TRACKING SCAVENGERS IN THE ABYSS: SWIMMING PERFORMANCES OF *CORYPHAENOIDES ARMATUS*, *ANTIMORA ROSTRATA* AND *BARATHRITES IRIS*

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EXTENDED ABSTRACT ONLY – DO NOT CITE

Fish tracking methods have advanced considerably in recent years allowing for a better understanding of fish behaviour. This is true especially of inaccessible areas such as the deep-sea in which, only three decades ago demersal fishes were believed to be largely static. Nowadays, thanks to the availability of *in situ* methods of fish tracking, it is known that these fish are rather active, swimming at speeds similar to shallow-water fish of a similar size.

Cohen (1977) calculated the swimming speed of the deep demersal fish *Antimora rostrata* (Osteichthyes, Moridae), at a depth of 2400m, using photographs taken at 10s intervals from the deep submersible *Alvin*. The results were based on a single *A. rostrata* swimming ahead of the submersible and its swimming speed was recorded as 0.392 ms^{-1}. These were the first quantitative data to be published on the swimming of a deep demersal fish.

Technology has since evolved and it is now possible to track the speeds and directions of fish in their natural environment. Cohen's (1977) results were from a fish during an escape response and therefore not its normal swimming speed. By inducing fish to ingest acoustic transmitters, embedded in bait and placed on the sea floor together with an automatic tracking unit,

fish were tracked *in situ* (Priede *et al*, 1991) without their behaviour being affected.

Priede *et al* (1991) tracked *Coryphaenoides armatus* and *C. yaquinae* (Osteichthyes, Macrouridae) in the central North Pacific using these baited transmitters. Studies at different times of year and at contrasting locations also showed that these species are not only active but also responsive to seasonal changes, swimming faster at a time of high food availability and slowing down when food is scarce.

Studies at different latitudes in the Northeast Atlantic have shown that abundance of demersal fishes, at depths of 3,000 to 4,000m, is correlated with surface primary production (Henriques *et al*, in Press).

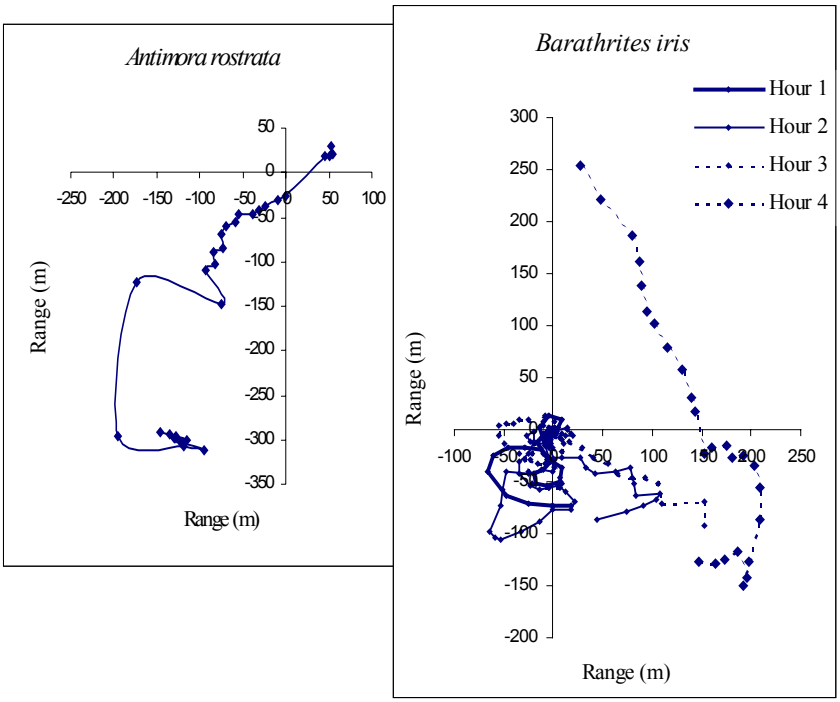
Bagley et al (1994) carried out tracking studies on demersal fishes in the Porcupine Seabight and Porcupine Abyssal Plain regions of the Northeast Atlantic. In this case the AUDOS lander (Aberdeen University Deep Ocean Submersible) was used to deploy the TRATEX sonar system (Transponding Acoustic Tracking Experiment) and a new type of baited transmitter, the CAT (Code-activated Transponder). During this experiment Bagley *et al* (1994) obtained swimming speed values for *C. armatus*, *A. rostrata* and *Centroscymnus coelolepis* (Condrichthyes, Selachii). The mean speeds recorded for these fish were $0.088ms^{-1}$, $0.141ms^{-1}$ and $0.072ms^{-1}$, respectively. This was the first time fish other than macrourids were tracked using the ingestible transmitter technique.

