

The R-H Push-net, a Gear for Study of Juvenile Flatfishes along the Beach

Muhammad Husni AMARULLAH and Tetsushi SENTA

Details of the design of a handy push-net, a slight modification of the Riley push-net, to be used in the study of juvenile flatfishes along sandy beaches are illustrated. Some examples of the results of the collections along the western coasts of Kyushu with the net are also given.

Key words: handy push-net; juvenile flatfishes; sandy beach ichthyofauna.

European scientists have well proved the importance of beaches as nursery grounds for plaice and turbot from after metamorphosis through their first year of life (Edwards and Steele, 1968; Jones, 1973; Gibson, 1973; Lockwood, 1974; van der Veer and Bergman, 1986). Sandy beaches of Japan are also inhabited by larvae and juveniles of various kinds of flatfishes (Fujimoto, et al., 1973; Yusa, et al., 1977; Sudo, et al., 1985; Ikemoto, et al., 1986; Minami, 1987; Senta, et al., 1989).

Riley (1971) designed a handy push-net to be operated by one person wading along the beach for the study of plaice; the net, named the Riley push-net, has widely been used in Europe (Lockwood, 1972; Jones, 1973).

In our study on larval and juvenile fishes in surf zones, we categorized the ichthyofauna along beaches into the pelagic and demersal components (Senta and Kinoshita, 1985). At the beginning of our study on the demersal components we made a Riley push-net. The net was found very effective. However, as the net is manually operated by one person, some problems were experienced as follows; 1) difficult to handle in the waters deeper than 50 cm, especially on rough days, 2) too heavy for one person to push on soft bottom (muddy sand), 3) difficult to keep a pace of pushing at a constant speed, especially for a long distance (e.g. 100m), 4) difficult for one person to lift the net at the end of operation at cer-

tain depth and carry to the land.

To overcome the problems mentioned above, a slight modification was made to the Riley push-net, and we call the modified net R-H push-net. The construction of the R-H push-net and some examples of the results of samplings with the net are given below.

Design principle

In designing the net, the followings were taken into consideration.

- 1) Small size to assure an easy manual operation in waters up to 100 cm deep.
- 2) Fixed mouth opening to assure a quantitative sampling.
- 3) Capability to catch juvenile and young flatfishes burrowing in the sand.
- 4) Easiness of assembling and disassembling for convenience of transportation.
- 5) Availability of parts to make repair easy during field survey.

Construction

The net consists of a beam frame, a pair of ski feet, a handle, tickler chains, and a bag net (Fig. 1).

1) Beam frame: The beam frame is made of three pieces of PVC-coated steel pipe, 27.5 mm in outside diameter and 2.0 mm in wall thickness.

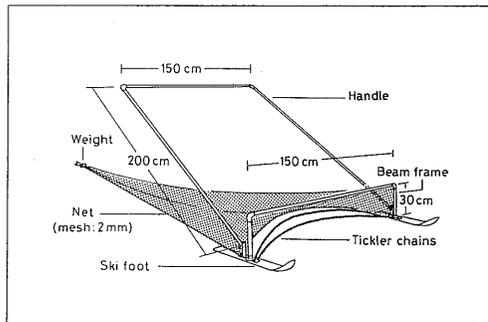


Fig. 1. The setup of the R-H push-net to collect the demersal components of larval and juvenile fishes occurring along sandy beaches. This net is a modification of the Riley push-net (Riley, 1971).

On each end of a pipe, 150 cm long, is fixed a PVC-elbow, to which a 30-cm pipe is put as an upright. Fixing of the elbows to the pipes is assured with 5-mm bolts and nuts.

2) Ski foot (Fig. 2A): The ski foot is made of 3-mm thick steel sheet, 78 × 8 cm, with the leading edge smoothly bending upward. On each of the ski feet are attached the followings.

a) A stainless steel eye plate to receive one end of tickler chains and ground chain.

b) A PVC socket plate, 28.0 mm in inside diameter, into which the lower end of an upright is inserted.

c) A lug for the handle, consisting of a steel pipe, 10 cm in length, with a pair of steel sheets, 60 × 25 mm, welded onto it and projecting backward; a hole for a bolt with wing-nut is made on each of the steel sheets. The lower end of the handle is secured between the steel sheets so that the handle can swing around the bolt. The free end of the steel pipe is sealed by steel weld to prevent the entry of sea water.

