0.57 $\pm$ 0.10 <sup>b</sup>	0.65 $\pm$ 0.11 <sup>c</sup>	0.49 $\pm$ 0.13 <sup>b</sup>	0.27 $\pm$ 0.07 <sup>a</sup>
K	1.85 $\pm$ 0.03 <sup>b</sup>	1.74 $\pm$ 0.09 <sup>a</sup>	1.92 $\pm$ 0.01 <sup>b</sup>	1.68 $\pm$ 0.04 <sup>a</sup>	1.83 $\pm$ 0.04 <sup>b</sup>	1.79 $\pm$ 0.00 <sup>a</sup>

IW: Initial weight, FW: Final weight, SR: Survival rate, SGR: Specific growth rate, K: Condition factor. Values are represented as triplicate mean $\pm$ SE, with 15 fish in each replicate. Different superscripts within a row indicate significant ( $p < 0.05$ ) differences among means.



**Fig. 3.** Trends of body weight of *Dormitator lebretonis* reared during 4 weeks in water of different salinity (0‰, 5‰, 10‰, 15‰, 20‰, 25‰).



**Fig. 4.** Standard Length growth of *Dormitator lebretonis* reared during 4 weeks in water of different salinity (0‰, 5‰, 10‰, 15‰, 20‰, 25‰).

## DISCUSSION

In this experiment of *Dormitator lebretonis* reared in water of variable salinity concentrations, the water quality parameters (Table 1) recorded during the whole experiment are suitable for the survival and growth of this squeaker regardless of treatments. These water features were similar to those reported by Sonon et al. (2021) [11] in *D. lebretonis* habitat in lake Nokoué where water temperature ranged between 27.5 - 31.1°C, pHs between 5.8 - 7.55, and dissolved oxygen between 0.55mg/l - 8.9 mg/L. In contrast, *Dormitator latifrons*, the most cultivated Eleotrid in Mexico, seems to tolerate higher water temperature (31.9°C - 32.3°C) and higher pH (7.2 - 8), but lower variations of dissolved oxygen (6.4 - 7.3 mg/L) compared to *D. lebretonis* (Basto-Rosales et al. (2019) [19]. Overall, in the current experiment, there were no significant variations ( $P>0.05$ ) in water features within tanks suggesting that, globally, the water quality remained invariable during the fish culture. Indeed, one-way Anova statistics ( $F$ ,  $P$ ) ranged between  $F_{2,165}=0.060$  and  $F_{2,165}=0.343$  ( $P$ : 0.051-0.942) for temperature, between  $F_{2,165}=0.265$  and  $F_{2,165}=4.731$  ( $P$ : 0.058 - 0.951) for dissolved oxygen and between  $F_{2,165}=0.135$  and  $F_{2,165}=3.27$  ( $P$ : 0.058-0.874) for pH. Also,  $F$  ranged between  $F_{2,42}=0.20$  and  $F_{2,42}=4.60$  ( $P$ : 0.179 - 0.833) for ammonia, between  $F_{2,42}=0.1$  and  $F_{2,42}=3$  ( $P$ : 0.250 - 0.833) for nitrite and between  $F_{2,42}=0.000$  and  $F_{2,42}=1.4$  ( $P$ : 0.417 - 1.00) for nitrate. Thus, mean values of physicochemical parameters such as temperature ( $28.21\pm0.12$  to  $29.21\pm0.47^\circ\text{C}$ ), pH ( $6.55\pm0.25$  to  $6.75\pm0.42$ ), dissolved oxygen ( $4.21\pm0.45$  to  $4.86\pm0.68$  mg/l), ammonium ( $0.06\pm0.25$  to  $0.09\pm0.24$  mg/l), nitrite ( $0.06\pm0.03$  to  $0.08\pm0.02$  mg/l), and nitrate ( $0.66\pm0.048$  to  $0.80\pm0.48$  mg/l) were not limiting factors in the expression of growth and survival potential in *Dormitator lebretonis* subjected to different salinity levels.

