



## BIOLOGICAL AND FISHERIES INDICES OF *Cheilodactylus variegatus* "PINTADILLA" IN THE LA LIBERTAD REGION DURING THE YEAR 2020

Dra. Zoila Gladis Culquichicón Malpica [zculquichicon@unitru.edu.pe](mailto:zculquichicon@unitru.edu.pe)

Dr. Alvaro Edmundo Tresierra Aguilar [atresierraaguilar@gmail.com](mailto:atresierraaguilar@gmail.com)

Dr. Carlos Alfredo Bocanegra García [cbocanegra@gmail.com](mailto:cbocanegra@gmail.com)

Dra. Bilmia Veneros Urbina [bveneros@gmail.com](mailto:bveneros@gmail.com)

### ABSTRACT

*Cheilodactylus variegatus* "pintadilla" is a species of interest to artisanal fishermen and sports fishermen, the objective of this study was to know the situation of this species in the La Libertad Region in 2020, only focused on commercial fishing. The global sex ratio is adjusted to 1M:1H and in the pattern of the sex ratio to the length the predominance of females is observed. The growth is allometric and the infinite length has been estimated at 39.90 cm,  $K=0.48/\text{year}$  with  $R_n$  of 0.376,  $t_0=-0.56$  years. The exploitation rate 0.59 is higher than the optimal level (0.50), however, the impact of recreational fishing on this stock still needs to be evaluated. The vessels dedicated to pintadilla fishing are boats and punts, with the most frequent use of net gills. The percentage of extracted juveniles is 43%, which places this hydrobiological resource at risk.

**Key word:** pintadilla, fishing indices, biological indices, small fisheries.

### INTRODUCTION

The fishing resources, according to Nureña (2012), although they are renewable, must be extracted in a rational manner since landings of "pintadilla" were 13,955 t per year, this species is for direct human consumption, thus taking advantage of their nutritional, economic and social nature.

Likewise, this author indicates that Peru is one of the countries with the greatest marine biodiversity, this is associated with the ecosystems of outcrops, shallow beach areas and the mangrove ecosystem in Tumbes.

One of the main sources of food supply in Peru is the artisanal fishery, this generates employment for coastal inhabitants; one of the main problems that are currently occurring is the constant decrease in the sizes of the main target species (Aguilar, 2017).

The distribution of *Cheilodactylus variegatus* "pintadilla"; that it is one of the resources that sustains the artisanal fishery in the La Libertad Region; ranges from Paita (Peru) to Talcahuano (Chile), the Cheilodactylidae family is considered anti-equatorial since they are found at 20° - 25°N of the Northern Hemisphere, while in the Southern hemisphere they reach 27° - 28°S (Queensland in Australia) (Vargas and Pequeño, 2001).

This family is made up of *Nemadactylus bergi*, *Nemadactylus gayi*, *Goniistius plessisi* and *Cheilodactylus variegatus*, the latter being known as "bilagai or pintacha" in Chile and "pintadilla" in Peru, but few scientific studies have been carried out on this species.

González (2012) indicates that the "pintadilla" is a benthic-coastal species of coastal rocky, sandy, sandy-rocky bottoms, strong waves with the presence of vegetation, especially macroalgae.

*C. Variegatus* feeds mainly on polychaetes, crustaceans (porcellanidae) and other minor crustaceans, which is why it is considered a carnivorous species; algae remain have sometimes been found inside the stomach, so it can also be considered omnivorous (Carhuas, 2018).

In Peru, the artisanal fishing of this species is carried out within 5 miles using hooks and curtain nets, the catches since 1950 shows a record of 122 t in 1995 increasing to 371 t in 2005 except, during El Niño 1997-1998, where one of the lowest catches was recorded with 76 t (Mostacero et al., 2005).

Cornejo (2014) mentions that the need to study the biology of fish lies especially in those that are economically important since they are constantly exploited, therefore, knowing their exploitation, conservation and feeding help to obtain study models, becoming an object of vital importance.

Within the area of biology, there is reproductive biology, which according to Gómez, Paredes and Chipollini (1995) evaluates reproductive processes, determines the variations in the reproductive cycle and its relationship with the marine environment. For this, parameters such as the gonadosomatic index (IGS), spawning, sizes at first maturity, sex ratio, etc. are determined.