In the present study we compare the swimming behaviour of deep demersal fish as tracked using the latest version of the CAT at two different latitudes in the NE Atlantic. Firstly in the tropical upwelling region off West Africa at ca. 17°N and secondly at temperate latitudes ca. 49°N in the Porcupine Seabight.

The first study was done during Cruise 243, of *RRS Discovery*, to the Cape Verde Terrace (17°45'N; 20°30'W), off West Africa. Data were obtained from eleven AUDOS deployments. The fishes tracked were the macrourid *C. armatus* and the ophidiid *Barathrites iris*. The first swimming speed data ever obtained for the latter species are presented. The second study was done as part of a large-scale experiment in the Porcupine Seabight (49°30'N; 13°37'W), Northeast Atlantic. It began during the first of a series of five research cruises to this area commencing in September 2000 and followed by alternating spring and autumn cruises, with the last voyage planned for October 2002. These trips are aimed at obtaining seasonal data on various aspects of fish biology.

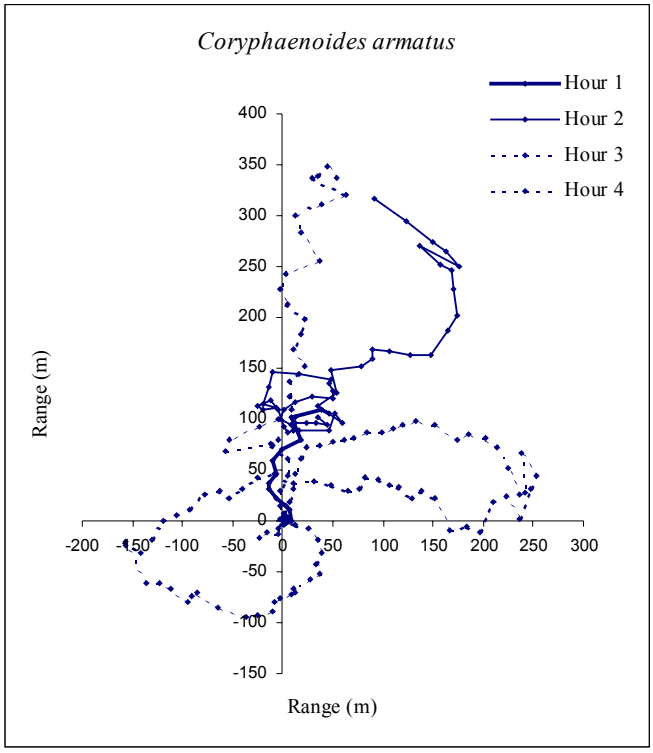
The Mk II CAT operates on the delayed pulse code impulse. Each CAT only responds when interrogated by a pair of pulses with the correct time interval between them. The AUDOS sonar is programmed to transmit paired interrogation codes at regular intervals. Any CAT within range, (within a fish stomach) upon recognition of its code, responds after a time delay. The time delay allows reverberations from the powerful interrogation pulse to die away. Then the relatively low power response pulse is received at each of three hydrophones mounted on the AUDOS vehicle and times are logged on the onboard computer. From the three time delays the range and bearing of the CAT relative to the AUDOS vehicle are calculated. Using this system up to four fish can be tracked simultaneously with locations recorded every 60 seconds. Examples are presented of tracks of macrourids (*C. armatus*), ophidiids (*B. iris*) and morids (*A. rostrata*) at depths of 2,500 to 4,000m.

Figure 1 – Tracks of *Antimora rostrata* and *Barathrites iris* in the Porcupine Seabight and Cape Verde Terrace, respectively. Where the two axis cross is the position of the lander and the bait. North is upwards.



Figures 1 and 2 are examples of fish tracks of the three species in the Northeast Atlantic. The track of *A. rostrata* on Fig.1 is from a fish swimming at a mean speed of $0.22ms^{-1}$ at a depth of 2,500m in the Porcupine Seabight (Collins *et al*, 1999). The tracks of *B. iris* (Fig.1) and *C. armatus* (Fig. 2) are from the Cape Verde Terrace at 4,000 and 3,000m respectively. The mean swimming speeds recorded for these two fish are $0.014ms^{-1}$ for *B. iris* and $0.017ms^{-1}$ for *C. armatus*.

Figure 2 – Track of Corypahenoides armatus in the Cape Verde Terrace. Key as for Fig.1.



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