



Scientific Note

Detection of the Whitemouth croaker (*Micropogonias furnieri*) and entangling nets using acoustics in the estuarine shallow waters of the Patos Lagoon (Southern Brazil)

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Abstract. Whitemouth croaker (*Micropogonias furnieri*) single echoes, which represent single fishes, as well as entangling nets were recorded with a 200 kHz Hidrotrac echo sounder in the shallow waters of the Lagoa dos Patos, Rio Grande do Sul, Brazil.

Key words: Shallow water acoustics, Sciaenidae, entangling nets

Resumo. Detecção da corvina (*Micropogonias furnieri*) e redes de espera utilizando acústica nas águas rasas estuarinas da Laguna dos Patos (Sul do Brasil). Registros acústicos de corvina (*Micropogonias furnieri*), que representam peixes individuais, bem como de redes de espera foram registradas com uma ecosonda de 200 kHz Hidrotrac em águas rasas da Lagoa dos Patos, Rio Grande do Sul, Brasil.

Palavras-chave: acústica de água rasa, redes de espera

Good acoustic records of individual fish in shallow water are not frequently obtained due to physical and behavioral limitations. Firstly because the propagation of sound in restricted distances can generate multiple and false echoes and secondly, because fish react to disturbances. Using acoustics in deep waters is a traditional and worldwide practice for a large spectrum of applications (MacLennan & Simmonds, 2005). On the other hand, shallow water use of acoustics for fisheries can be limited due to the short distance between the echo sounder transducer and the targets.

Target detection depends on the proper acoustic beam formation which, at very short distances can be limited by the near field, an area where the sine waves are forming as a result of the vibration of the ceramic elements in the transducer. The lower the echo sounder frequency the most pronounced the limitation.

Fish frequently react to noisy sources such as a surveying boat. In shallow waters this effect is of greater concern than in deeper areas due to the

distance between the noise source and fish or bottom. Therefore acoustically measured density of fish in estuarine and riverine environments can be biased by the so called avoidance reaction, particularly if a boat with an engine and a propeller are used as the moving platform where the transducer is located.

In order to avoid the physical limitation of the wave forming area very high frequencies are used with shorter near fields. However, high frequencies utility can also be limited in areas with high levels of suspended material in the water column which scatter sound and reduce ability to detect biological targets. Under these conditions high threshold levels must be used to remove noise or undesirable acoustic signals. Such a procedure also removes useful biological information which makes its practice undesirable. Avoidance reaction can be reduced with sophisticated very low level noise emitting boats but this is also a matter of controversy (Ona *et al.*, 2007).

In this note we show Whitemouth croaker's

(*Micropogonias furnieri*; Sciaenidae) acoustic records detected in waters from 2 to 8 m deep using an Odom Hidrotrac Echosounder, operating with a 200 kHz transducer in a small 5 m long boat

surveying at 2 to 3 knots (Fig. 1 and 2). This experiment was part of field class to teach bathymetric methods to undergraduate students and it was not intentionally driven to detect fish.

