Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 36-42

Maejo International Journal of Science and Technology

ISSN 1905-7873
Available online at www.mijst.mju.ac.th

Communication

Selectivity of traps for blue swimming crab in Trang province

Apirak Songrak [1], Winai Bodhisuwan [2] and Thanitha Thapanand-Chaidee [1,*]

[1] Department of Fishery Biology, Faculty of Fisheries, Kasetsart University, Bangkok 10900, Thailand
[2] Department of Statistics, Faculty of Science, Kasetsart University, Bangkok 10900, Thailand

* Corresponding author, e-mail: ffistnt@ku.ac.th

Received: 1 August 2012 / Accepted: 23 May 2013 / Published: 12 June 2013

Abstract: The blue swimming crab (*Portunus pelagicus*) is an important commercial species in Trang province, Thailand. This study aims to investigate the selectivity of the three types of traps for this species and analyse the probability of capture with respect to inner carapace width (ICW). Blue swimming crabs were randomly sampled on a monthly basis (October 2010 to July 2011) from the catches of small-scale fishers in three fishing villages: Ban Chang Lang, Ban Nam Rab and Ban Haad Sum Ran. The total numbers of crab from those three villages were 1,208, 1,357 and 1,555 respectively. The ICW ranged between 4.75-13.25 cm, 5.25-14.00 cm and 5.25-14.00 cm respectively. The size at first capture (ICW_c) and selection range were 7.74 (7.04-8.42) cm in the fixed box trap, 9.31 (8.69-9.93) cm in the collapsible vertical trap and 9.41 (8.65-10.17) cm in the collapsible box trap. The selection factor (SF) of the three types of trap were 1.80, 1.86 and 3.14 respectively. This study shows that the ICW_c from the fixed box traps is smaller than the crab size at 50% maturity ($ICW_{m50\%}$= 7.80 cm) and that the crab stock is therefore at risk from the use of the fixed box trap. Moreover, the catch composition among the three gear types also shows variation with respect to the fishing ground and seasonal shift related to climate change.

Keywords: blue swimming crab, *Portunus pelagicus*, crab traps

---

INTRODUCTION

The blue swimming crab (*Portunus pelagicus* Linnaeus, 1758) is an important commercial resource for small-scale fisheries throughout the Indo-West Pacific from Africa to India, South-east Asia and Australia [1-3]. In Thailand, they are a major source of livelihood for small-scale fishers in many parts of the Andaman Sea and Gulf of Thailand [4]. The production of blue swimming crab in Thailand during 2005 was approximately 3,000 metric tons [5]. However, in 2008 exports fell rapidly due to low production, as measured in terms of the quantity of fishing gear. Moreover, the size of the blue swimming crabs was also smaller than in the previous years [6-7].

Traps are a major type of gear for catching blue swimming crab apart from bottom gillnets. Since traps were introduced from Japan in 1981, there has been intensive fishing by small-scale fishers, who set 100-300 traps per boat [8]. In Trang province, southern Thailand, there are three types of traps, namely fixed box trap, collapsible vertical trap and collapsible box trap. Boutson *et al*. [8] reported that 32-42% of blue swimming crabs in Thailand are immature based on onboard monitoring. Nitiratsuwan *et al*. [9], and Jindalikit [10] reported that 64.2% of the total landings on the Trang coast are small-sized.

Gear selectivity is one of the most important pieces of information needed to develop measures for the sustainable management of the blue swimming crab fishery. The aim of this study is to investigate the selectivity of three types of crab trap in terms of inner carapace width (ICW) and selection factor (SF) by analysing the probability of capture.

METHODS

Study Area

This study was conducted in Trang province in southern Thailand along 119 km of coast between longitude 99º 10´-99º 35´ E and latitude 7º 5´-7º 27´ N (Figure 1). That area supports a large part of the landing (around 30%) of blue swimming crab from the Andaman Sea and covers an area of 650 km^2 including the intertidal zone down to 5-15 m in depth.

