Agriculture and Natural Resources 50 (2016) 125–132

Contents lists available at ScienceDirect

Agriculture and Natural Resources

journal homepage: http://www.journals.elsevier.com/agriculture-and-natural-resources/

Original article

Comparison of ghost fishing impacts on collapsible crab trap between conventional and escape vents trap in Si Racha Bay, Chon Buri province

Santiphong Putsa,[a, b, *] Anukorn Boutson,[c] Suriyan Tunkijjanukij[c]

[a] *Graduate School, Kasetsart University, Bangkok 10900, Thailand*
[b] *Center for Advanced Studies for Agriculture and Food, Kasetsart University Institute for Advanced Studies, Kasetsart University(CASAF, NRU-KU), Bangkok 10900, Thailand*
[c] *Department of Marine Science, Faculty of Fisheries, Kasetsart University, Bangkok 10900, Thailand*

A R T I C L E I N F O

Article history:
Received 14 November 2014
Accepted 29 July 2015
Available online 10 June 2016

Keywords:
Blue swimming crab
Crab trap
Escape vent
Ghost fishing
Portunus pelagicus

A B S T R A C T

This study investigated the impacts of ghost fishing on collapsible crab traps targeting the blue swimming crab, *Portunus pelagicus*. The impacts were examined by a simulated lost-gear experiment to compare conventional and vented traps, with long-term diving monitoring from 6 January 2013 to 15 January 2014, at a depth of 4–6 m in Si Racha Bay, Gulf of Thailand. Twelve pairs of box-shaped traps 36 × 54 × 19 cm were compared using the conventional design and a vented trap with escape vents of 35 × 45 mm. Throughout the 374 d experiment, 520 individuals from 25 different species were entrapped in the conventional traps, with 19 were classified as target, and 501 individuals as by-catch species. In the vented traps, 222 individuals of 24 species were entrapped in total, of which 17 were classified as target and 205 as by-catch. The catch-per-unit-effort of all animals entrapped in conventional traps was significantly higher than in the vented traps at each time observation. Furthermore, the vented traps showed lower entrapment and mortality numbers than the conventional traps. These results demonstrate the positive functions of escape vents in reducing the negative impacts of ghost fishing, not only on the number of entrapped individuals but also on mortality rates.

Introduction

Ghost fishing can be defined as the ability of fishing gear to continue catching or trapping fish after all control of that gear has been lost by those using it to fish (Smolowitz, 1978) and also refers to derelict fishing gear either lost or abandoned which retains its capture function in water and continues to induce mortality of aquatic organisms without human control (Matsuoka et al., 2005). Trap loss occurs for several reasons including bad weather, bottom snags, navigational collisions, faulty fishing methods, vandalism and gear failure (Laist, 1995), the accidental or intentional removal of marker floats and traps by other vessels, heavy weather moving traps into deeper water and incidental removal of floats by large animals including sharks (Sumpton et al., 2003). Trap ghost fishing can occur through a variety of mechanisms. Theoretically, ghost fishing occurs when the contents of a lost trap (both target and by-catch species) die and attract more animals into the trap. These animals then die and attract more until the trap breaks down and ceases its capture function (Campbell and Sumpton, 2009) which has also been named auto-rebaiting, involving rebaiting by other species and lost traps also can attract more animals due to the trap alone (Breen, 1990). The materials used in the construction of the traps do not deteriorate easily, which increases the potential for animals entrapped and unaccounted mortality in lost traps for prolonged periods (Bullimore et al., 2001) including target, non-target and even endangered or protected species (Dayton et al., 1995). The impacts of ghost fishing on some commercial grounds have been estimated to be between 5 and 30 percent of total annual landings (Laist, 1995) and the mortality rate from ghost fishing is currently an intangible and remains of significant concern to both fishers and fisheries managers (Jennings and Kaiser, 1998). In a trap fishery in Kuwait, financial losses were estimated to range from 3 percent to 13.5 percent of the total catch value (Mathews et al.,

* Corresponding author.
E-mail address: santipong.ku@gmail.com (S. Putsa).
Peer review under responsibility of Kasetsart University.

http://dx.doi.org/10.1016/j.anres.2015.07.004

1987). Ghost fishing mortality at 25 simulated lost fish traps was estimated to be 1.34 kg per trap per day, or about 67.27 kg per trap and 78.36 kg per trap for 3 and 6 mth, respectively in Oman (Al-Masroori et al., 2004). Overall mortality from ghost fishing is dependent upon the number of ghost traps, trap location, season, length of ghost fishing period and the mortality rate per trap (Guillory et al., 2001; Matsuoka et al., 2005).

To reduce the negative impacts of trap ghost fishing, Al-Masroori et al. (2004) suggested that the traps should be equipped with time-release or degradable sections or panels, and sometimes openings are included in the traps to release undersized animals. Traps with escape windows or vents attached for a blue swimming crab (*Portunus pelagicus*) fishery in Thailand have been investigated by Boutson et al. (2009), who reported the escape vents (35 × 45 mm) in traps had a positive function in reducing the by-catch, discards and the catch of undersized target species as immature crab, while not affecting the catch efficiency of mature-sized crabs, and also had a high probability of reducing the negative impacts of ghost fishing.

