Title	Development of turtle releasing system in the pound net: Guiding method of loggerhead sea turtle Caretta caretta with slope of the upper panel
Author(s)	TAKAHASHI, MUTSUKI; SHIODE, DAISUKE; HU, FUXIANG; TOKAI, TADASHI; ABE, OSAMU; KOBAYASHI, MASATO
Citation	Proceedings of the 5th International Symposium on SEASTAR2000 and Asian Bio-logging Science (The 9th SEASTAR2000 workshop) (2010): 25-27
Issue Date	2010-02
URL	http://hdl.handle.net/2433/107341
Right	
Type	Conference Paper
Textversion	publisher

Development of turtle releasing system in the pound net: Guiding method of loggerhead sea turtle *Caretta caretta* with slope of the upper panel

MUTSUKI TAKAHASHI[1], DAISUKE SHIODE[1※], FUXIANG HU[1], TADASHI TOKAI[1], OSAMU ABE[2], AND MASATO KOBAYASHI[2]

[1]*Tokyo University of Marine Science and Technology, 108-8477 Tokyo Japan*

[2]*Seikai National Fisheries Research Institute, Fisheries Research Agency, 907-0451 Okinawa Japan*

**Corresponding author: Daisuke Shiode*

E-mail: shiode@kaiyodai.ac.jp

ABSTRACT

To reduce incidental mortality of sea turtles in a pound net, a new releasing system was developed to allow turtles to escape from the bag net. The turtle releasing device with flapped vent has already been developed for small-scaled pound nets, but seems ineffective for large-scaled pound nets because the turtles rarely encounter the device in a large bag net. This study examined the validity of the sloping upper panel for guiding sea turtle to the releasing device in the bag net. Tank experiments were performed with three types of experimental bag nets: a box-shaped net with horizontal upper panel, one with square-pyramid shaped upper panels of 10 degrees (10 degrees slope net), and square-pyramid shaped bag net with upper panel of 20 degrees (20 degrees slope net). Five loggerheads in captivity (SCL: 42.8cm-50.0cm) were prepared. The turtle swam around after entering the bag net, and about five minutes later it started to push its head up against the upper panel. In the 20 degrees slope net, the turtle moved to the shallowest space of the net. This suggested that the sloping upper panel guided the loggerhead turtle to the releasing device in the bag net of a large-scaled pound net.

Keywords: behavior control, by-catch, pound net, sea turtle, sloping upper panel

INTRODUCTION

Incidental catch of endangered species is an important management issue in marine fisheries. In recent years, particular concern regarding the interaction with sea turtles has been expressed.

The pound net fishery is a major and important coastal fishery in Japan, and the pound net occasionally catches sea turtles in some coastal regions. Pound net gears are classified into two types: the bag net open to the sea surface and the one fully submerged into the water, from the viewpoint of incidental mortality of sea turtles. While a turtle entering a pound net with a surface open bag net can still breathe freely, the turtles straying into the fully-submerged bag net often drown because the upper panel of the bag net blocks the turtles from swimming up to the surface to take breaths.

For the fyke in a small-scaled pound net, the turtle releasing device which comprised a square vent and a flap has been already developed (Abe, 2006, Abe *et al*., 2002). The flap over the vent swings up on hinges and is installed on the upper panel of the cone-shaped bag net. The turtle can go out of the bag net through the vent, when it pushes up the flap. In the tank experiment, the releasing device allowed 81% of green turtle *Chelonia mydas* to escape from the bag net (Abe, 2006). Similar results were obtained for loggerhead turtle *Caretta catetta*, and hawksbill turtle *Eretmochelys imbricata* (Abe, 2006). In contrast, only 4% of tropical coral fishes escaped through the device (Abe, 2006). This suggested that the releasing device was effective to release turtles from the fyke net. However, most large-scaled pound net have a larger bag net. The length of the largest bag nets is up to 50m, and it implies difficulty of the turtle encountering the device. In order to make such a releasing device effective in the large scale pound net, a method for guiding sea turtle to the device is required.

Sea turtles in the fully-submerged bag net were observed to push the head up against the upper panel with the body axis vertical for taking breaths (Abe, 2006, Abe *et al*., 2002). The slope of the upper panel may be able to induce the turtle to move up to the shallowest space in the net.

In this study, the behavior of sea turtle in the bag net with the upper panels of three different angles was observed, and the validity of a sloping upper panel was examined for guiding the turtle to the shallowest space in the bag net.