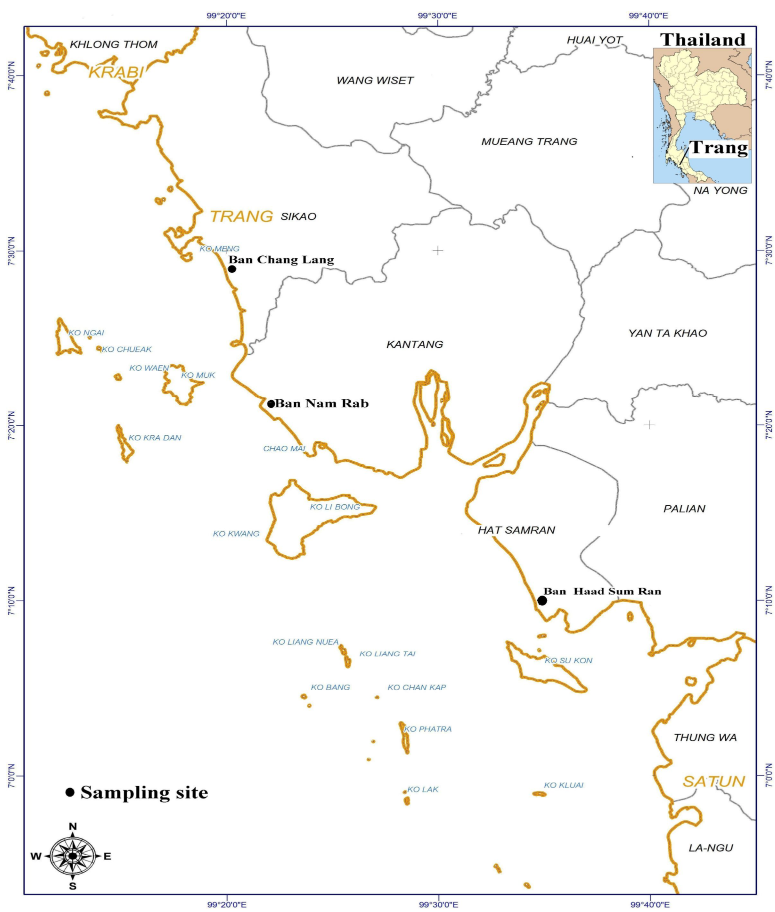


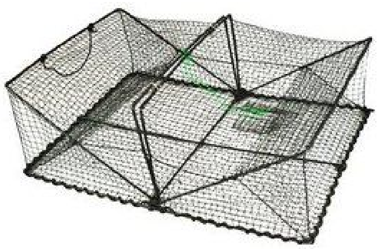
Figure 1. Map of fishing villages and sampling sites in Trang province, Thailand

Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 36-42

Sample Collection

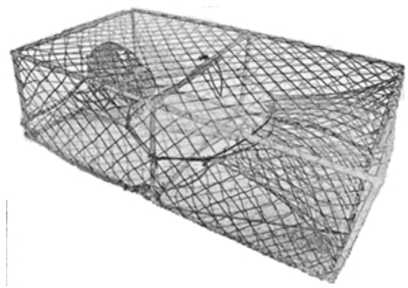
Blue swimming crabs were collected on a monthly basis during October 2010 - July 2011 from small-scale fishers in three fishing villages: Ban Chang Lang in Sikao district, Ban Nam Rab in Kantang district and Ban Haad Sum Ran in Haad Sum Ran district. Each village used different types of trap. A traditional fixed box trap (30x45x20 cm) covered with a red polyethylene net with mesh size (*m*) of 4.3 cm (Figure 2a) was used in Ban Chang Lang, where fishers set an average of 100 traps per day per boat. The second type of trap was a collapsible vertical trap with a diameter of 50 cm covered with a green polyethylene net with mesh size of 5.0 cm (Figure 2b). It was used in Ban Nam Rab, where fishers set an average of 180 traps per day per boat. The third type of trap was the common collapsible box trap (35x50x20 cm) covered with a green polyethylene net with mesh size of 3.0 cm (Figure 2c). It was used in Ban Haad Sum Ran, where fishers set an average of 700 traps per day per boat.

A sample of 120 crabs was drawn from the total landing at each sampling site per month. Each crab was sexed, weighed and the inner carapace width (ICW) measured.



(a) Fixed box trap

(b) Collapsible vertical trap



(c) Collapsible box trap

Figure 2. Three types of trap used to capture blue swimming crabs on the coast of Trang

Data Analysis

Selection curves were generated by the probability of capture method [8, 11] using the 'solver' tool in Microsoft Excel. The size at first capture (ICW_c) and the selection range ($ICW_{25\%}$ - $ICW_{75\%}$) were estimated using mesh size (m). Selection factor (SF) and optimum mesh size (m_o) in each gear type were estimated by comparing the size at 50% maturity ($ICW_{m50\%}$) of female crabs.[9] :

