

Skipjack larvae and juvenile research project in the Tropical waters by Japan

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1. Introduction

The research on the early life history of fish provides the principal information on population dynamics. In recent years, total catch of skipjack in the tropical western Pacific had increased and amounted to 800,000 mt. Japan has yielded about 150,000 mt of skipjack annually around Japan as well as fishing in the tropical waters as the distance water fisheries nation. We consider that it is important to accumulate the biological data on skipjack at spawning and early life stages in their main reproduction area. Since there was no effective sampling method for juvenile and young skipjack and tunas so far, biology and ecology of these fish had not been studied very well. Larvae net and small size trawl net were regarded as not appropriate sampling gears for skipjack and tropical tunas more than 10 mm in body length. Some experimental drift gill net operations were tried to catch young skipjack but scarcely obtained target specimens in 1984-1986.

Since 1992, TNFRI has conducted the research on juvenile skipjack in the tropical western Pacific using the high speed mid water trawl net. Here we present the outline of our research and the coming cruise plan in October - December, 1996.

2. Mid water trawl net configuration

We had developed a high speed midwater trawl net (TANSYU) for sampling juvenile and young skipjack (Fig. 1). The total length of the net is 71.6 m and the estimated mouth opening is 18 m height, 20 m width. The net can be towed at 4-5 knots. The stretched mesh size is 1,000 mm at the mouth and diminished successively to 60 mm at the codend. The inner net of 8 mm mesh size was attached inside the codend. The net-depth recorder (Furuno FNR200) is used to monitor the mouth height and the depth of the net.

3. 1992-1995 research

Research cruises in 1992-1995 were carried out from late October to early December in each year. The research area was the offshore waters of Palau and Federated states of Micronesia in the tropical western Pacific (Fig. 2). One hour trawlings were conducted four times a day during daytime as well as night time. Oceanographic observations using the CTD were made at every trawling stations. Current direction and velocity data were collected by the Acoustic Doppler Current Profiler (ADCP) while under way (Fig.3). The research area were composed mainly of two current zones. The northern area, usually north of 10 N, belonged to the north equatorial current zone. The area between 4 N and 10N belonged generally to the north equatorial counter current zone.

A total of 402 operations were made during four years cruise and 6,143 skipjack and 1,209 tunas were caught (Table). Skipjack were caught at 49.3 % of total operations and tunas were caught at only one fourth operations. Once, 1,163 skipjack were caught at a operation but the average number of fish caught per one operation was 15.3 individuals for skipjack. That of tunas was 3.0 individuals. The range of the body length of skipjack caught was from 7.0 mm to 171.6 mm and 92 % of skipjack were less than 50 mm in fork length (Fig. 4). Skipjack more than 100 mm in fork length were caught only at night time towing and there were only a few fish at one operation. The body length distribution of tunas was similar to that of skipjack.

Skipjack were distributed widely in the research area and tunas showed limited distribution compared to skipjack (Fig. 5). For both species, southern part of the research area tended to be much abundant. Skipjack were collected in the upper 200 m of the water column and tunas were restricted upper 140 m (Fig.6). The mode of vertical distribution of skipjack was 80-100 m depth layer, on the other hand most tunas were caught in the 0-20 m depth layer.

Otolith of skipjack sampled has being examined to study age and growth. After morphological measuring, stomach of skipjack were removed and stored separately for stomach contents study. Fatty acid of larvae skipjack are also analyzed by the lipid chromatographic resolution in order to study the Docosa Hexaenoic Acid production process. All these biological analysis are under processing now. Specimens except for skipjack and tunas are being examined by cooperative institutes etc.

4. 1996 research cruise

In previous four years research we had collected successfully biological samples, especially skipjack and tuna larvae. This year is the 5th year of this research project and the purpose of this year's research is to accumulate detailed oceanographical information in the research area. We will assign two research vessels, one for mainly biological sampling by the midwater trawl net and another one for oceanographical observation. Research area will be same as these of previous year's research, encompassed between 2N and 20N, 130E and 160E, except the 200 miles zone of the country without a permission of the Government (Fig. 7).

Research vessel engaging in biological sampling is Omi Maru (403 GT, 49.6 m length) and cruise is planed to be from 24 October to 15 December. Fourteen trawl stations are arranged along the north-south track lines in the research area. The midwater trawl net will be used to catch juvenile and young skipjack at various depth strata between surface and 500 m. Samples of larva skipjack will be collected by oblique tows of the bongo net and the larva net between surface and 200 m. Daytime and nighttime tows are carried out for these sampling. The CTD will be used to observe temperature and salinity between surface and

1,000 m at each trawl stations. The XBT will be also used occasionally. Adult skipjack will be caught by the hook and line on the trip between trawl stations and body length, body weight, stomach contents, and gonad will be examined. One scientist from TNFRI will be onboard.