Likewise, this author emphasizes that these parameters are fundamental to understand the dynamics of a population and, therefore, for the management of the fishing resource, since it provides important data to establish a management of the fishery.

*Cheilodactylus variegatus* "pintadilla" is a species that is part of the Peruvian sea ecosystem, constituting a link in the food chain, it also has a delicious flavor and is a source of food, on the other hand, it has social and economic importance since it is acceptable and allows fishermen to earn income to support himself and his family.

Artisanal fishing extracts hydrobiological resources to accomplish the internal demand for fresh fish, a product that is preferably destined for direct human consumption; this activity is mainly based on the extraction of *Cheilodactylus variegatus* "pintadilla", it has been observed that over the years the value of the maximum size of capture has decreased, as a consequence of the high pressure of the fishing that is being applied to the juvenile specimens of this species. The indiscriminate capture of the smallest sizes of the species, can cause a series of consequences in the structure of the population whose effects can be showed both into a decrease in fishing yields, and in the appearance of states of overexploitation that alter the stock relationship. – recruitment, which may cause the collapse of the fishery.

The research problem is what are the characteristics of the biology and fishery of *Cheilodactylus variegatus* "pintadilla", from the La Libertad Region, during the year 2020.

The general objective is to determine the characteristics of the biology and the fishery of *Cheilodactylus variegatus* "pintadilla", from the La Libertad Region, during the year 2020, with specific objectives: determine the reproductive characteristics, growth, mortality and exploitation rates, determine the characteristics of the fishery

## MATERIAL AND METHODS

The sample of *Cheilodactylus variegatus* "pintadilla" was taken from Pacasmayo, Salaverry and Port Morin from artisanal landings and transferred to the Fisheries Biology Laboratory of the National University of Trujillo to carry out the biometric and biological sampling. For the biometric analysis, an ichthyometer graduated to one centimeter was used. In the biological analysis, the total length (Lt) in cm, total weight (g) was recorded, an electrical scale of 0.1 gram of sensitivity was used, and sex was also determined.

The total length of each of the sample specimens was measured, registering the code on the biological sampling sheet. Frequency tables were prepared and entered into a FiSAT file and excel sheets for processing.

To calculate the overall sex ratio, all females and males, it was obtained the percentage for each sex. The results were analyzed with the  $X^2$  statistical test and their values were analyzed at 95% confidence. To determine the  $X^2$ , the Zar formula (1974) was used.

$$X^2_{Cal} = \sum \frac{(O - E)^2}{E} \qquad X^2_{tab} (0.95;1) = 3.84$$

The sexual proportion to the size was calculated by grouping the data in class intervals, the percentage of males was calculated for each level of total length and the curve that defines the relationship between both variables was drawn; determining the equation to which the information best fits.

The gonadosomatic index was calculated using the formula:

$$IGS = (PG/PT) * 100$$

The Kolmogorov-Smirnov statistical test was used to assess whether there are differences between the distributions of males and females.

The lengths were used to analyze the growth according to the programs to calculate growth constants in FISAT II, using direct adjustment of the curve to the eye, the parameters of growth were obtained, also was estimated the beginning of the growth curves.

The relationship total weight (g) – total length (cm) will be analyzed using the potential regression:

$$PT = a * LT^n$$

The information for fishery was extracted from the landings of "pintadilla", coming from the La Libertad Region, PRODUCE 2019, also gillnets, boats, date. The distribution of size was analyzed with the length of TMC = 26 cm (Minimal size of Capture). The data was processed using the Excel program. These data were processed for evaluation, likewise, the Windows Word program was used for the text.

## RESULTS

The pintadilla (Fig. 1) is a coastal species that is extracted by artisanal fishermen for direct human consumption, as a fresh product.



Figure 1. *Cheilodactylus variegatus* "pintadilla (Source: Perú LNG, s.f.)

The overall sex ratio is favorable to females (Fig.2), however, the calculated chi square value (1.42) is lower than the tabulated chi square for one degree of freedom (3.84), therefore it is concluded that the M:H ratio in pintadilla in 2020 is 1:1.