The eye plate and socket plate are fixed with bolts and nuts on the ski foot, while the lug is welded.

3) Handle: The handle consists of three pieces of the same steel pipe as the beam frame, jointed with PVC-elbows to form a U-shape of 200 × 150 cm (Fig. 1). Fixing of the elbows to the

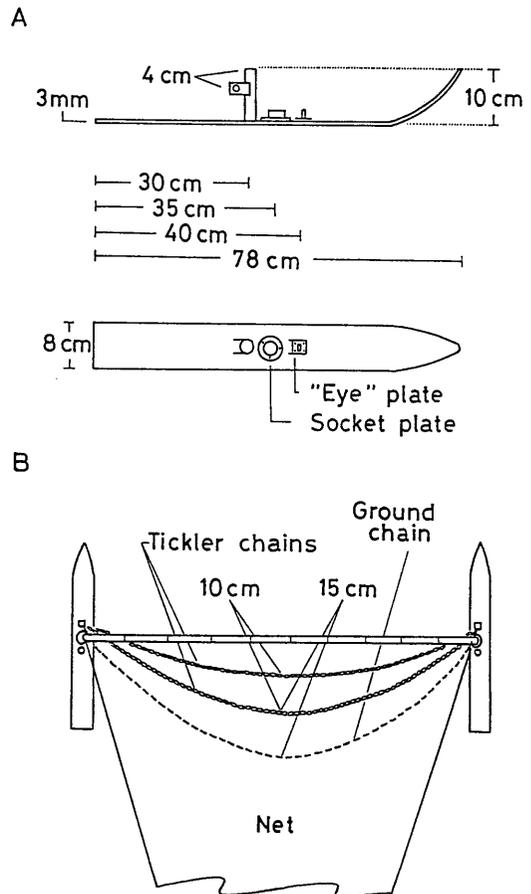


Fig. 2. The plan of the ski foot (A) and the arrangement of anterior components of the net viewed from the top (B).

pipes is assured with 5-mm bolts and nuts.

4) Tickler chains. A set of two tickler chains is attached to each eye on the ski foot with a shackle. The chain links are 41.2 mm long, 20.0 mm wide and 5.5 mm thick, and the weight of chain is about 540 g per meter. The length of the front chain is 155 cm, and the hind one 160 cm (Fig. 2B).

5) Bag net (Figs. 1 and 3): The bag net is constructed of 2-mm mesh nylon russell netting (Nihon Bolting Cloth Co. Ltd., T-140) except for the anterior part of the bottom with 5-mm mesh (NBC, NS-4.5). The lower margin of the mouth is weighted with a chain of 177 cm long constructed of links of 31.0 mm long, 11.4 mm wide and 3.0

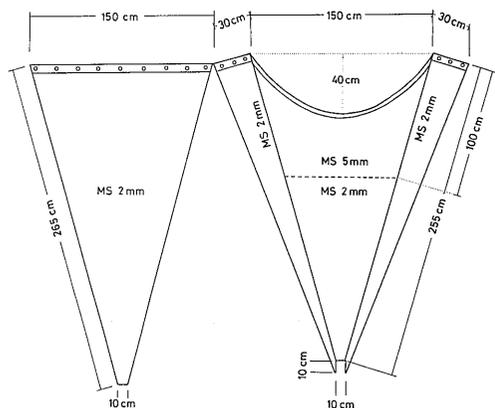


Fig. 3. The layout of the bag net.

mm thick, weighing 145 g per meter, each end connected to the eye plate with the same shackle as that for the tickler chains. The top and sides of the mouth are hemmed by canvas furnished with eyelets (10 mm in diameter of hole) at intervals of 10 cm; when fitted to the frame these are laced to the beam and uprights. The cod end has an opening of 10 by 10 cm which is tied close by a cord and loaded with a weight (225g) during operation.

Operation

The net is pushed by two persons at a constant speed of about 35 m per minute following Riley and Corlett (1966) along 50 or 100 m of beach in water within wading depths, 15 to 110 cm (Fig. 4). For one sampling, we repeat this operation three or four times, parallel to each other at different depths, usually at 15, 50 and 100 cm. Although we usually do collections at around low tide, continuous 24-h collections are also sometimes made. In such collections, actual lines of collection move landward and seaward with proceeding and receding of the water line.

