PRELIMINARY REPORT ON A MIGRATION OF FISH IN THE JAVA SEA

by

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One of most important fisheries in the Java-sea is that on the l a j a n g, a *Decapterus*-species (*Carangidae*), the Indian equivalent of the European horse-mackerel. What is called l a j a n g by the natives is not one single species but a mixture of some two or three, which are very alike. In the wellknown book on the Indo-Australian fishes by WEBER and DE BEAUFORT four species are mentioned.

The occurrence of a fifth is certain however and judging from the distribution of two more species as mentioned in the rather scattered literature the occurrence of a sixth and even of a seventh is probable, provided that all statements are true, which I doubt! As a matter of fact I suppose that the systematics of the genus badly need a revision. The systematics of the genus *Decapterus* however are not the object of this paper. A discussion of this will have to be postponed. As the biology so far as known of the different species is in general about the same we will treat them here as a single one.

The l a j a n g seems to be a fish which lives in the clear waters of a high salinity of the ocean and of the deep seas in the eastern part of the Indo-Australian Archipelago. In the shallow Java-sea mostly young, immature specimens are found though they may grow here to maturity and may even spawn. The latter is the case at least in the eastern part of the Java-sea bordering upon the deep Flores-sea with its oceanic water. I am not sure however that all species reach maturity in the Java-sea, at any rate not in its western part, which is fundamentally different from the eastern half as we shall see later on. Really full grown specimens, which may attain twice the length of beginning maturity are seldom if ever caught in the Java-sea. All records at my disposal are from the bordering deeper water.

In general we may say that l a j a n g is not caught nearer than about twenty miles from the coast. The l a j a n g is a fish from the open sea with pelagic habits, which is not really at home in the Java-sea, though some parts may suit him to a certain degree when the circumstances (clear water of a sufficient salinity) are favourable. L a j a n g in the Java-sea is of oceanic origin therefore [1]).

[1]) With "oceanic origin" is also meant the Flores-sea which has oceanic conditions. Dr. SUNIER, formerly head of the Laboratory for Investigation of the Sea, had come independently from me to the same conclusion, as he informed me by word of mouth.

is not confined to the vicinity of the Thousand Islands (see above) but found elsewhere too and the more to the East earlier as can be expected.

When the Eastmonsoon gives way to the Westmonsoon the l a j a n g will wander reversely into an eastward direction, since in the Westmonsoon the Java-sea will gradually be filled up with water of a lower salinity which is unsuitable to the l a j a n g. Gradually but surely the l a j a n g will be driven again to its original home in the eastern part of the Java-sea and beyond.

When considering now the currents in the Westmonsoon more in detail, we see in the first place a strong current coming out of the South Chinese Sea through the Gaspar and Karimata Straits. This currents bends to the East and flows South of the coast of Borneo where it will be strongest and as it will flow out more or less fanlike it will reach the Java coast too. This influence will be more obvious farther to the East. And as a matter of fact along the coast of Middle Java young l a j a n g is caught before the bigger ones, just like during the East Monsoon (see below also).

From the Indian Ocean through the Sunda Straits a rather small current with clear water of a relatively high salinity comes into the Java-sea. This current flows quite near the northcoast of Java where it will find — as was the case with the currents from the East — the Thousand Islands as a barrier in its way. The Sunda Straits current has to divide into a southern and a northern branch. In each branch l a j a n g can be caught in a greater or lesser quantity in the months from December to March. Just as in the east monsoon the lajang went westward it now goes eastward for the same reasons as given above. Parts of the Java-sea are becoming suitable to the l a j a n g now by this Sunda Straits current.

From what has been said above two conclusions can be made:

1. In the Java-sea we have to distinguish at least two groups of l a j a n g, which we may call provisionally e a s t- and w e s t l a j a n g. In the Eastmonsoon it is therefore the e a s t l a j a n g which comes into the Java-sea and this e a s t l a j a n g moves from the East to the West. The Westmonsoon drives this e a s t l a j a n g back again to the East, whereas w e s t l a j a n g now enters the Java-sea from the Sunda Straits moving to the east.