$$SF = \frac{ICW_c}{m}$$

Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 36-42

$$m_o = \frac{ICW_{m50\%}}{SF}$$

RESULTS AND DISCUSSION

The total number of blue swimming crabs during October 2010 - July 2011 caught by each gear type was as follows: 1,208 (males 651, females 557) by fixed box trap; 1,357 (males 662, females 695) by collapsible vertical trap; and 1,555 (males 810, females 745) by collapsible box trap. The ICW ranged between 4.75-13.25 cm for fixed box trap, 5.25-14.00 cm for collapsible vertical trap, and 5.25-14.00 cm for collapsible box trap (Figure 3). The size at first capture ($ICW_{50\%}$) and selection range ($ICW_{25\%}$ - $ICW_{75\%}$%) were 7.74 (7.04-8.42) cm, 9.31 (8.69-9.93) cm and 9.41 (8.65-10.17) cm for the fixed box trap, the collapsible vertical trap and the collapsible box trap respectively. The selection factor (SF) of the three types were 1.80, 1.86 and 3.14 respectively (Table 1 and Figure 4).

The optimum mesh size (m_o) in each gear type (fixed box trap, collapsible vertical trap and collapsible box trap) were 4.40, 4.20 and 2.50 cm respectively.

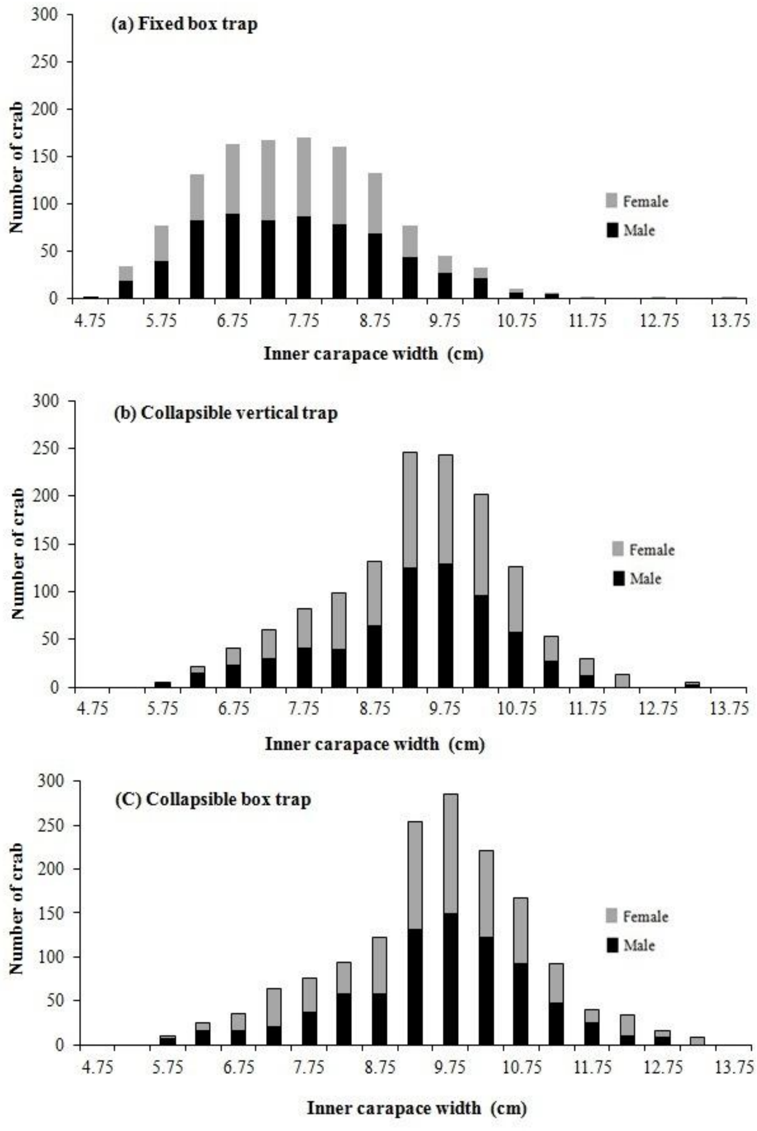


Figure 3. Size distributions of blue swimming crabs from three trap types

Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 36-42

Table 1. Selectivity parameters of three trap types

Gear types	Sex	Mesh size of gear (cm)	$ICW_{25\%}$ (cm)	$ICW_{50\%}$ (cm)	$ICW_{75\%}$ (cm)	SF	M_o
Fixed box trap	Male		6.49	7.39	8.28	1.72	
	Female		6.76	7.49	8.21	1.74	
	Combined	4.3	7.04	7.74	8.42	1.80	4.40
Collapsible vertical trap	Male		8.60	9.22	9.83	1.84	
	Female		8.56	9.28	9.99	1.86	
	Combined	5.0	8.69	9.31	9.93	1.86	4.20
Collapsible box trap	Male		8.72	9.43	10.14	3.14	
	Female		8.60	9.38	10.16	3.13	
	Combined	3.0	8.65	9.41	10.17	3.14	2.50