In this study, high percentages of survival of *D. lebretonis* were recorded regardless of treatment and varied between 86.66% and 100%. In particular, the treatment of salinity 5‰, 10‰, 15‰ and 20‰ showed 100% of survival and similar to those recorded by Basto-Rosales et al. (2019) [19] where *Dormitator latifrons* survival ranged between 99% and 100% when reared in fresh water. Overall, percentages of survival were significantly different ( $F_{5,264}= 4.311$ ;  $P=0.006$ ) between group of treatments of different salinities (0‰, 5‰, 10‰, 15‰, 20‰, 25‰). This high survival recorded regardless of treatment indicated that *D. lebretonis* tolerate a high range of salinity (0‰ - 25‰), suggesting that this

eleotrid is an euryhaline fish species. The presence of accessories organs that allow the species to utilize atmospheric oxygen may explain this high rusticity and survival [19]. The great tolerance in salinity and the adaptive air breathing behavior allow *D. lebretonis* to colonize most Benin brackish waters such as Porto-Novo lagoon, Lake Nokoué, Lake Ahémé, Coastal Lagoon showing a wide range of salinity varying nearly between 0‰ and 25‰ [20,11]. Furthermore, in the Coastal Lagoon, *D. lebretonis* were caught in a water of 30‰ – salinity indicating that this eleotrid may support sea water. Also, when reared in a 0‰-salinity (treatment1), the resulting survival ( $86.66 \pm 4.44\%$ ) still relatively high indicating that *D. lebretonis* was able to survive and to growth in a typically freshwater. In Benin, *D. lebretonis* individuals were common in the freshwater floodplains of the Ouémé River, the Sô River and the Mono River where they were relatively abundant during a short period of flooding [10,21,22]. They mostly originated from their reproduction grounds such as swamps and adjacent aquatic grasses from where they were dragged in the open water during flooding [10,21]. Also, results on the population structure reported by Sonon et al. (2023) [23,24] and the findings on the current experiment agreed with that reported by Quesada (2017) [25] in the Cross River and Chiloango River in Guinea, some freshwaters of salinity between 0 and 5‰ where *D. lebretonis* constituted an important component of the fish fauna.

This wide range of salinity (0-30‰) tolerated by *D. lebretonis* could be an adaptation to the coastal habitats by developing a high osmoregulation potential. Probably, the species has evolved in an euryhaline aquatic environment characterized by variable hydrological regimes that yearly include floodings from rivers during rainfall associated with intrusions of seawater. As a result, in both habitats (freshwater, brackish water), *D. lebretonis* individuals exhibit high survival and high growth. Navarro-Rodríguez et al. (2010) [26] reported similar observations with *Dormitator latifrons*, a fish species occurring abundantly in the Boca Negra Estuary in Mexico. When transported abruptly from freshwater and placed directly in different levels of salty water, 97.5 % individuals of *Dormitator latifrons* survived in a water of salinity up to 35‰ [19]. In the current rearing experiment, though percentages of *D. lebretonis* survival were quite high and significantly ( $F_{5,264}=4.311$   $P=0.006$ ) different between groups of treatments, insignificant ( $F_{5,18}=0.328$ ,  $P=0.890$ ) variations of specific growth rate (SGR) were recorded among the six treatments and lower than that reported by Basto-Rosales et al. (2019) [19] for *Dormitator latifrons* where SGR approximated  $5.5\% \cdot \text{day}^{-1}$ . This finding suggested that the range of salinity (0 - 25‰) considered did not significantly affect the specific growth rate (SGR) of *D. lebretonis*. Nevertheless, though not significant, relatively lower values of SGR were recorded in a 25‰ water salinity. Overall, regardless of treatments, *D. lebretonis* exhibited relatively high condition factors (K) that significantly ( $F_{5,264}=18.160$ ;  $P=0.000$ ) varied across treatments. Indeed, high salinity levels may directly affect fish physiology causing the reduction of growth rate and survival. In addition, osmoregulation mechanism need energy and species with lower metabolic rates utilize about 20 to 50% of the total energy available [27]. Nevertheless, in this study, *D. lebretonis* showed high condition factors ( $K>1$ ) with means ranging between  $K=1.68 \pm 0.04$  (15‰) and  $K=1.92 \pm 0.09$  (10‰) suggesting that the species showed good wellbeing compared with those recorded for *Dormitator maculatus* in the Alvarado Lagoon, in Mexico where K ranged between 0.16749 and 0.20856 [28].

As results, *D. lebretonis* tolerate freshwaters and brackish water habitats of salinity ranging between 0‰ and 25-30‰ allowing higher survival and growth performances. Consequently and as suggestion, extensive commercial culture of *D. lebretonis* could be implemented in the fresh and brackish swamps habitats that are widely available at the Benin coastal waters. Likewise, some other existing numerous isolated freshwater swamps could be valorized through the rearing of *D. lebretonis* for food production and the improvement of grassroots revenues.