The sex ratio to size (Fig. 3) fits a third-degree polynomial curve (Fig. 2), observing the predominance of females in most sizes.

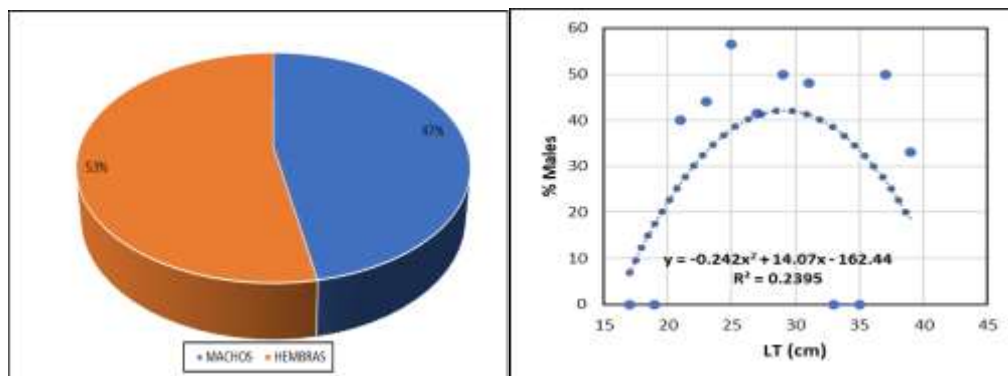


Figure 2. Global sexual proportion of pintadilla. Figure 3. Sexual proportion at size of pintadilla

The values of the gonadosomatic index (IGS) of females are greater (Fig. 4) than the values of males, since the weight of the ovaries is greater than the weight of the testicles, with the average values for females being 0.93 and 0.17 for males.

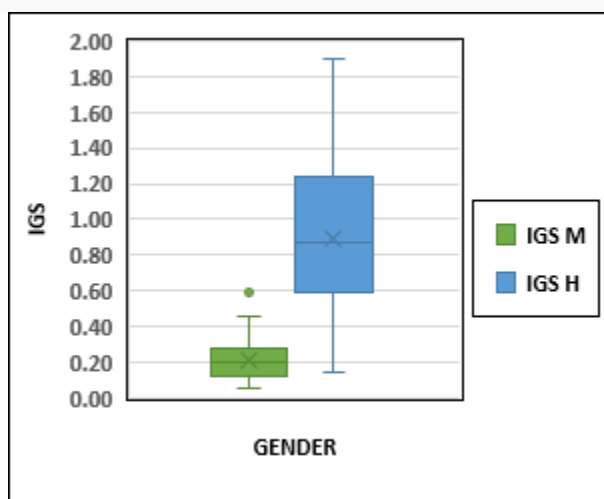


Figure 4. IGS of pintadilla related to the gender.

Regarding the frequency distributions by lengths by gender, it is observed that the greatest difference occurs at higher values (Fig. 5), this difference is not significant since  $D_c$  (0.11) is less than  $D_t$  (0.3), therefore It is concluded that the cumulative length frequency distributions by gender are equal. The mean and median length is 27 cm and the mode is 28 cm.

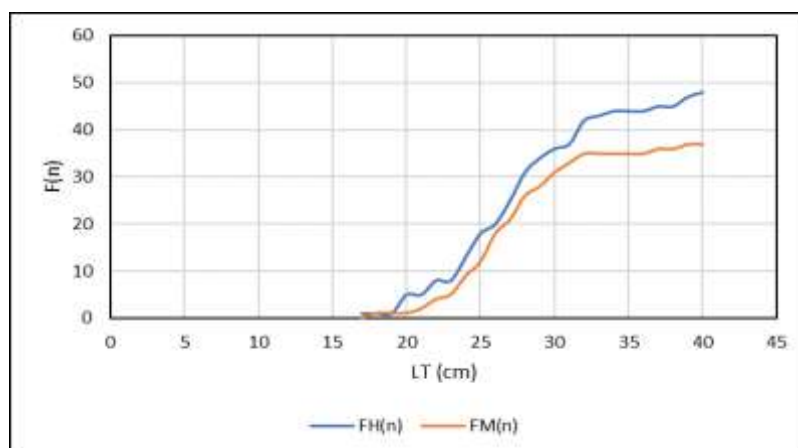


Figure 5. Test of Kolmogorov-Smirnov to evaluate cumulated distributions of size frequencies per gender of pintadilla.