Note: Size at 50% maturity of female blue swimming crabs in Trang province is 7.80 cm

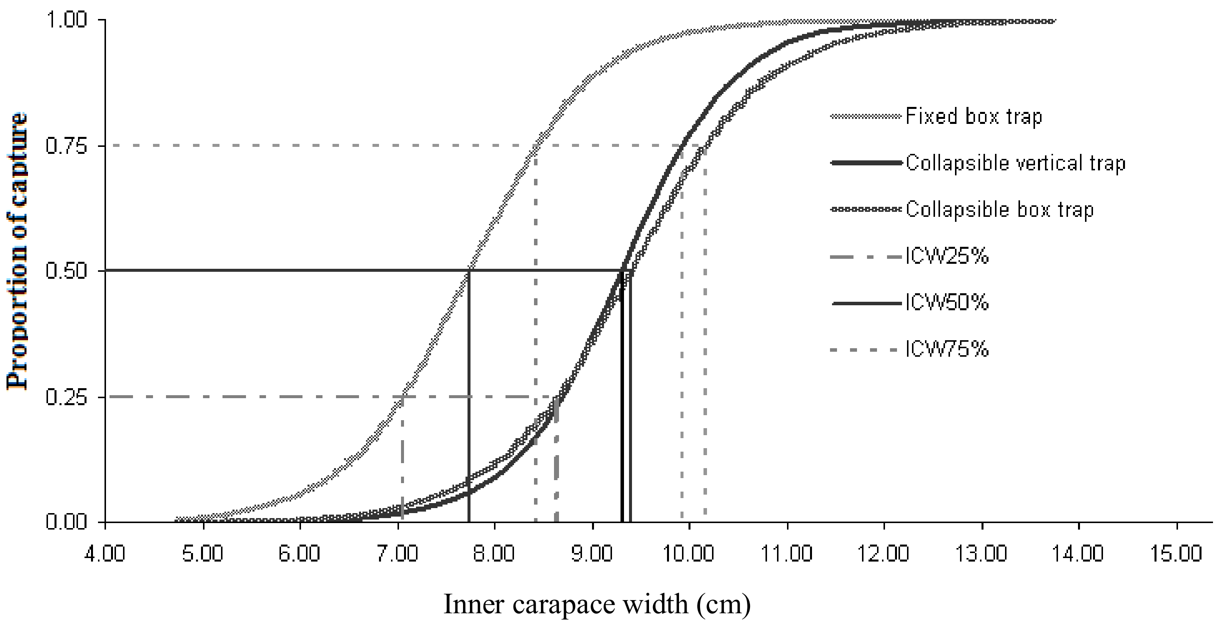


Figure 4. Selectivity curves for blue swimming crabs from three trap types

Traps are known to be selective with respect to species and size of catch, which is related to passive behaviours and the attraction of appropriate bait. The $ICW_{50\%}$ of the catch in collapsible vertical traps and collapsible box traps (Table 1) was higher than the size at 50% maturity reported by Nitiratsuwan *et al.* [9]. The $ICW_{50\%}$ from fixed box traps, on the other hand, was smaller than the maturity size. The variation of $ICW_{50\%}$ among trap types was also due to the differences among fishing grounds, which were clearly separated because of movements of blue swimming crabs between near-shore and off-shore areas [8].

It is shown in this study that for the fixed box trap, the size at first capture (ICW_c) was less than the size at maturity ($ICW_{m50\%}$) for female broodstock. If $ICW_{m50\%}$ was considered, the fishermen should change the fixed box trap mesh size. By applying the concept of optimum mesh size (m_o), the mesh size of the fixed box trap should be enlarged to 4.50 cm to reduce the impact on immature stock. Optimum mesh size can reduce the destruction of young populations without reducing the catch efficiency for crabs of marketable size [8]. Selection performance is a critical point in the construction of many gear types. For example, mesh size modification in Japan and increase in the number of trap funnel entrances have improved trap fisheries according to studies on selectivity and catch efficiency

[12, 13]. Bigger mesh sizes on traps have been shown to be more efficient for larger blue swimming crabs while reducing by-catch [14]. These concepts can also be applied to the future management of crab trap fisheries in the coastal waters of Trang.