Some Examples of the Results of Collections

For more than ten years we have been studying larval and juvenile fishes occurring along several sandy beaches on the western coast of

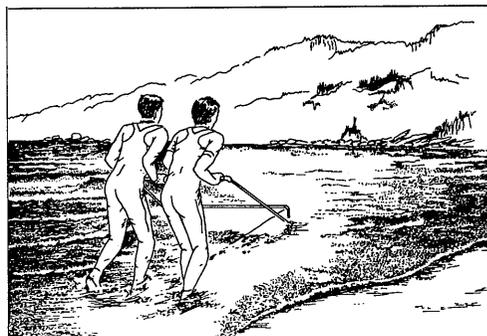


Fig. 4. A schematic illustration of two persons pushing the net along the beach.

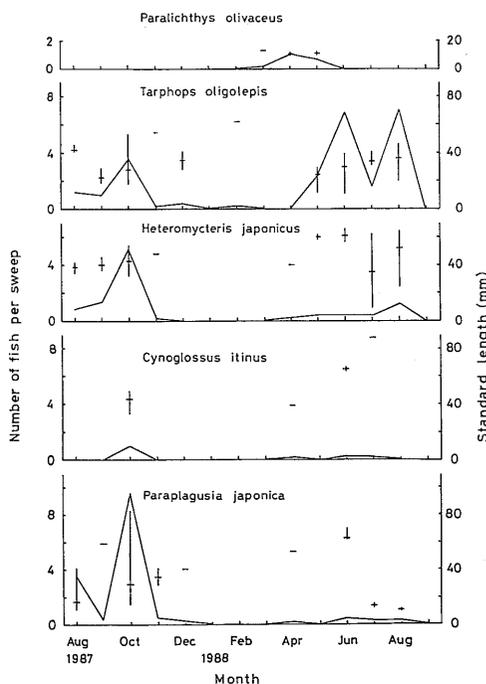


Fig. 5. Flatfishes caught along Takahama beach, near Nagasaki, from August 1987 to August 1988, by bimonthly samplings within wading depths with the R-H push-net. The catch is expressed as the number of fish per sweep of 100 m. The horizontal and vertical bars show the mean and range of standard lengths, respectively. (Senta, et al., 1989).

Kyushu, although the study on the demersal components of them started only in 1987. Some selected examples of the results to show the effec-

tiveness of the R-H push-net are given below.

Species and sizes of flatfishes caught with the R-H push-net

Fig. 5 illustrates the species and sizes of flatfishes caught with the R-H push-net by seasons at Takahama beach, about 25 km south-west from Nagasaki City. Juveniles and youngs, ranging from 11 to 88 mm SL, of five species were caught. In other beaches, we have caught *Paraplagusia japonica* as big as 267 mm SL. Besides the five species caught at Takahama beach, juveniles and youngs of two more flatfishes, *Pleuronichthys cornutus* and *Pseudaesopia japonica* were also caught in other beaches.

Commercially important demersal species other than flatfishes occurring in the catch of the R-H push-net included youngs of flatheads (*Platycephalus indicus* and *Inegocia japonica*) and adults of devil stinger (*Inimicus japonicus*).

Collection of juvenile Japanese flounder just after settlement

The settlement of juveniles of the Japanese flounder, *Paralichthys olivaceus* following metamorphosis takes place from March through May in waters of Kyushu. Fig. 6 summarizes the result of collection with the R-H push-net made at Yanagihama beach, about 55 km north-west of Nagasaki City, on April 16 and 17, 1988 when the juveniles of the fish were most abundant during the 1988 season. The catch fluctuated by times of a day, by tidal phases and by depths, with big catches always at low tides. The maximum catch per operation was as big as 131 fish, and a total of 433 juveniles was obtained on these two days.