The infinite length is 39.90 cm,  $K = 0.48/\text{year}$  with  $R_n$  of 0.376,  $t_0 = -0.56$ , these parameters are expressed in the length growth curve (Fig. 6), which presents an initial phase of accelerated growth in the first pintadilla stage of life, then the slope softens until reaching the asymptotic phase.

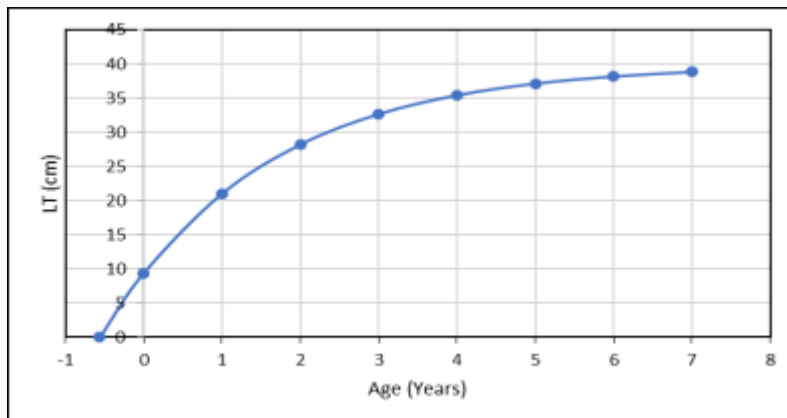


Figure 6. Curve of length growth of pintadilla.

The weight-length relationship is significant, 70% of the data fit a potential relationship (Fig. 7), the exponent indicates a negative allometric growth, overweight specimens are observed in smaller lengths, although there are only two specimens. At greater sizes, overweight is observed significantly.

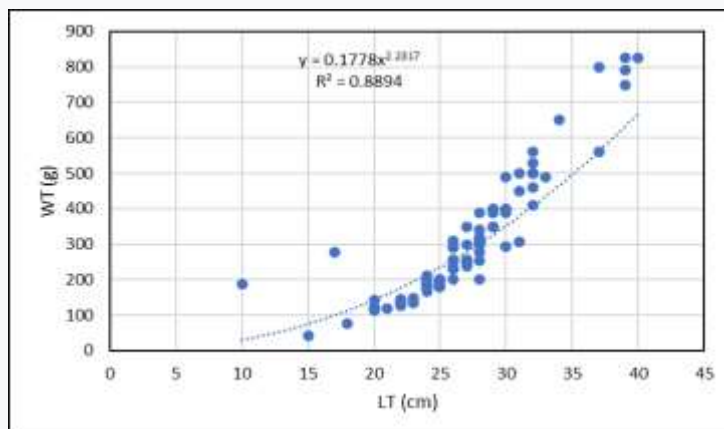


Figure 7. Relationship between total weight-total length of pintadilla

The weight growth curve (Fig. 8) indicates a low rate before one year of age, from that age the rate increases, showing a high slope, then decreases, approaching the asymptotic phase.

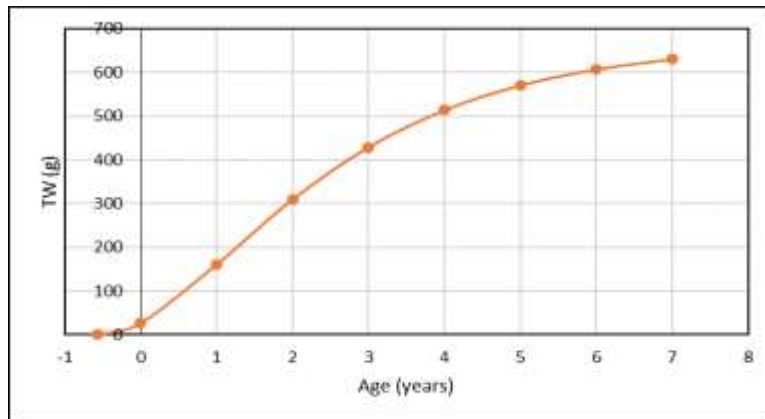


Figure 8. Total weight growth curve of pintadilla.