## CONCLUSION

The current research on salinity tolerance of *Dormitator lebretonis* reared in water tanks indicated that this eleotrid tolerate a wide range of salinity ranging between 0‰ and 25‰ that generate a high potential of survival and growth performances. These findings could serve as reference data for the valorization of numerous coastal wetlands and swamps through an extensive rearing of *D. lebretonis* to increase the species stocks and improve the revenue of the fishermen.

## REFERENCES

1. Manush SM, Pal AK, Chatterjee N, Das T, Mukherjee SC. Thermal tolerance and oxygen consumption of *Macro-brachium rosenbergii* acclimated to three temperatures. *J. Therm. Biol.* 2004 ; 29: 15-19.
2. Perry GML, Martyniuk CM, Ferguson M M, Danzmann RG. Genetic parameters for upper thermal tolerance and growth-related traits in rainbow trout (*Oncorhynchus mykiss*). *Aquaculture.*2005 ; 250: 120– 128
3. Leon J, Kannan K, Lin HK, Moon HB, Kim DS. Bioconcentration of perfluorinated compounds in blackrock fish, *Sebastes schlegeli*, at different salinity levels. *Environmental toxicology and chemistry.* 2010 ; 29 (11): 2529-2535.
4. Jefferies KM, Connon RE, Verhille CE, Dabruzzi TE, Britton MT. Divergent transcriptomic signatures in response to salinity exposure in two populations of an estuarine fish. *Evolutionary applications.* 2019 ; 12 (6) : 1212-1226.
5. Sterzelecki FC, Rodrigues E, Fanta E, Ribeiro CAO. The effect of salinity on osmoregulation and development of the juvenile fat snook, *Centropomus prallelus* (POEY). *Brazilian Journal of Biology.* 2013; 73(3): p609-p615.
6. Lisboa V, Barcarolli IF, Sampaio LA, Bianchini A. Effect of salinity on survival, growth and biochemical parameters in juvenile Lebranch mullet *Mugil liza* (Perciformes: Mugilidae). *Neotropical Ichthyology* 2015; 13(2):447-452.
7. Manliclic ADC, Corpuz MNC, Vera Cruz EM. Optimum conditioning period before packing, salt-treated water, and blue background color improved the survival of Nile tilapia (*Oreochromis niloticus* L.) fingerlings during transport. *Philippine Agricultural Scientist.* 2018;101(1):76-83.
8. Bringolf RB, Kwak TJ, Cope WG, Larimore MS. Salinity tolerance of flathead catfish: implications for dispersal of introduced populations. *Transactions of the American Fisheries.* 2005;134: 927-936.
9. Alcatraz C, Bisazza A, Garcia-Berthou E. Salinity mediates the competitive interactions between invasive mosquitofish and an endangered fish. *Oecologia.* 2007 ; 155(1) :205-213.
10. Adite A, Fiogbe ED. Fish biodiversity and community structure of the ecotonal zone of the Mono River in Benin and Togo (West Africa). *International Journal of Current Research.* 2013;5(12): 3876-3885.
11. Sonon PS, Sossoukpe E, Adite A, Gbankoto A and Abou Y. Diversity and community characteristics of Eleotridae (Pisces: Actinopterygii: Perciformes) from the coastal waters of Benin (West Africa). *J. Bio. & Env. Sci.* 2021;19(6) p.63-79.
12. Nordlie FG. Niche specificities of Eleotrid fishes in a tropical estuary. *Revista de Biologia tropical.*1978 ; 27. 35-50.
13. Nordlie FG. Feeding and reproductive biology of Eleotrid fishes in a tropical estuary. *Journal of fish Biology.*1981 ; 18: 97-110.
14. Azaza S, Kraïem MM. Etude de la tolérance à la température et à la salinité chez le tilapia du Nil *Oreochromis niloticus* (L.) élevé dans les eaux géothermales du sud tunisien, *Bull. Inst. Natn. Scien. Tech. Mer de Salammbô.*2007;34:145-155. French
15. Viveen WJAR, Richter CJJ, Vanoordt PG, Hisman EA. Manuel pratique de pisciculture de poisson-chat africain, *clarias gariepinus*, Département de Zoologie de l'Université de la Guyane, Pays-Bas et UN-FAO Bangui, RCA 1985 ; p4-p7, 128p
16. Babatounde A. Eléments d'écologie et de biologie de *Dormitator lebretonis* (Eleotridae) à la lagune côtière du Bénin. *Memoire de Master. Faculté des sciences et techniques d'Abomey calavi.* UAC 2015; 16-25. French
17. Toko I, Fiogbé E, Koukpodé B, Kestemont P. Rearing of African catfish (*Clarias gariepinus*) and vundu catfish (*Heterobranchus longifilis*) in traditional fish ponds (whedos): Effect of stocking density on growth, production and body composition. *Aquaculture.* 2007 ; 262 (1) 65-72.
18. Adité A, Fiogbé ED, Accodji JM. Effects of weaning age on survival and growth factors of *Heterotis niloticus* (Cuvier, 1829) larvae. *Int. J. Biol. Chem. Sci.* 2009; 3(6): 1310-1319
19. Basto-Rosales MER, Rodríguez-Montes GAO, Carrillo-Farnés O, Álvarez-González CA, Badillo-Zapata D, Vega-Villasante F. Growth of *dormitator latifrons* under different densities in concrete tanks. *Tropical and Subtropical Agroecosystems* 2019 (22): 499-503.
20. Navarro-Rodríguez MDC, Flores-Vargas R, González-Guevara LF, Téllez-López J, Amparán-Salido R. Distribución y abundancia de las larvas de *Dormitator latifrons* (Pisces: Eleotridae) en elestero Boca Negra, Jalisco, México. *Ciencia y Mar.* 2010 ; 14 (40): 3-9.

