

*Short Communication*

**Bathymetric range extension of the Peruvian flounder *Etropus peruvianus* Hildebrand, 1946 in the Gulf of California, Mexico**

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**ABSTRACT.** From September 2004 to February 2005, 204 specimens of *Etropus peruvianus* were collected onboard exploratory fishing cruises in the eastern Gulf of California, caught in trawls at 276 m in depth. This finding exceeds the limit of vertical distribution (125 m) previously known for this species. Oceanographic conditions (such as temperature, salinity and dissolved oxygen), feeding and reproductive behavior determines the extension of the vertical distribution of *E. peruvianus*.

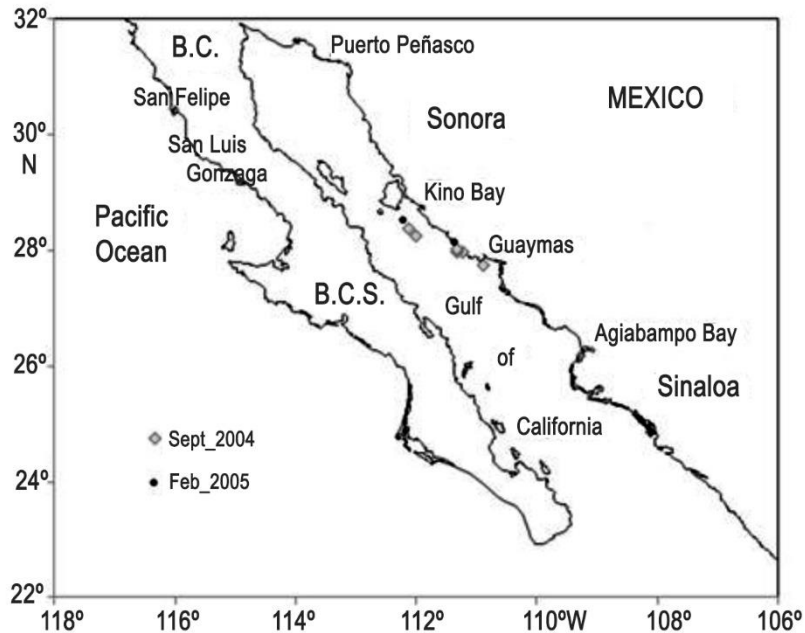
**Keywords:** *Etropus peruvianus*, depth, distribución, sexual maturity, Gulf of California, Mexico.

The Peruvian flounder *Etropus peruvianus* (Paralichthyidae) occurs in the East Pacific, from Baja California to Perú, including the Gulf of California (Van der Heiden, 2010; López-Martínez *et al.*, 2012; Del Moral-Flores *et al.*, 2013), where it is identified as a component of the Sinuscalifornian, Mexican, and Panamic provinces. The Peruvian flounder ranges at depths of 46 to 125 m in benthic habitats close to sandy and muddy bottoms, including rubble, its maximum size is 100 mm in total length (Hensley, 1995). This species is listed as Least Concern (LC) in the International Union for the Conservation of Nature (Van der Heiden, 2010), it has been reported in the list of shrimp bycatch fauna in the Gulf of California (Rábago-Quiroz *et al.*, 2008; Acevedo-Cervantes *et al.*, 2009; López-Martínez *et al.*, 2010; López-Martínez *et al.*, 2012; Rábago-Quiroz *et al.*, 2015).

The continental shelf of the central coast of Sonora shows sandy-clay, slime, and sandy sediments (Van Andel, 1964), similar to the environment described in the distribution of these organisms (Hensley, 1995). The central region of the Gulf of California is characterized by temperatures of 31°C in the warm season (June to October) with strong thermal stratifica-

tion down to 40 m in depth and average temperatures from 11 to 13°C in depths from 150 to 350 m (Robles & Marinone, 1987). The concentration of dissolved oxygen shows an area of minimum values from 300 to 1,000 m (Hendrickx & Serrano, 2010), which are usually greater than 2 mg L<sup>-1</sup> in the surface layer. To date, the presence of *E. peruvianus* at waters deeper than 125 m has not been reported in literature yet. Thus, the aim of this work is to report a range extension in the vertical distribution of *E. peruvianus* down to 260 m in the Gulf of California.