MATERIALS AND METHODS

Behavior observation of sea turtle in a bag net model were performed at the outdoor tank (10 m × 10 m × 2.1 m) of Ishigaki Tropical Station, Seikai National Fisheries Research Institute, Fisheries Research Agency, from 22 to 24 June 2006. Three types of bag net models were tested (Fig.1): 1) a box-shaped bag net of 8m square and 1m high (horizontal roof net), 2) one with square-pyramid shaped upper panels of 10 degrees (10 degrees slope net), 3) 8m square-pyramid shaped bag net with four upper panels angled at 20 degrees (20 degrees slope net). In 20 degrees slope net, there was no box-shaped space owing to the restriction of tank depth. Bag net models were constructed of polyethylene knotless net with square mesh of 75mm mesh size that is the most popular material for pound nets. Five loggerhead turtles in captivity (SCL: 42.8cm - 50.0cm) were prepared for the observation.

In the observation, a single turtle was put into the bag net model set in the water tank, and the behavior was recorded by two video cameras from lateral and overhead views. From the video images of overhead view, the horizontal location of the turtle was measured every five seconds. When the turtle pushed up the upper panel with the body axis vertical to the video image of the lateral view, the horizontal positions of the turtle pushing-up were also recorded. In addition, in this observation, when the turtle in the bag net model began to swim up frantically, the turtle was released out of the net by the diver to avoid suffocating to death.

RESULTS

For around five minutes after the turtle was put into the bag net model, it swam at a constant speed along the side wall of the net, sometimes pushing softly the head and nose to the upper and side panels, which was associated with checking the net. And then the turtle started to push the head up against the upper panel frequently with the body axis vertical (Fig. 2).

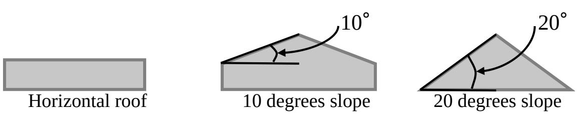

Fig. 1 Experimental bag nets.
Horizontal roof net: a box-shaped net of 8m square and 1m high
10 degrees slope net: a roof angled at 10 degrees toward the center
20 degrees slope net: 8m square pyramid with a roof angled at 20 degrees

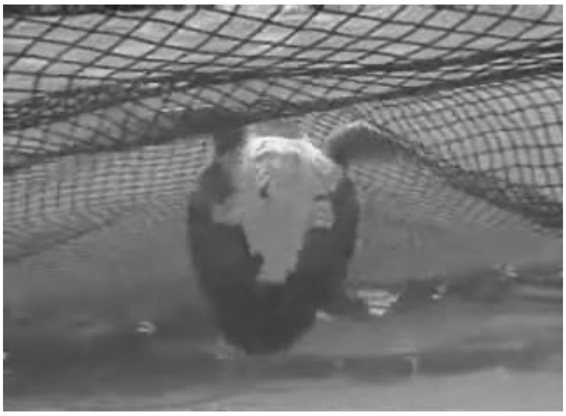

Fig. 2 A turtle pushing up the upper panel

The horizontal positions of the turtle pushing-up behavior were plotted mostly around the center in the 20 degrees slope net, while the turtle pushed up along the side panel of the box-shaped net in the horizontal roof net and 10 degrees slope net (Fig. 3).

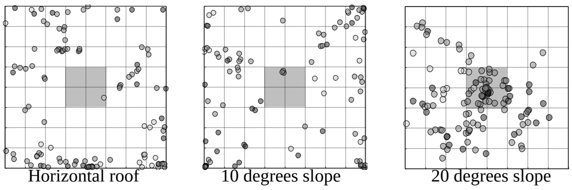

Fig. 3 Horizontal positions of the turtles pushing up the upper panel.
Shaded area is the central square(2m x 2m).

Moreover, the turtles pushing-up behavior was observed from ten times to over twenty times per one observation. In the horizontal roof net, there was only one turtle which pushed up one time the upper panel of the central square area (2m × 2m), and one turtle pushing up the central panel three times in the 10 degrees slope net. In contrast, all of five turtles pushed up the upper panel of the central square area in the 20 degrees slope net.

Table 1 The proportion of the pushing-up behavior in the central square (2m x 2m)

ID	Horizontal roof	10 degrees slope	20 degrees slope
A	0% (0/21)	0% (0/21)	26.7% (8/30)
B	0% (0/18)	15.0% (3/20)	37.5% (9/24)
C	0% (0/30)	0% (0/22)	60.0% (15/25)
D	4.2% (1/24)	0% (0/15)	15.4% (2/13)
E	0% (0/18)	0% (0/19)	19.2% (5/26)
Ave.	0.9% (1/111)	3.1% (3/97)	33.1% (39/118)

The proportions of the pushing-up behavior in the central square area to the total ones were 0.9%（= 1 / 111） at the horizontal roof net，3.1%（= 3 / 97） at the 10 degrees slope net, and 33.1%（= 39 / 118） at the 20 degrees slope net (Table 1).