The instantaneous total mortality rate of pintadilla (Fig. 9) was 1.87/year, while the instantaneous natural mortality rate was 0.76/year and the instantaneous fishing mortality rate was 1.11, with the exploitation rate reaching a value of 0.59.

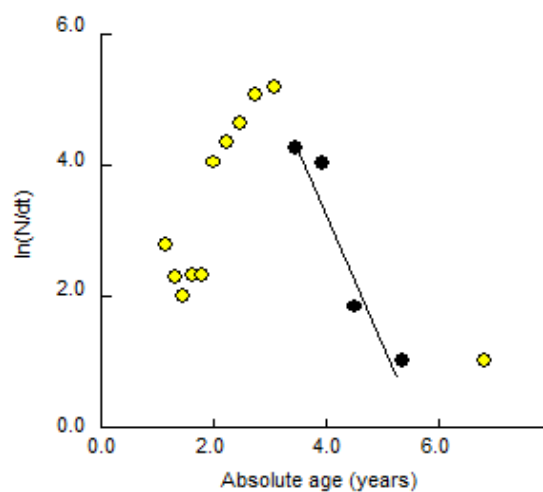


Figure 9. Instantaneous total mortality rate of pintadilla

Pintadilla landings show fluctuations, a big one from February to march, then the variation is around 1000 kg approximately, but the theoretical tendency is to decrease (Fig. 10).

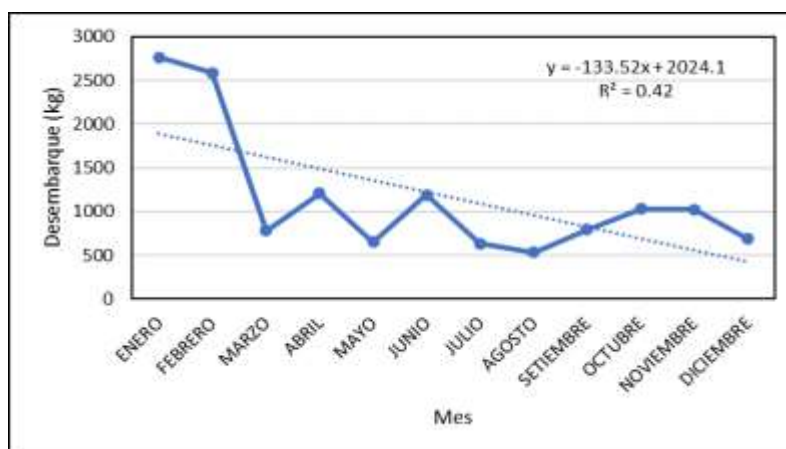


Figure 10. Evolution of landings of pintadilla.

The vessels used to capture pintadilla are boats and scow (Fig. 11), the former being the ones with the largest hold capacity and greatest fishing power. Regarding fishing gear and gear, curtain gill nets are used for both boats, all gear are for passive fishing.

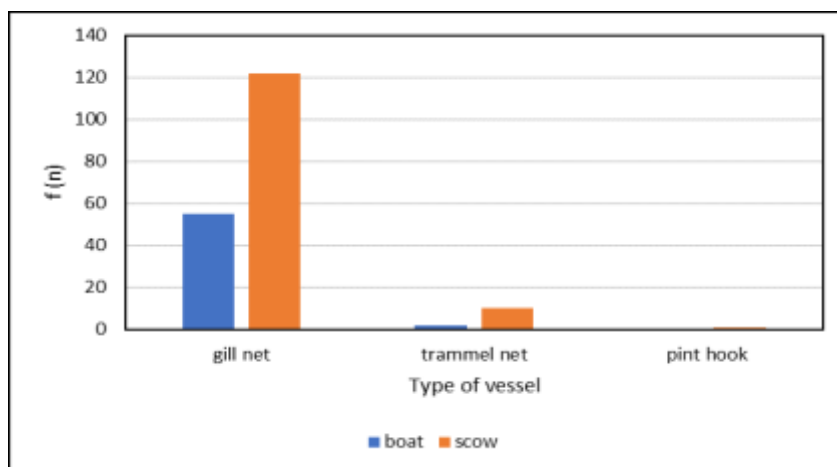


Figure 11. Vessels, gears using to capture pintadilla

Based on the minimum capture size of 26 cm (González, 2012), it was found that 43% are juveniles (Fig. 12).