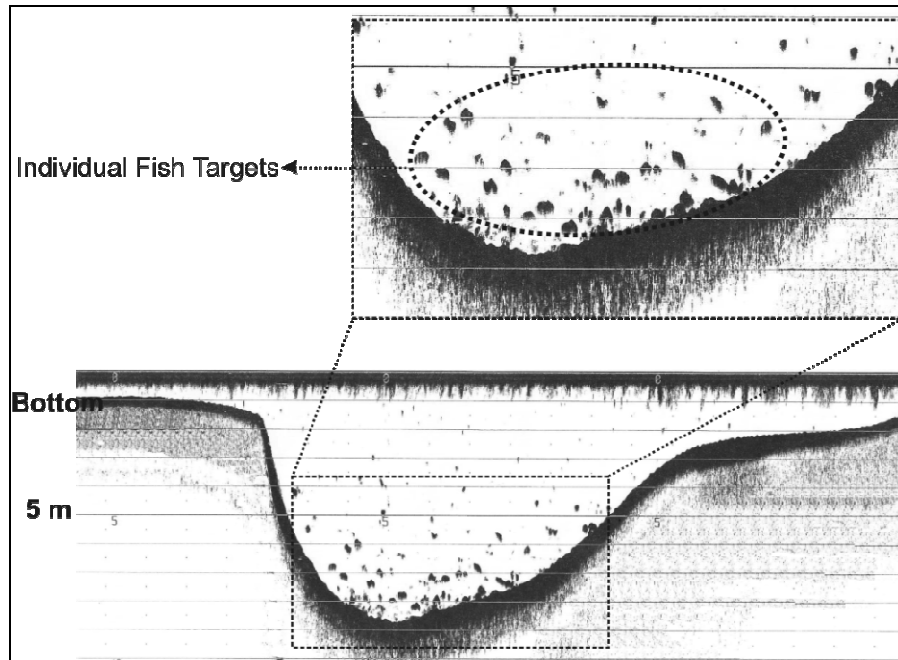


Figure 1. Echogram showing single fish records of Whitemouth croaker (*Micropogonias furnieri*) detected with a 200 kHz Hidrotrac echo sounder in a shallow channel of the Patos Lagoon (Brazil).

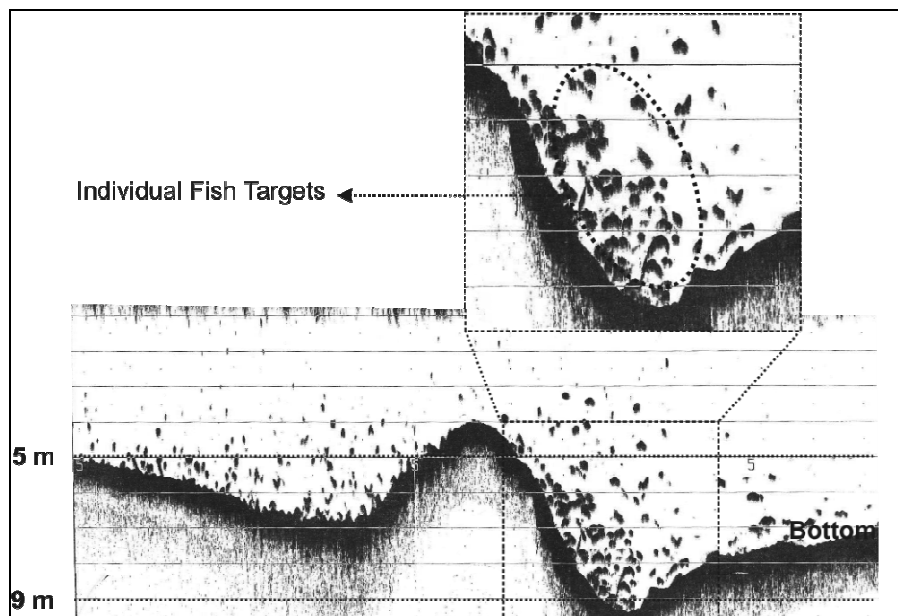


Figure 2. Echogram showing single fish records of Whitemouth croaker (*Micropogonias furnieri*) detected with a 200 kHz Hidrotrac echo sounder in a shallow channel of the Patos Lagoon (Brazil).

The Whitemouth croaker was under fishing pressure due to an illegal fishery in the estuary. Surprisingly we also detected entangling nets used to fish Whitemouth croaker. Those nets are weak

acoustic reflectors due to the building material such as Polyamide No. 0.6 (Fig. 3 and 4). However, net records were as clear as the fish records and could be useful to estimate fishing effort in shallow water

fisheries management, basically because the fishery being illegal the nets became gradually less visible at the surface. A sample was obtained from the

fishermen which showed that 100% of the catch was Whitemouth croaker. Mean size was 28.15 cm with a standard deviation of 8.01(N = 20).