From September 2004 to February 2005, 204 individuals of *E. peruvianus* were collected in two exploratory cruises onboard B/O BIP XII on the eastern coast of the Gulf of California, from Puerto Peñasco (Sonora) to Topolobampo (Sinaloa). Effective 1 h trawling tows were performed at 5.5 km h<sup>-1</sup> at depths from 90 to 540 m, using a bottom braided polyethylene 1 in mesh; the mouth perimeter in the stretched cloth was 68 m with a raised footrope of more than 38 m. The depth and geographic coordinates of each tow were recorded with a Furuno Echo Sounder and GPS, respectively. Specimens of *E. peruvianus* were measured in total length (mm) and weighted (g), sex



**Figure 1.** Stations with presence of *Etropus peruvianus* in exploratory fishing cruises.

**Table 1.** Distribution of all specimens of *Etropus peruvianus* captured in the Gulf of California, including biological and oceanographic data by depth stratum. Temperature (T, °C), salinity (S), and dissolved oxygen (O<sub>2</sub>, mg L<sup>-1</sup>).

| Depth (m) | n  | Males | Females | Undefined | Maturity |      |       |      |     | Oceanographic variables |      |                |
|-----------|----|-------|---------|-----------|----------|------|-------|------|-----|-------------------------|------|----------------|
|           |    |       |         |           | I        | II   | III   | IV   | V   | T                       | S    | O <sub>2</sub> |
| 90-110    | 0  | 0     | 0       | 0         | 0/0      | 0/0  | 0/0   | 0/0  | 0/0 | 16.1                    | 35.2 | 5.0            |
| 110-130   | 6  | 0     | 4       | 2         | 0/0      | 1/0  | 1/0   | 1/0  | 1/0 | 15.4                    | 35.1 | 4.1            |
| 130-150   | 8  | 0     | 0       | 8         | 0/0      | 0/0  | 0/0   | 0/0  | 0/0 | 14.8                    | 35.1 | 3.4            |
| 150-170   | 16 | 1     | 5       | 10        | 0/0      | 2/1  | 2/0   | 0/0  | 1/0 | 14.2                    | 35.0 | 2.7            |
| 170-190   | 82 | 17    | 27      | 38        | 0/1      | 1/12 | 14/4  | 12/0 | 0/0 | 13.6                    | 34.9 | 2.3            |
| 190-210   | 14 | 0     | 11      | 3         | 0/0      | 2/0  | 0/0   | 0/0  | 9/0 | 13.2                    | 34.9 | 2.0            |
| 210-230   | 0  | 0     | 0       | 0         | 0/0      | 0/0  | 0/0   | 0/0  | 0/0 | 12.8                    | 34.9 | 1.7            |
| 230-250   | 60 | 32    | 23      | 5         | 0/0      | 6/20 | 15/11 | 2/1  | 0/0 |                         |      |                |
| 250-270   | 18 | 7     | 3       | 8         | 0/0      | 1/7  | 2/0   | 0/0  | 0/0 |                         |      |                |

and maturity was obtained using the Nikolsky morpho-chromatic scale (Nikolsky, 1963). Temperature, salinity, and oxygen in the water column were measured with a CTD.

The organisms were collected in the coastal region of Sonora between 27°45'N and 28°30'N (Fig. 1) from 110 to 260 m in depth and with a greater abundance at depths of more than 180 m (Table 1). In general, the majority of the individuals were females (36%) and males 28%. The male/female ratio was 0.78:1.0 and 36% of the specimens were undefined. Sex distribution showed greater proportion of females in a depth range from 170 to 230 m and of males from 230 to 270 m. The majority of the females were from maturity stage III to V (82%); 98% of the males were from stages I to III.

Rábago-Quiroz *et al.* (2008) reported the occurrence of *E. peruvianus* in the central coast of Sonora with an abundance of 4% of the total number of flounders (family Paralichthyidae) in the 2002-2003 season. According to the relative abundance index (RAI) of demersal fish in the Gulf of California, in September 2004, 7 species added up to 71%, of which *E. peruvianus* (18%) was the most important in the 90 to 180 m depth stratum of the central region close to Sonora (Acevedo-Cervantes *et al.*, 2009). As part of the same study, López-Martínez *et al.* (2010), found a greater number of species with affinity to the San Diego and the Panamic provinces in a listing of 241 fishes, among which *E. peruvianus* stands out as the typical species in the southernmost region of the Western Tropical Pacific. The relative abundance of this species

in catches decreased toward the colder months (February and May) (López-Martínez *et al.*, 2012; Rábago-Quiroz *et al.*, 2015). The greater abundances could be related to migratory habits from deeper to shallower waters for reproductive purposes (Rábago-Quiroz *et al.*, 2015), which explains the greater proportion of mature females and at greater depths than males.

The oceanographic variables of the capture area for this species were similar to those reported at these depths from 16 to 13°C, where values of dissolved oxygen were from 5 to 2 mg L<sup>-1</sup> in this depth interval (Table 1). Abiotic (temperature, salinity, dissolved oxygen) and biotic (reproductive and feeding) factors determine geographic distribution (latitudinal and/or bathymetric) of this species. The finding of *E. peruvianus* captured at a greater depth indicated that this population is distributed widely compared to the previous reports. It not only inhabits the continental shelf with the mass of the Gulf of California Water (ACG) and the Equatorial Surface Water (ASE) but also the continental slope in the mass of Subsurface and Subtropical Water. Our work shows data that widen the bathymetric range distribution of the species for both sexes in different months, September and February, in the Gulf of California.

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