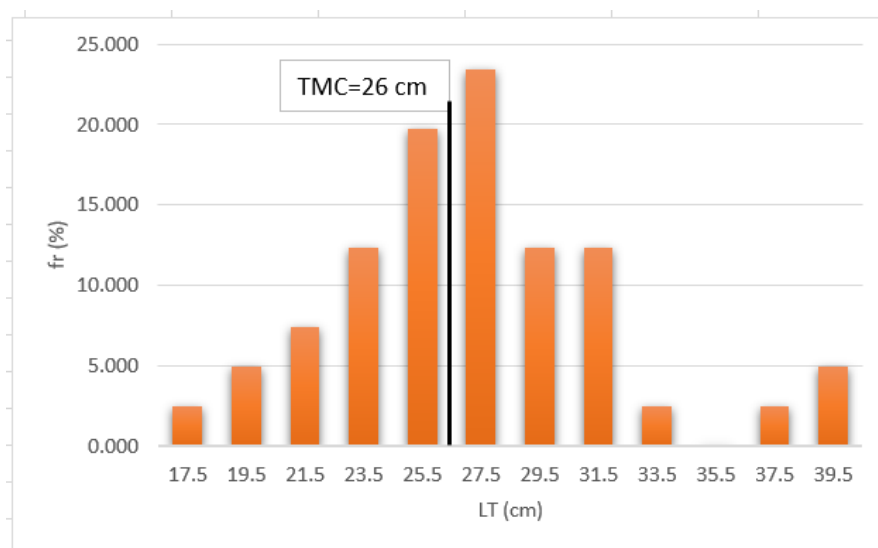


Figure 12. Distribution of size frequency of pintadilla

## DISCUSSION

González (2012) reports that the sexual ratio of pintadilla tends to be 1:1, coinciding with the result found. Likewise, this author observes that from 34.0 cm in total length, females predominate, in this study a greater presence of females was found from 28 cm to 40 cm. The average gonadosomatic index for females was calculated: 0.93 and for males: 0.17.

The mean for *Cheilodactylus variegatus* "pintacha" in Chile was 35 cm. (Universidad Arturo Prat, 2015) a value that is found in this research, inside the size range was from 10 to 40 cm, Mostacero et al., (2012) recorded values from 12 to 39 cm and González (2012) recorded a range of 13-41 cm.

The infinite length is 39.90 cm,  $K = 0.48/\text{year}$  with  $R_n$  of 0.376,  $t_0 = -0.56$  years, these values differ from Araya and Medina (2006) who estimated the infinite length at 49.62 cm and González (2012) at 42.43 cm.

The age  $t_0 = -0.838$  years reported by Araya & Medina (2006) and -0.816 years by González (2012) reaches a value higher than that estimated in this study, which expressed in months reaches non-logical values for the time than in the natural environment it takes for the pintadilla to develop from egg to reach age zero (0), the growth coefficient  $K$  0.176 years<sup>-1</sup> (Araya & Medina, 2006) and 0.2505 years<sup>-1</sup> (González, 2012) express a slower growth rate than estimated.

The weight-length relationship expressed in the value of the constants was  $a = 0.1272$  and  $b = 2.40$ , values that indicate an allometric growth coincident with Perez-Matus et al. (2014) who found values of  $a = 0.0208$  and  $b = 2.969$ . The weight growth curve shows a gentle slope at the beginning of the curve and then it rises as the length growth curve develops.

The total instantaneous mortality rate of pintadilla was 0.76 /year, a higher value than those reported by Araya & Medina (2006) and González (2012). The first estimates are from Chile and the second ones are for all of Peru in a period from 2004 to 2010, which would explain the difference.