Wakataka maru (692 GT, 57.7 m length) will conduct oceanographical observation during 10 November and 11 December. Oceanographic observation stations are arranged at each 30 nautical miles along the track line in the research area. Temperature, salinity and dissolved oxygen are observed by using the CTD between surface and 1,000 m. Biochemical factors including nutrient and chlorophyll are also measured by using the Carousel Water Sampler and analyzers. The MOCNESS system tows will be carried out at various depth strata between surface and 200 m. The current direction and velocity between surface and 600 m will be observed by the ADCP system while under way. Three scientists from TNFRI will be onboard.

Results of these research cruise and further analysis of biological samples will contribute to the development of scientific knowledge for skipjack in the tropical western Pacific and will advance the population study of skipjack and tropical tunas in the world wide oceans. We wish to thank the Palau Maritime Authority and the Micronesian Maritime Authority for their cooperation and allowing us to conduct the research in their EEZ.

Table. Results of collection of juvenile-young skipjack (SKJ) and *Thunnus spp.* (THS) by the midwater trawl net in 1992-1995.

Year	Number of tows	Rate of successful catch (%)*		Total catch (inds.)		Catch per tows (inds.)	
		SKJ	THS	SKJ	THS	SKJ	THS
1992	108	40.7	14.8	324	356	3.0	3.3
1993	121	51.2	30.6	1,232	255	10.2	2.1
1994	98	58.2	37.8	1,662	463	17.0	4.7
1995	75	46.7	26.7	2,925	135	39.0	1.8
Total	402	49.3	27.4	6,143	1,209	15.3	3.0

* (Number of tows that juveniles were caught) / (Number of total tows)

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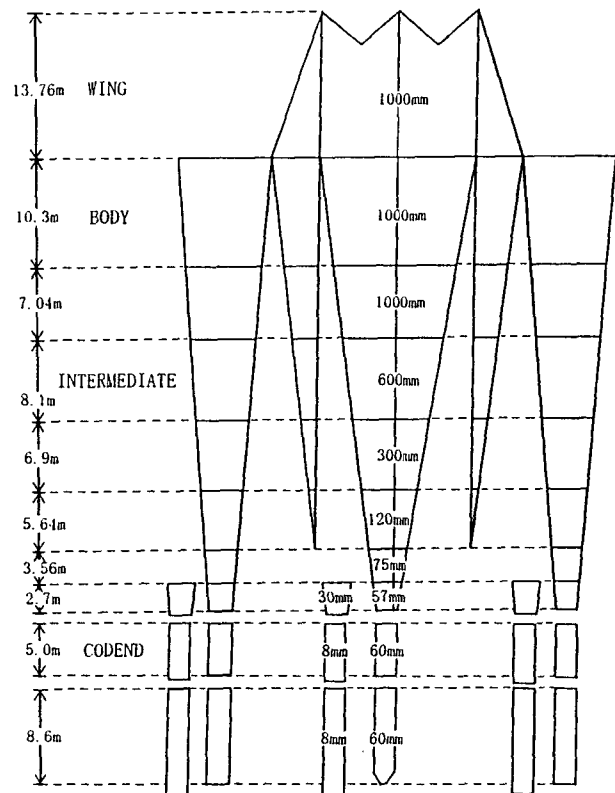


