Curtin
UNIVERSITY OF TECHNOLOGY

Centre for Marine Science and Technology

Non-Commercial Report

IMAGING OF A CRAYPOT MOORING USING MULTI-BEAM SONAR

Prepared for:
Fremantle Sailing Club

Prepared by: Dr Kim Klaka*, Dr Iain Parnum and Mr. Jamie McWilliam
Reviewed by: *IP, JMcW*
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*Cruising Section Safety Officer, FSC

1 INTRODUCTION

The aim of this project was to investigate the viability of detecting deployed cray pot gear using sonar. It was an unsolicited and unfunded project conducted for the benefit of FSC, to support their efforts to reduce the number of incidents of yachts becoming entangled in cray pot lines.

Yachts regularly sail up and down the west coast of Australia in water depths of 5-50m. Cray pots are set in these locations, particularly on the leads to anchorages. Entanglement usually occurs with the surface float line catching on either the rudder or the propeller gear, and results in the yacht being effectively anchored by the line. The consequences vary with circumstances. Sometimes the line can be cut from on deck with no damage to the yacht, but the pot is lost. On other occasions severe damage to the yacht can occur and a crew member may have to free the yacht by diving under the boat with a knife, often in rough conditions and at night. This is clearly hazardous.

Efforts are being made to improve the visibility and minimise the footprint of the floats and lines, but on-board early detection and avoidance is another avenue worth exploring. The purpose of these trials was to investigate the possibility of detection by sonar. A yacht typically travels at 3m/s and requires at least 5 seconds warning to be able to take avoiding action. This means that detection is only useful at ranges greater than about 15m.

2 EXPERIMENT CONDITONS

The trials were conducted using a Tritech Gemini 720i multi-beam sonar on loan to Curtin (Figure). It operates at 720kHz with a 120º horizontal field of view and 20º vertical beam-width. The effective angular resolution is 0.5º which corresponds to approximately 10cm resolution at 10m range.

Figure 1: multi-beam transducer head

Figure 2: sonar deployed.

The cray pot was typical of the ones used in WA – plastic, 700mm long, 600mm wide and 500mm high, of hexagonal cross section (Figure3). It was weighted down with a steel plate of approximately 10kg. A10m length of 8mm diameter polyethylene line connected it to a 230mm diameter polystyrene float .

Figure 3: cray pot and float

The survey was conducted at Fremantle Sailing Club on the morning of Thursday 31st July 2014, starting at about 1030 and ending about 1130. Wind was consistently S-SW at 5-10kn, Waves in the harbour were negligible, with barely any ripples in the survey area.

The sonar was deployed close to the junction of jetty “A” and the Collector Jetty. Power was from jetty mains supply. The sonar was mounted on the end of a 5m aluminium pole (Figure). For most of the measurements the sonar was held near or slightly above the horizontal plane, with 0º azimuth pointing approximately toward the target. The sensor head was approximately 0.5m below the water surface; water depth was approximately 3m.

The cray pot was deployed on the seabed at various distances along jetty “A” (fig 4). There were several reflective objects in the water column nearby – a powerboat hull, concrete mooring weights and concrete jetty piles.

The cray pot and its float were deployed seperately at ranges 4-15m from the sonar, approximately in line with its azimuth axis. For the float, recordings wee made with the float both stationary and being bounced or jiggled on the water surface to simulate wave-induced motion.