CONCLUSIONS

Traps are an effective small-scale fishing gear for catching blue swimming crabs in Trang. Catch composition varies among the three gear types and fishing grounds. The management measure recommended from this study is based on the minimum size at maturity of the blue swimming crab. However, before any change in the legal mesh size of fixed box traps is implemented, further information on crab biology, socio-economic factors and the fishing grounds is required to properly assess the status of blue swimming crab stocks along the coast of Trang. Moreover, the catch composition among the three gear types also shows variation with respect to the fishing ground.

ACKNOWLEDGEMENTS

This research was funded by the Thai Government Science and Technology Scholarship. The authors gratefully thank the Faculty of Science and Fisheries Technology, Rajamangala University of Technology Srivijaya for the ArcGIS 9 software. Thanks are also due to the small-scale fishers of Trang province for their kind assistance during field sampling. We also owe a debt of gratitude to our colleagues who assisted in the editing of this paper.

REFERENCES

1. G. S. Smith and W. D. Sumpton, "Behavior of the commercial sand crab *Portunus pelagicus* (L.) at trap entrances", *Asian Fish. Sci.*, **1989**, *3*, 101-113.
2. P. J. Kailola, M. J. Williams, P. C. Stewart, R. E. Riechelt, A. McNee and C. Greeve, "Australian Fisheries Resources", Bureau of Research Sciences and the Fisheries Research and Development Corporation, Australia, **1993**.
3. A. I. Chande and Y. D. Mgaya, "The fishery of *Portunus pelagicus* and species diversity of Portunid crabs along the coast of Dar es Salaam, Tanzania", *West. Ind. Ocean J. Mar. Sci.*, **2003**, *2*, 75-84.
4. M. Chaiyawat, I. Eungrasamee and N. Raksakulthai, "Quality characteristics of blue swimming crab (*Portunus pelagicus*, Linnaeus 1758) meat fed *Gracilaria edulis* (Gmelin) Silva", *Kasetsart J. (Nat. Sci.)*, **2008**, *42*, 522-530.
5. Fishery Information Technology Center, "Fisheries Statistics of Thailand 2005", Department of Fisheries, Ministry of Agriculture and Co-operatives, Bangkok, **2007**, p.91.
6. A. Songrak and P. Choopunth, "Stock assessment of blue swimming crab (*Portunus pelagicus*, Linnaeus) in Sikao bay, Trang Province, southern Thailand", Proceedings of International Conference on Coastal Oceanography and Sustainable Marine Aquaculture, **2006**, Kota Kinabalu, Malaysia, pp.260-267.
7. A. Sawusdee and A. Songrak, "Population dynamics and stock assessment of blue swimming crab (*Portunus pelagicus* Linnaeus, 1758) in the coastal area of Trang province, Thailand", *Walailak J. Sci. Technol.*, **2009**, *6*, 167-188.
8. A. Boutson, C. Mahasawasde, S. Mahasawasde, S. Tunkijanukij and T. Arimoto, "Use of escape vents to improve size and species selectivity of collapsible pot for blue swimming crab *Portunus pelagicus* in Thailand", *Fish. Sci.*, **2009**, *75*, 25-33.
9. T. Nitiratsuwan, A. Songrak, C. Sudtongkong and K. Juntarashote, "Fishery management for blue

Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 36-42

swimming crab (*Portunus pelagicus*) in Sikao District, Trang province", Department of Fishery Management, Faculty of Science and Fisheries Technology, Rajamangala University of Technology Srivijaya, Trang (Thailand), **2004**, pp.21-52.

10. J. Jindalikit, "Biology of the blue swimming crab *Portunus pelagicus* (Linnaeus, 1766) in the upper Gulf of Thailand", Seminar report, Department of Fisheries, Ministry of Agriculture and Cooperatives, Bangkok, **2001**, pp.242-252.
11. P. Sparre and S. C. Venema, "Introduction to tropical fish stock assessment Part 1: Manual", Food and Agriculture Organization of the United Nations, Rome, **1998**, p.407.
12. Y. Watanabe and Y. Sasakawa, "A preliminary note on pot selections for the size of the rock crab", *Bull. Fac. Fish. Hokkaido Univ.*, **1984**, *35*, 225-233.
13. D. Kim and K. Ko, "Fishing mechanism of pots and their modification 4. An experiment for modifying the pot for crab, *Charybdis japonica*", *Korean J. Fish. Aquat. Sci.*, **1990**, *23*, 310-314.
14. M. V. Archdale, C. P. Anasco and S. Hiromori, "Comparative fishing trials for invasive swimming crabs *Charybdis japonica* and *Protunus pelagicus* using collapsible pots", *Fish. Res.*, **2006**, *82*, 50-55.