21. Lederoun D, Chikou A, Vreven E, Snoeks J, Moreau J, Vandewalle P, Lalèyè P. Population parameters and exploitation rate of *Sarotherodon melanotheron*, *melanotheron rüppell*, 1852 (Cichlidae) in Lake Toho, Benin. *Journal of Biodiversity and Environmental Science*. 2015 ; 6(2): 259-271.
22. Hazoume RUS. Diversité, organisation trophique et exploitation des poissons de la rivière Sô au Benin (Afrique de l'Ouest). PhD Thesis, University of Abomey-Calavi, Benin. 2017 ; 162p.
23. Sonon PS, Sidi Imorou R, Arame H, Adjibadé KN, Adite A. Assessment of size structures, length-weight models and condition factors of Eleotridae (Pisces : Perciformes : Gobodei) from the coastal waters of Benin (West Africa). *Int. j. Forest, Animal fish Res.*2023 ; 7(1) : 2456-8791.
24. Sonon PS, Sidi Imorou R, Adjibade KN, Arame H, Adite A. Demographic characteristics and exploitation rate *Dormitator lebretonis* (Pisces: Eleotridae: Steindachner, 1870) from coastal lagoons of Southern Benin, West Africa. *Aquatic Research* 2023 ; 6(2), 97-108.
25. Navaro-Rodriguez M, Flores-Vargas R, Gonsalves Guevara L, Gonzalez Ruelas M. Distribution and abundance of *Dormitator latifrons* (Richardson) larvae (Pisces : Eliotridae) in the natural protected area " Estero El salado" in Jalisco, Mexico. *Revista de Biologia Marina y Oceanografia*. 2004 ; 39(1) : 31-36.
26. Ramos-Morales E, Sanz-Sampelayo MR, Molina-Alcaide E. Nutritive evaluation of legume seeds for ruminant feeding. *J. Anim. Physiol. Anim. Nutr.* 2010; 94 (1): 55-64.
27. Semra K. The effects of salinity on growth of goldfish, *Carassius auratus* and crucian carp, *Carassius carassius*. *African Journal of Biotechnology*. 2013; 12 (16): 2082-2087.
28. Franco-López J, Bedia-Sánchez CM, Peláez-Rodríguez E, Viveros-Legorreta JL, Antolín Ortiz-Touzet M, Vázquez-López H. Ecological Aspects of *Dormitator maculatus* Bloch, 1792 in the Alvarado Lagoon, Veracruz, Mexico. 2019; *Turk. J. Fish. & Aquat.Sci.*20(1),51-60 [http://doi.org/10.4194/1303-2712-v20\\_1\\_05](http://doi.org/10.4194/1303-2712-v20_1_05)