Figure 1. The diagram of the midwater trawl net, TANSYU

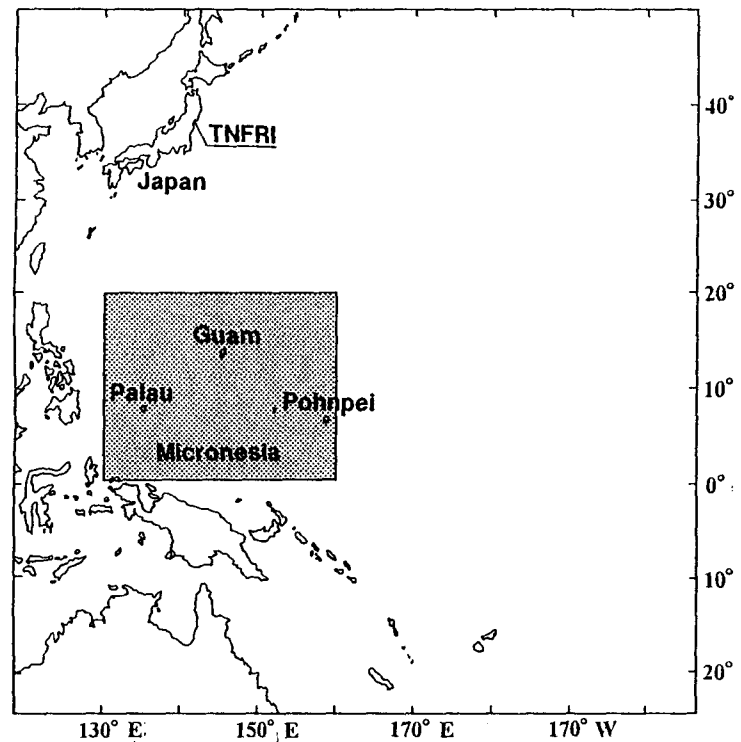


Figure 2. Research area

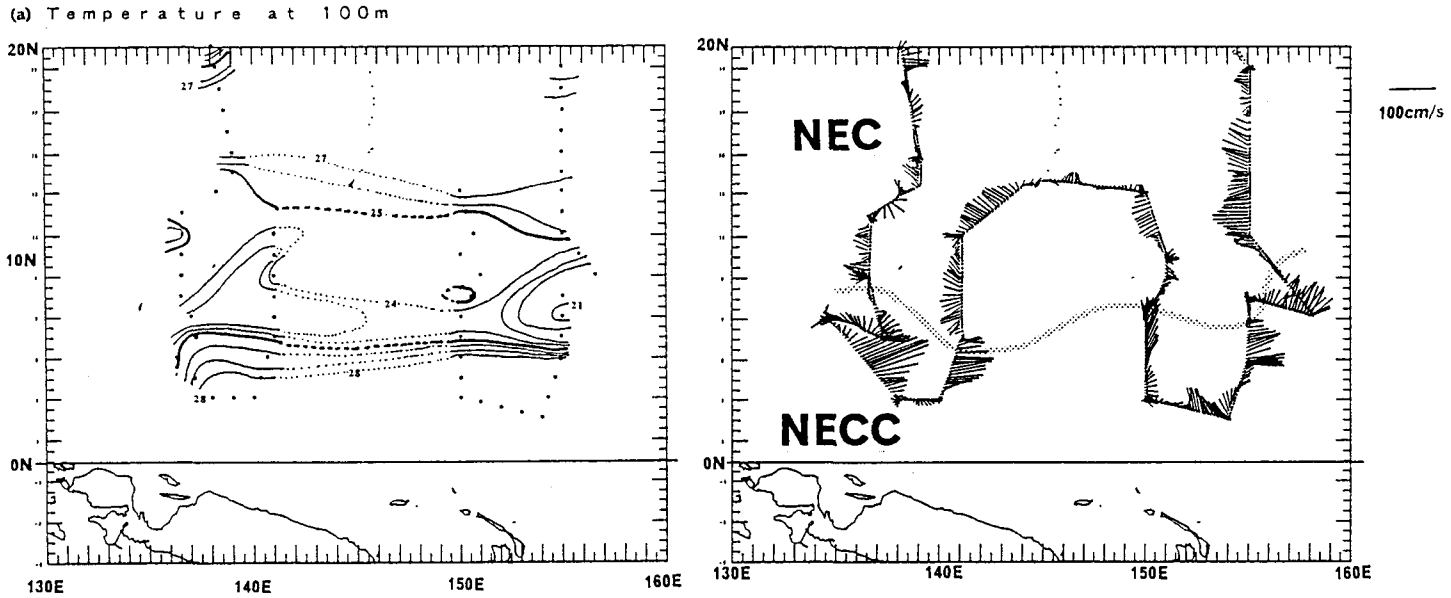


Figure 3. The temperature distribution at 100 m depth layer and the current velocity field on the sea surface. Dotted line shows the boundary between the north equatorial current (NEC) and the north equatorial counter current (NECC).