Figure 1: deploying craypot at 7m range

3 RESULTS

3.1 Cray pot

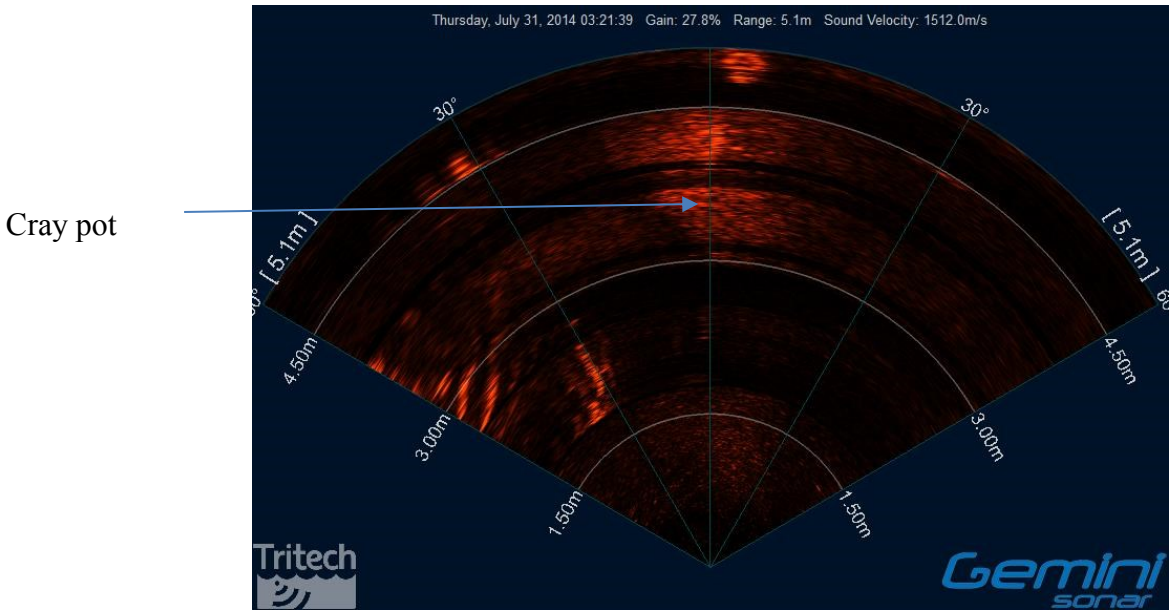

Figure 2: cray pot at 4m range

The cray pot could be detected at a range of 4m, but not identified as such (Figure 2). At 7m range it could be detected in real time but not during post-processing of the image i.e. you had to know it was there in order to see it on the screen. The pot was clearer in the image during deployment compared with on the seabed, possibly due to the large number of air bubbles seen rising to the surface as the pot sank in the water column. The cray pot line could not be detected at any time.

3.2 Float

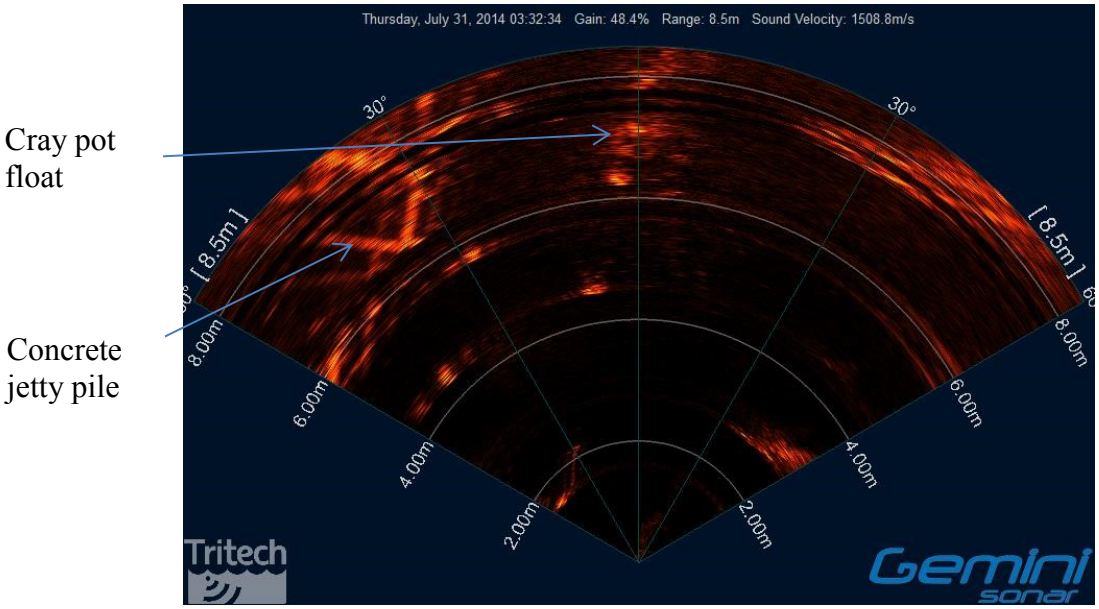

Figure 3: cray pot float at 7m range

The cray pot float could be detected in real time but not during post-processing of the image i.e. you had to know it was there in order to see it on the screen. This was the case for all ranges tested. However, if the float was bounced or jiggled on the surface, it could be detected at ranges of up to about 7m.

4 DISCUSSION AND RECOMMENDATIONS

The stationary pot and the float could be detected at ranges of up to approximately 7m but could not be readily identified at any of the ranges tested. If the float was moving or the pot sinking, detection was improved, but the object could still not be identified for what it was.

The sonar used was far more sophisticated than those currently fitted to recreational vessels. Given the levels of detection in these tests, it is unlikely that cray pots can be avoided using existing sonar systems. The situation might improve in 5-10 years as sonar technology improves.

However, the detection of the pot on the seabed is unlikely ever to yield useful results because the pot is deployed amongst other similar-sized objects (rocks etc.), so clear positive identification would be required in order to reduce the number of false alerts.

Detection of surface floats may hold slightly more promise. If surface waves create float motion and the entrapped air bubbles in breaking waves do not obscure the image, then floats with a higher acoustic reflectivity might be detectable at useful ranges(>15m) with sophisticated sonar. Reflectivity could be improved by using hollow floats, or by covering them in a reflective surface such as steel or aluminium. Both these options have operational implications for the crayfishers.

It is concluded that cray pot gear detection by sonar is not a realistic option in the near or mid future. However, if float reflectivity were improved along with significant improvements in sonar technology for recreational vessels, then a further set of trials should be conducted in about 5 years' time.

5 ACKNOWLEDGEMENTS

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