Regarding the instantaneous mortality rate due to fishing, it was 1.11/year, the exploitation rate reaching a value of 0.59, which indicates a very slight level of overfishing (critical value=0.50), the University of Prat concludes that there is no Pintadilla overfishing and González (2012) estimate an exploitation rate of 0.44, a value that indicates the same conclusion reached by previous authors.

The recorded sizes show a high percentage of juveniles (43%), considering the estimate of the minimum capture size (TMC) (26 cm) by González (2012) as the basic criterion. This species is caught with curtain nets (gillnets and trammel nets) as well as pint hook, it is a species caught by artisanal and sport fishermen using longline or hand lines and it is consumed fresh (Peru LNG, 2016).

## CONCLUSIONS

The overall sex ratio is 1:1 and the sex ratio to the size shows a predominance of females.

The frequency distributions of pintadilla size by gender are equal.

The infinite length is 39.90 cm,  $K = 0.48/\text{year}$  with  $R_n$  of 0.376,  $t_0 = -0.56$ , growth is allometric

The weight growth curve reaches the asymptote at a value greater than 600 g

The instantaneous rates of total mortality are 1.87/year, natural mortality 0.76/year, and fishing mortality 1.11/year.

The exploitation rate is 0.59 and the percentage of juveniles captured is 43%

## RECOMMENDATIONS

Even when the pintadilla stock situation is not overexploited, it is necessary to establish a legal catch size, as well as the percentage of juveniles that can legally be taken. Also, it is necessary to register the catches from the sport fishermen to know the impact of this activity on this species.

## BIBLIOGRAFIC REFERENCES

- Aguilar, A. (2017). Determinación de la proporción potencial de desove basada en longitudes para *Cheilodactylus variegatus* (valenciennes, 1833) "pitadilla" en la localidad de Ancón.
- Cornejo, M. Fierro, P. Bertrán, C. Vargas, L. (2014). Composición y sobreposición dietaria de *Pinguipes chilensis* (Perciformes: Pinguipedidae), *Cheilodactylus variegatus* (Perciformes: Cheilodactylidae) y *Aplodactylus punctatus* (Perciformes: Aplodactylidae) en el litoral costero valdiviano, Chile.



- Carhuas, V. (2018). Taxonomía y ecología de los metazoos parásitos de la "pintadilla" *Cheilodactylus variegatus* valenciennes, 1833 (perciformes: Cheilodactylidae) en la costa central de Perú.
- González, A. (2012). Parámetros biológico-pesquero y talla mínima de captura de *Cheilodactylus variegatus* Valenciennes.
- Gómez E. Paredes F. Chipollini A. (1995). Aspectos biológico-pesqueros de la *lisa Mugil cephalus* L. en el litoral peruano.
- Mostacero, J. Goicochea, C. Moquillaza, P. (2005). Edad y crecimiento de *Cheilodactylus variegatus* Valenciennes en El Callao.
- Nureña, M. (2018). Biología reproductiva de *Ethmidium maculatum* "machete" (valenciennes, 1847) proveniente de la región la libertad, de mayo 2017 a abril 2018.
- Toledo, L. (2003). Biología reproductiva de *Sciaena deliciosa* "lorna" procedente de la pesca artesanal en el Departamento La Libertad, enero a diciembre del 2002. Tesis para optar el Título de Biólogo Pesquero. Universidad Nacional de Trujillo. Trujillo. Perú.
- Vargas, L. y G. Pequeño, G. (2001). Hallazgo del bilagai (*Cheilodactylus variegatus* Valenciennes, 1833), en la bahía Metri, Chile
- Araya, M., C. Azocar, G. Claramunt, M. Medina, P. Montero, R. San Juan, F. Olivares, M. Oliva, A. Vargas, R. Canales, S. Fuentealba & R. Pepe. 2015. Diagnóstico y propuesta de manejo sustentable de pesquerías costeras de peces litorales en la XV, I y II Regiones. INFORME FINAL CORREGIDO. Universidad Arturo Prat Chile
- Perú LNG. S.f. Guía de identificación de peces. Melchorita. Recuperado de: [https://perulng.com/wp-content/uploads/2016/05/Guia\\_identificacion\\_peces.pdf](https://perulng.com/wp-content/uploads/2016/05/Guia_identificacion_peces.pdf)