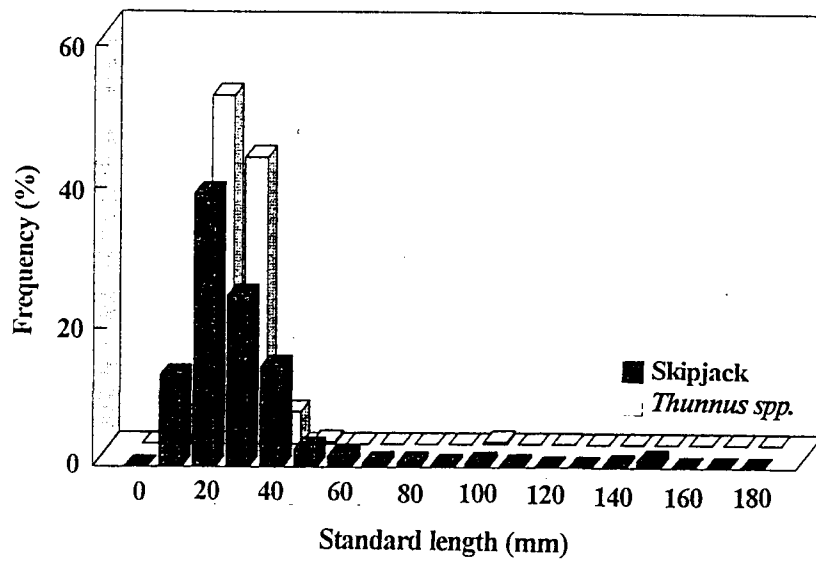


Figure 4. Length frequency distributions of juvenile skipjack and *Thunnus spp.*

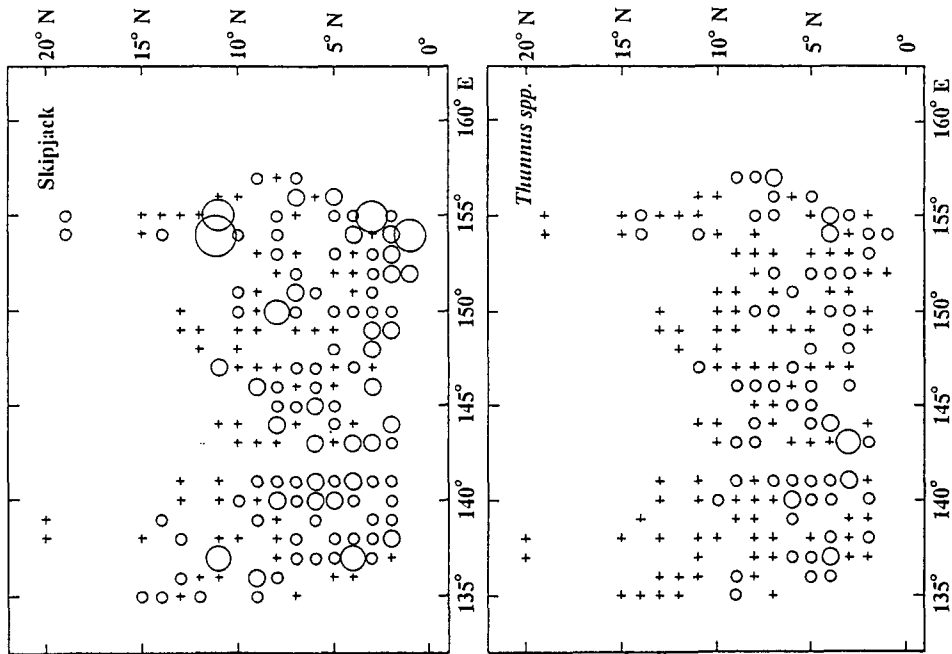


Figure 5. Horizontal distributions of juvenile skipjack and *Thunnus spp.* in the tropical western Pacific, Oct.-Dec. 1992-1995