Collapsible-traps targeting blue swimming crab have recently become a major type of fishing gear operating year round in the Gulf of Thailand. The small-scale fishers operate their traps inshore with 200–300 traps/operation, and commercial boats operate with long-line settings of 2000–5000 traps/operation or more (Boutson et al., 2009). According to interviews by the author with fishermen (data unpublished), the traps are quite often lost at sea (about 3–20 traps/d for small-scale fisherman). Their traps are constructed using a galvanized rod frame covered with clear rubber tubing and are covered with green polyethylene (Fig. 1B) so that the traps are not easily degradable when lost at sea. However, the ghost fishing effects on blue swimming crab and other animals from trap fishing in Thailand have been not evaluated and reported. Accordingly, the objectives of this study were to examine the ghost fishing characteristics of the conventional trap used by small scale fishers compared to the vented trap. Specifically, the rates of entrance, escape and mortality of the target species and the by-catch species were assessed and compared between both trap types.

Materials and methods

Site selection

The study was conducted in Si Racha Bay, Chon Buri Province, in the upper Gulf of Thailand (Fig. 1A). This site features green mussel sea farming and it is a fishing ground for small-scale, crab-trap fisherman, about 0.8 km from shore with a depth of 4–6 m, and the substratum is composed of muddy sand.

Experiment protocol

In total, 24 new, collapsible crab traps were obtained from a fisherman to simulate lost traps at the study site. The traps have a box shape with dimensions of 360 × 540 × 190 mm and two slit entrances (Fig. 1B), a frame structure made from galvanized iron (4 mm diameter) covered with clear rubber tubing and the trap structure is covered with a green, square-shaped polyethylene net with a mesh size of 38 mm. There is a hook attached to the top panel that controls the trap set up and collapse function. Two trap designs were used in the experiment. The first type was 12 conventional traps which were the same as the local fishers used (Fig. 1B). The second trap type was 12 vented traps (Fig. 1C) with two escape vents consisting of a vent size of 35 × 45 mm, located on opposite sides of the bottom panel of the trap (Boutson et al., 2009).

The 12 simulated traps of each type were deployed in a paired experiment over 454 d from 6 January 2013 to 5 April 2014 at the

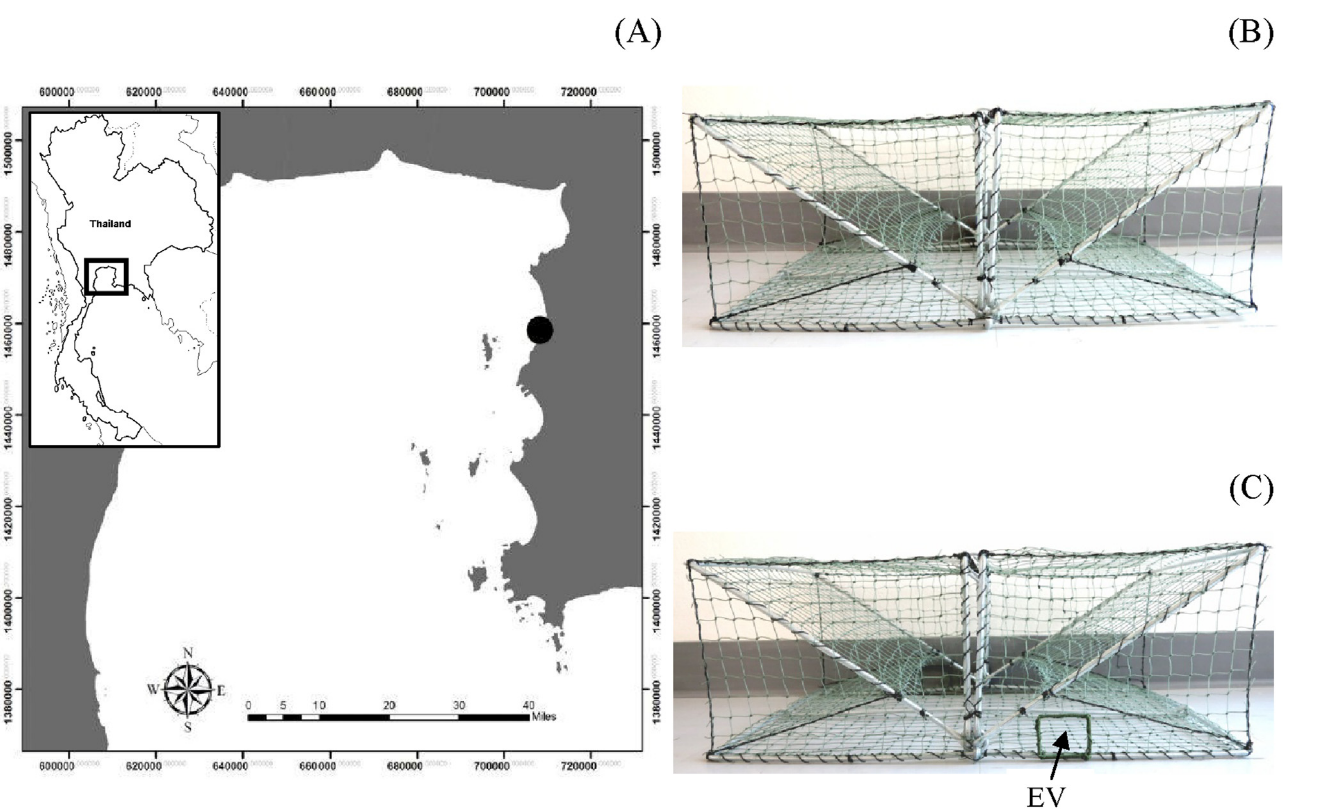

Fig. 1. (A) Location map of the study site (●) in Si Racha Bay, Gulf of Thailand; (B) Conventional trap obtained from local fishers 36 × 54 × 19 cm; (C) Vented trap with escape vents (EV; 35 × 45 mm) located on both sides of the bottom panel.