Efficiency Comparison between Conventional and Vented Trap in Ghost Fishing Experiment, Si Racha Bay, Gulf of Thailand

Santiphong Putsa[1], A. Boutson[2] and S. Tunkijjanukit[2]
[1] Southeast Asian Fisheries Development Center, Training Department, P.O.Box 97, Phrasamutchedi, Samutprakan 10290, Thailand
[2] Faculty of Fisheries, Kasetsart University, Bangkok 10900, Thailand

Introduction

Traps are an effective and economically important multi-species fishing gear used widely for harvesting crustaceans and finfish around the world. The collapsible trap targeting blue swimming crab (*Portunus pelagicus*) has recently becomes a major type of fishing gear and operated over year in the Gulf of Thailand. Small scale fishers operate their traps inshore with the numbers of 200-300 traps/boat while commercial scale fishers operate further (offshore) with the numbers of 2,000-5,000 traps onboard. Both fishing types have possibilities become lost or derelict as a result of several processes. Lost traps are widely thought to result in mortality because of "ghost fishing" a term used to describe the process by which derelict fishing gear continues to trap organisms and induce mortality in an uncontrolled manner (Matsuoka *et al*. 2005). The phenomenon of ghost fishing is a concern to fisheries managers and the fishing community interested in long term sustainability of the trap fishery. The ghost fishing effects on the blue swimming crab and other animals from the trap fishing in Thailand have been very poor 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 and mortality of the target species and the by–catch species were assessed and compared between both trap types.

Materials and Methods

The study site was conducted in Si Racha Bay, Chon Buri Province, in the upper Gulf of Thailand. This site is about 0.8 km from shore with a depth of 4–6 m. The 24 new collapsible crab traps were obtained from a fisherman to simulate the lost traps in the study site. The traps have a box shape with dimensions of 360 × 540 × 190 mm and 2 slit entrances, trap structure was covered with green polyethylene net with a mesh size of 38 mm, and the hook was attached at the top panel for trap set up and collapse function. In this experiment two trap designs were used. The first type was the 12 conventional traps which are the same as the local fishers use (Fig. 1). The second trap type was the 12 vented traps with escape vent size of 35 × 45 mm located at opposite sides of the bottom panel of the trap (Fig. 2).

The traps were deployed with paired experiment to compare between conventional and vented traps from 6 Jan 2013 to 5 Apr 2014 (454 days) at the study site. Each trap was baited once only at the beginning with trevally (*Selaroides leptolepis*) at the center bottom trap panel. A diver surveyed the traps immediately after deployment to confirm that the traps were deployed on the seabed correctly. We were observed on each trap in the day time by SCUBA diving to monitor the situation after traps deployment as every day for the first 2 weeks, then continuously every 2–3 days or 3–4 days for 3 months, and about once a month afterward up to 454 days after traps initial deployment. At each diving, we tried to minimize interference in order to maintain the condition of ghost fishing as autonomous in environment. In each trap we recorded the baited and traps conditions, the number of new entrapped, escaped or dead in each entrapped animals and estimated their size, we also observed their behavior and condition with underwater video recording.

The catch compositions and percent by number were analyzed. Catch rates of all animals and blue swimming crabs were calculated as CPUE by number (Bullimore *et al*., 2001). The potential numbers of commercial species entrapped per trap per year were estimated. We also estimate dead to ghost fishing from percentage dead of each species between conventional and vented traps in this experiment.

Fig. 1 The conventional trap

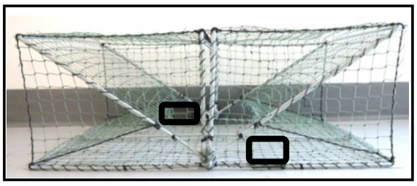

Fig. 2 The vented trap

Results and Discussion

In our underwater observations, the fish bait within traps was either consumed or decomposed rapidly within 3 days in vented traps and 4 days in conventional traps. This finding is similar with Al-Masroori *et al*. (2004) and Matsuoka *et al*. (2005), by contrast with Bullimore *et al*. (2001) who reported the initial bait was exhausted after 27 days. Throughout the 454 days of this experiment, at the simulated traps ghost fishing there were many entrapped animals including target and by-catch specie. The numbers of aquatic animals that entrapped in conventional trap was higher than vented traps. The conventional traps had 23 different entrapped species (548 animals), of which 379 (69.2%) animals were classified as commercial catch. Of these, rabbit fish (n=98), toad fish (n=70), spiral melongena (n=50) and catfish (n=45) dominated. While 169 (30.8%) were considered to have no commercial value for conventional traps, the sea urchin (n=126) and butterfly fish (n=23) dominated. The vented traps entrapped 23 different species (243 animals), of which 155 (63.80%) were classified as commercial catch. The dominant species of these were toad fish (n=44), rabbit fish (n=24) and blue swimming crab (n=17). Of these, 88 (36.2%) were considered as non-commercial catch such as sea urchin (n=64) and butterfly fish (n=12). However, mostly the commercial species such as spiny rock crab, mangrove stone crab, rabbit fish and toad fish for vented traps escaped at a higher rate than conventional traps.