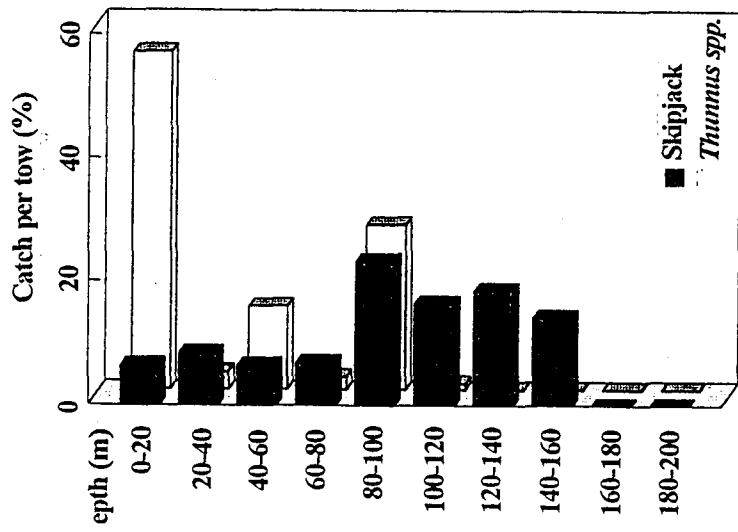


Figure 6. Vertical distributions of juvenile skipjack and *Thunnus spp.*

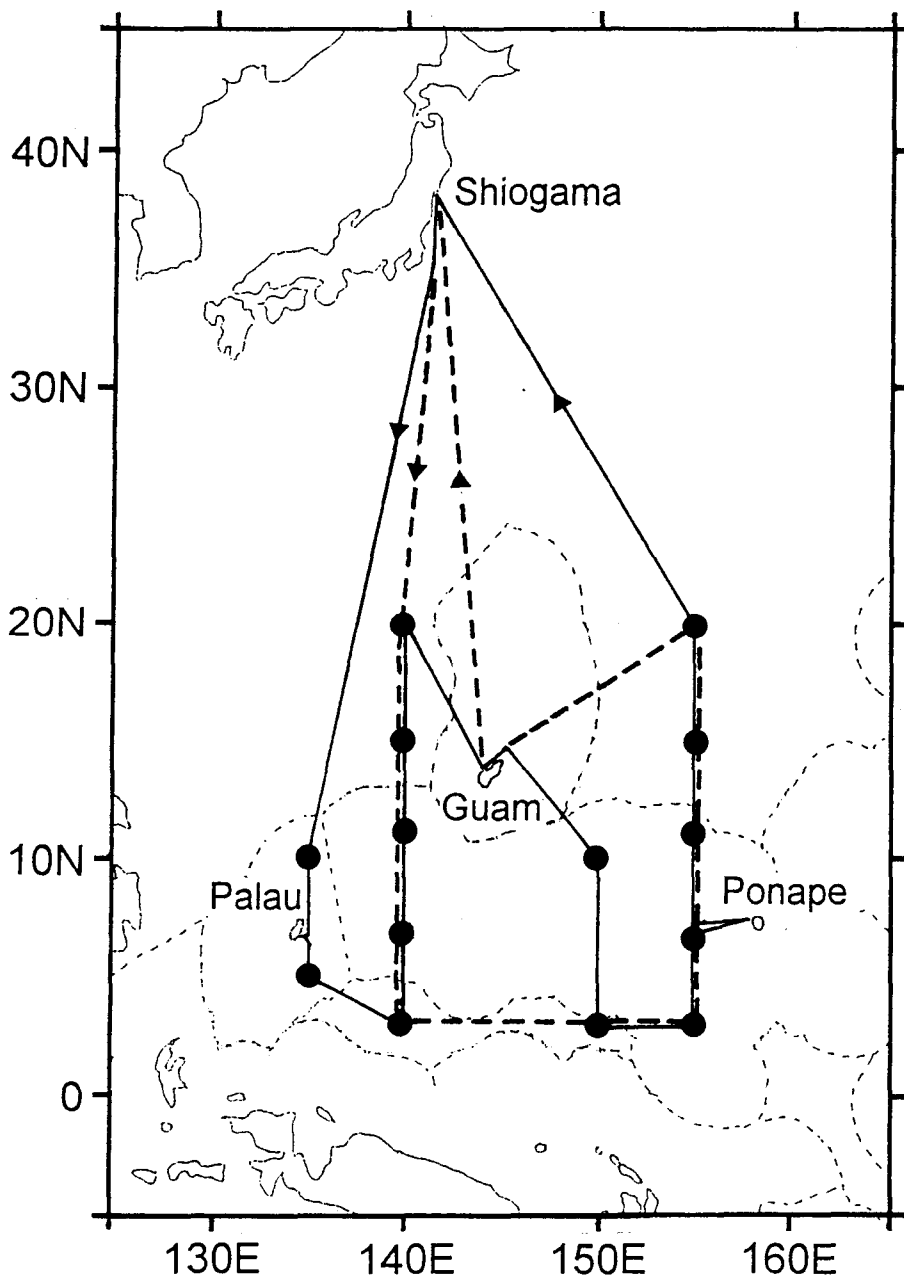


Figure 7. Proposed cruise tracks of *R/V Omi maru* (solid line) and *R/V Wakataka maru* (dashed line). Closed circles indicate trawl stations.