In addition to the above-mentioned sampling with the R-H push-net, we made simultaneously the sampling with a small seine for the pelagic components. The seine is a 1.3- by 1-m rectangular piece of polyester netting, 0.7 mm in mesh width, without having either floats or weight, and with each end attached to a stick handle. The

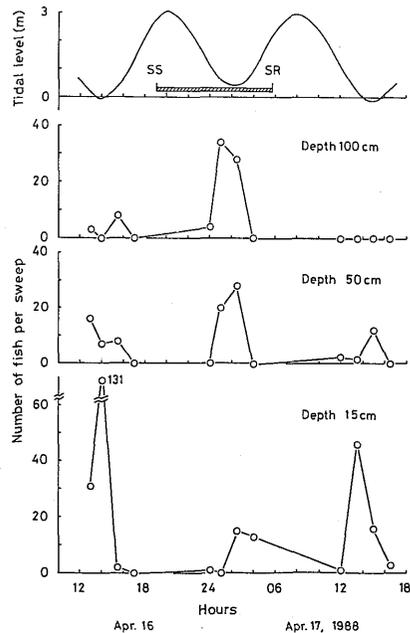


Fig. 6. Juvenile Japanese flounder just after settlement caught with the R-H push-net at three depths along the sandy beach of Yanagihama, near Nagasaki, on April 16 and 17, 1988. The catch is expressed as the number of fish per sweep of 100 m. The tidal phase and the times of sunset and sunrise (SS and SR) are illustrated on the top. (Senta, et al., 1989).

stretched seine is pulled by two persons along 50 m of beach, with its lower margin kept well above the sea bed (Senta and Kinoshita, 1985). On April 16 and 17, we made a total of 26 such hauls in water ranging from 30 to 60 cm deep. A total of only five juvenile Japanese flounder was caught.

The above results show that the Japanese flounder just after settlement live either in contact with or burrowing in the bottom sand, and the R-H push-net is an effective gear for them.

Sizes of pelagic juveniles caught with the seine and R-H push-net

Larvae and juveniles of many commercially important fishes are caught both with the seine and R-H push-net in wading depths along sandy

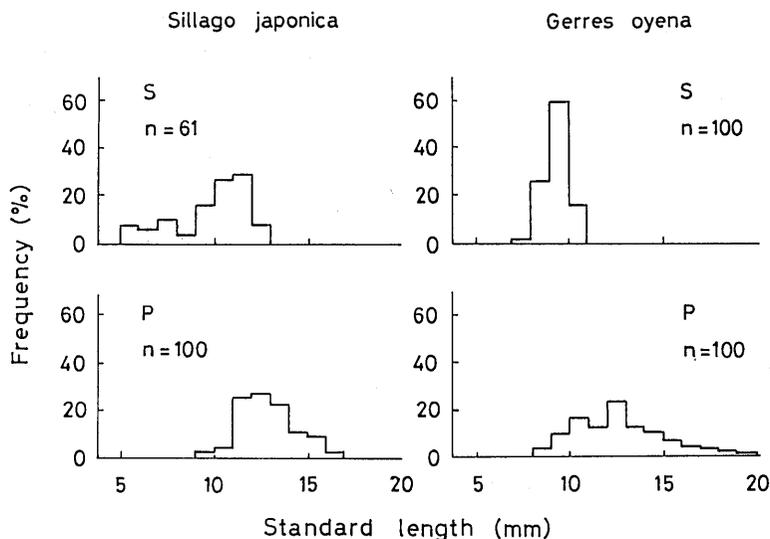


Fig. 7. Examples of length frequency histograms of larvae and juveniles of whiting (*Sillago japonica*) and silver-biddy (*Gerres oyena*) simultaneously caught with the seine (S) and R-H push-net (P) at Yanagihama beach, Nagasaki Prefecture in August 1988. (partly cited from Senta, et al., 1989).

beaches. Comparisons of size compositions of a species occurring in catches simultaneously obtained with both gears revealed that the juveniles caught with the R-H push-net tended to be larger than those with the seine as seen in examples shown in Fig. 7. The same tendency was observed also in sea breams (*Acanthopagrus schlegeli* and *Sparus sarba*), sea bass (*Lateolabrax latus*), and so on (Senta, et al., 1989).

This suggests that some of the pelagic components of surf zone juvenile fishes become bathy-pelagic as they grow, living in the lower part of the water column even in waters as shallow as 50 cm deep or less. Therefore, it is not enough to use an unweighted seine alone, even when the purpose of the study is restricted to a certain species of the pelagic components.