The both traps can continue to ghost fishing for more than 1 year similar reported with Bullimore *et al*., 2001 and Al-Masroori *et al*., 2004. The CPUE of all animals entrapped in conventional traps was significantly higher than vented traps in each time observations (Fig. 3a), which were high in the first few weeks and gradually declined as an inverse function of time and reached an average maximum of 5.33±4.22 and 3.5±2.13 individuals/trap/day respectively. Over the course of the experiment, more entrapped any other species than target species as blue swimming crab, with relatively few retained in both traps. The CPUE of blue swimming crabs were calculated by average catch per trap per day. It was clear that The CPUE trend for blue swimming crabs was high entrapped at the first week, declined rapidly to a minimum rate until 119 days after, and then increased again before no more entrapped in both traps (Fig. 3b). The bait and trap condition had an effect to the catch rate (Stevens *et al*., 2000). However, the present study showed a low entrapped number of blue swimming crabs with a catch of 1.58±0.63 and 1.42±0.82 crabs/trap/454 days in conventional and vented traps, respectively.

The total entrapped number did not indicate the total mortality of animals associated with the traps ghost fishing. We were able to confirm the mortality by monitoring dead bodies of the entrapped animals remaining. According to diving observation, the total number of mortalities in conventional traps was higher than vented traps, 137 (25%) and 31 (12.76%) individuals in total number, respectively. The majority of dead for commercial species observed in conventional traps were finfish such as catfish (42 individuals) and rabbit fish (42 individuals), while the vented traps had a very small number of dead in same species as 1 and 4 individuals respectively. The main reason of animals were die may happen from starvation and/or eaten by predator (Stevens *et al.*, 2000). The vented traps showed less entrapped and mortality number than conventional traps. These demonstrate the positive functions of escape vents in reducing the negative impacts of ghost fishing, not only the amount of entrapped but also the mortality.

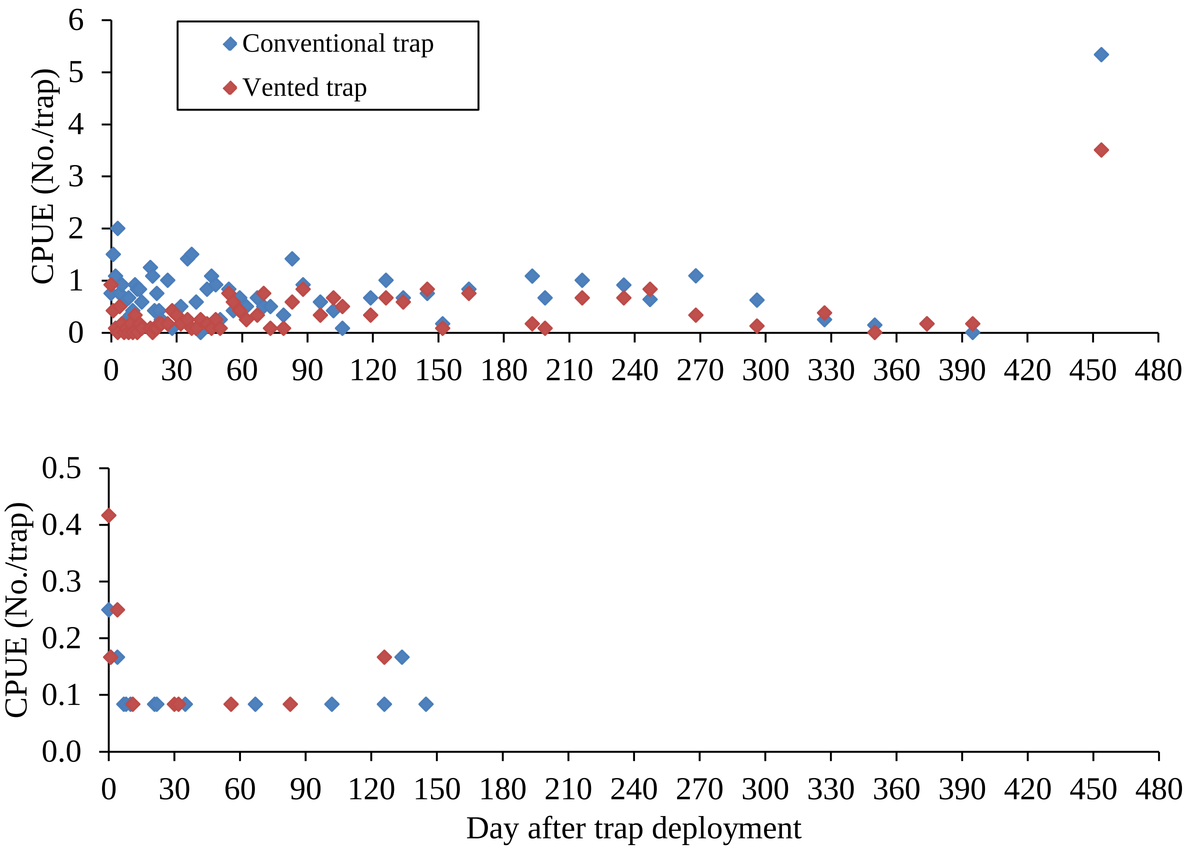

Fig. 3 The catch per unit effort (CPUE) of total entrapped animals (a) and blue swimming crabs (b) between conventional and vented traps

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