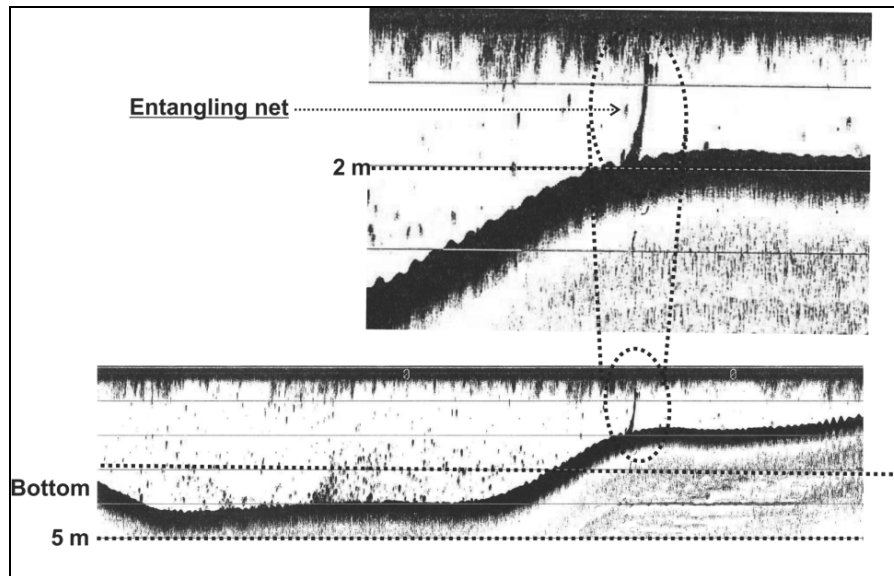


Figure 3. Echogram indicating an entangling net detected with a Hidrotrac echo sounder in a shallow channel of the Patos Lagoon (Brazil).

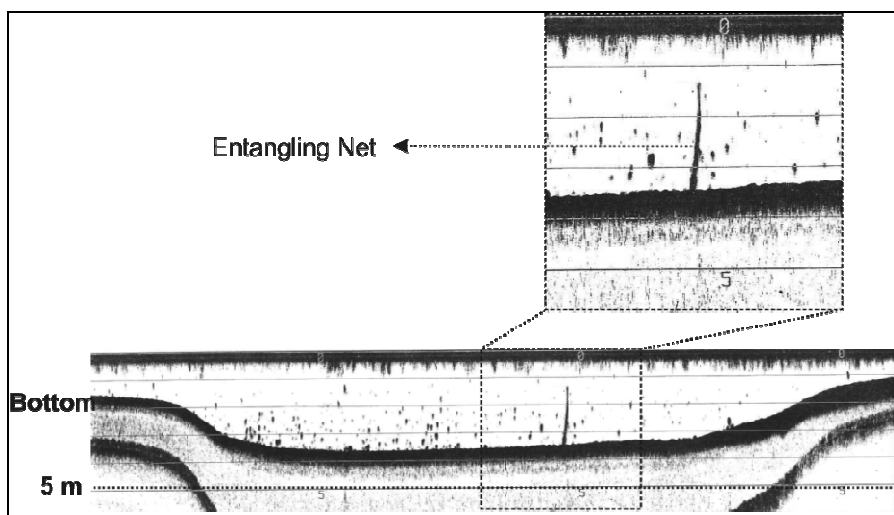


Figure 4. Echogram indicating an entangling net detected with a Hidrotrac echo sounder in a shallow channel of the Patos Lagoon (Brazil).

Traditional parameters applied to count individual fish depend on detecting each fish as a single target which is a function of the distance between fishes and the pulse length. The shorter the pulse length the higher the resolution. If fish are sufficiently away from each other, then individual echoes can be counted and the target strength (TS) estimated. TS is the ratio between incident and backscattered acoustic energy by a single target and it is the basic parameter to be used in the echo-counting method or to convert Nautical Area Scattering Coefficient (NASC), an acoustic measurement proportional to fish density in fish/m²

or fish /m³. NASC is used when fish are within schools and individual target measurements are not feasible. TS and NASC can be routinely obtained with scientific echo sounders.

Our results showed that Whitemouth croakers are not completely demersal, at least part of the day they swim in the water column and not very close to the bottom where their detection is rather more difficult. Also the field results showed that single fish detection and consequently TS and echo-counting can be obtained and measured in this environment. Therefore a new method to estimate density and perhaps biomass for such a species can

be applied. Furthermore we also argue that the results can be used to estimate fishing effort from artisanal fisheries in the estuarine areas of the Patos Lagoon. We encourage new experiments in the area using both ordinary and scientific echosounders because the first do not allow us to set different parameters such as pulse length, as it is possible with the second ones. Surveying the area with higher resolution would show if fish were also detected close to the bottom, within the acoustically Dead Zone, and not recorded with longer pulse lengths. Using the proper

methods to estimate the bias due to such a limitation Whitemouth density could be calculated.

References

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