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Literature cited

- Edwards, R. R. C. and J. H. Steele. 1968. The ecology of 0-group plaice and common dabs in Loch Ewe. I. Population and food. *J. exp. mar. Biol. Ecol.*, 2 : 215—238.
- Fujimoto, T., N. Matsumoto and H. Sasaoka. 1973. Ecology of juveniles and youngs of the stone flounder around the mouth of rivers*. *Saibai-gyogyo Gijutsu Kaihatsu Kenkyu*, 2 (1): 23—26 (in Japanese).
- Gibson, R. N. 1973. The intertidal movements and distribution of young fish on a sandy beach with special reference to the plaice (*Pleuronectes platessa* L.). *J. exp. mar. Biol. Ecol.*, 12 : 79—102.
- Ikemoto, R., H. Sudo and F. Kato. 1986. Ecology of wild juveniles and reared-and-stocked fry of Japanese flounder in Shijiki Bay*. *Progress Rep. Mar. Ranching (Flatfishes)* (S. 59 & 60), *Seikai Reg. Fish. Res. Lab.* : 25—35.
- Jones, A. 1973. The ecology of young turbot, *Scophthalmus maximus* (L.), at Borth, Cardiganshire, Wales. *J. Fish Biol.*, 5 : 367—383.

- Lockwood, S. J. 1972. An ecological survey of an 0-group plaice (*Pleuronectes platessa* L.) population, Filey Bay, Yorkshire. Ph. D. Thesis to the University of East Anglia, 169 pp.
- Lockwood, S. J. 1974. The settlement, distribution and movements of 0-group plaice *Pleuronectes platessa* (L.) in Filey Bay, Yorkshire. J. Fish Biol., 6 : 465—477.
- Minami, T. 1987. Early life history of flatfishes—XI. Nursey ground. Aquabiology, 9 : 408—414 (in Japanese).
- Riley, J. D. 1971. The Riley push-net. p. 286—290 in Holmes, N. A. and A. S. McIntyre (eds.). Methods for the study of marine benthos. Blackwell Scientific Publication, Oxford.
- Riley, J. D. and J. Corlett. 1966. The numbers of 0-group plaice in Port Erin Bay, 1964—66. Rep. Mar. Biol. Sta. Port Erin, 78 : 51—56.
- Senta, T., M. H. Amarullah and M. Yasuda. 1989. Invitation to the study of juvenile fishes occurring in surf zones. Proc. Symp. Develop. Mar. Reso. Intern. Coop. Yellow Sea and East China Sea, Oct. 19—22, 1988, Cheju, Korea, (in press).
- Senta, T. and I. Kinoshita. 1985. Larval and juvenile fishes occurring in surf zones of western Japan. Trans. Amer. Fish. Soci., 114 : 609—618.
- Sudo, H., M. Azeta and R. Ikemoto. 1985. Distribution and feeding habit of juvenile and young Japanese flounder in Shijiki Bay*. Progress Rep. Mar. Ranching (Flatfishes) (S. 57 & 58), Seikai Reg. Fish. Res. Lab. : 25—30.
- van der Veer, H. W. and M. J. M. Bergman. 1986. Development of tidally related behaviour of a newly settled 0-group plaice (*Pleuronectes platessa*) population in the western Wadden Sea. Mar. Ecol. Prog. Ser., 31 : 121—129.
- Yusa, T., K. Kyushin and C. R. Forrester. 1977. Outline of life history information on some marine fish. Res. Inst. N. Pac. Fish., Hokkaido Univ., Spe. Vol., 123—173.
- (* the title is originally given in Japanese and put into English by us)

汀線付近におけるカレイ目稚魚採集具 R-H Push-net

M. H. アマルラ, 千田 哲資

砂浜海岸の汀線付近に出現するカレイ目稚魚の生態研究の目的で製作した押し網の詳細について図示・記述するとともに、この網を使つての採集結果の一部を紹介した。これは Riley push-net を改造したもので、1.5mのビームとスキーを備えたものであり、汀線から水深1mまでの範囲で使用できる。ヒラメを始めとして各種カレイ目稚魚の採集に効果的であったのみでなく、碎波帯に生息する浮遊性仔稚魚についても、成長して近底生性となった稚魚をよく採集できた。