Some of the turtles were observed to shift in a horizontal direction, pushing up the upper panel with the body axis vertical. In the horizontal roof net and the 10 degrees slope net, such a horizontal shifting rarely occurred, and the direction varied. However, in the 20 degrees net, long horizontal shifting to the center often occurred, and the pushing-up behavior continued even at the center of the net with the shallowest space (Fig. 4).

DISCUSSION

The results suggested that the sloping upper panel of 20 degrees was able to guide the pushing-up loggerhead turtle to the shallower space in the bag net. When the releasing device is installed in the shallower space of the bag net, the turtle would push up the flap of the device to escape out. According to Abe's report, similar pushing-up behavior was observed in green turtles and hawksbill turtles (Abe, 2006). It is expected that the guiding method with the sloping upper panel is valid for all of the turtle species.

The dimensions of the bag net model used in the experiment was 8m×8m square base and 2m high owing to the restriction of tank capacity. The usual bag net utilized in a large-scaled pound net is much lager than the model. The validity of the guiding method proposed in this study is still unknown in such a large bag net. In particular, time duration required for the turtle to shift from the alongside to the shallowest space maybe too long to hold its breath. Another issue on the guiding method is technical difficulty in net manufacture of constructing the sloping upper panel in the bag net of large-scaled pound nets.

Further observation of the turtle behavior in a full-scaled bag net for large-scaled pound nets should be carried out, and the time duration required for the turtle to escape out through the releasing device should be considered for the future application of this system.

REFERENCES

Abe, O. (2006). *Kogata teichiami niyoru umigame konnkaku wo boushisuru gijyutukaihatu nituite* (Technology development to avoid sea turtles by-catch in small-scaled pound net). *Teichi* **109**, 63-76 (in Japanese).

Abe, O., Shibuno, T., Takada, Y., Hashimoto, K. (2002). Preliminary study to prevent incidental capture of sea turtles by pound net. *Proceedings of the 3rd Workshop on SEASTAR2000*, 35-38.

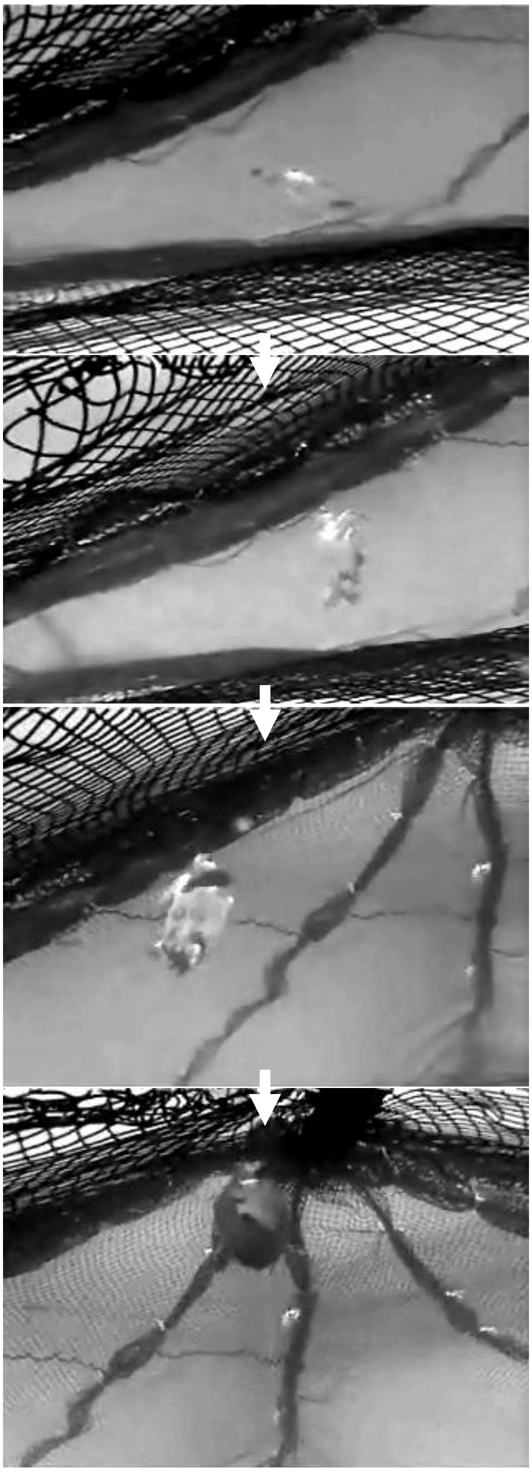

Fig. 4 The shift of the turtle to the shallowest space with pushing-up the upper panel of 20 degrees.