2. The fisheries of l a j a n g are in the eastern part of the Java-sea fundamentally different from those in the western part. In the western half the fisheries are dependant from a stock of e a s t- and of w e s t l a j a n g. We shall have a bad year when one of the two groups stays away or in other words, when one of the two groups does not move sufficiently to the East or to the West which will happen when West- or Eastmonsoon fails. The fisheries in the eastern part of the Java-sea depend only on the stock of e a s t l a j a n g. Here also sometimes the l a j a n g will wander to and fro somewhat, which may explain occasional periods of scarcity.

Whether the two groups of l a j a n g are at any time separated from each other or whether their boundaries may be confluent or are even surpassing each other in some years is not quite known thus far. The solution of these

problems will depend from further studies. I suppose all three possibilities given above may be true. Analyses of the catches will serve us a good deal as the composition of the catches consisting mainly of lajang is not the same. The admixtures in the catches of east or westlajang are different in some cases. Furthermore race investigations should be started. This cannot be done however before the systematics of the genus have become entirely clear (see above).

Besides eastlajang and westlajang there is perhaps a third group which is more or less hypothetical so far and which I will call northlajang. This northlajang will be found only in the Java-sea during the Westmonsoon and has its origin in the South Chinese-sea. During the Westmonsoon this group enters the Java-sea together with the currents of those months through the Gaspar- and Karimata Straits. In consequence this northlajang will have its main centre of distribution in the northern part of the Java-sea at some distance from the coast of South Borneo and from here it may gradually move southward where it may come in the vicinity of the Java coast. According to the currents this lajang will not be found along the north coast of West Java near Batavia and the Thousands islands, but it may occur near shores of middle Java.

I have the following arguments for a possible existence of this northlajang.

a. According to fishermen from Middle Java in some years young lajang may be caught in December or January, which is at first rather far out at sea but which gradually comes nearer. Later on bigger specimens are caught, which are the same phenomona as in the Eastmonsoon. It is obvious that this young lajang is now coming from the north or northwest in accordance with the currents. A West-East movement along the coast is not mentioned by the fishermen and therefore the lajang cannot have come with the Sunda Straits current. Moreover hydrographical observations show us that this current is not strong enough to manifest itself so far to the East.

b. During the Westmonsoon an about triangular patch of water of a lower salinity is found in the western part of the Java-sea. This triangle has its base on the shore line of Sumatra and Banka and its top at some distance east of Etnadroogte. No lajang is found in this patch of water. To the South near the Javacoast the westlajang will occur as has been shown above. To the North there are no regular fisheries but experimental fishing brought home some lajang. This lajang cannot be anything but northlajang. It cannot be westlajang as in that case it should have swum through a great distance of water not suitable to it and it is not likely too that the lajang should have rounded the top of the triangle coming from the South. Eastlajang it cannot be either as this group is in these westmonsoonmonths already far away to the East. So the only possibility is to assume a group of northlajang. How far this northlajang will

come eastward and whether it will mix with west- or eastlajang is of course not yet known. Further investigations will have to show this.

Summary:

1. The principal winddirections in the Java-sea are a consequence of the monsoons prevailing in these regions. The Eastmonsoon — better South-East-monsoon — prevails half a year from May to October and the Westmonsoon — better North-West-monsoon — the other six months.

2. The currents or drifts in the shallow Java-sea coincide with the monsoons. In the Eastmonsoon water of a high salinity flows from the Flores-sea into the Java-sea to leave it again through the Sunda Straits in the Southwest and through the Gaspar- and Karimata Straits in the Northwest. During the Westmonsoon the currents are just the reverse coming in through the above-named straits in the western part of the Java-sea and leaving it again in the East into the Flores-sea.

3. The lajang (*Decapterus* species) is a fish living only in water of a rather high salinity (not lower perhaps than 32 ‰), not really at home in the Java-sea but which may live there, provided the conditions are suitable which is for instance the case when the above-named currents bring in water of a sufficient salinity.

4. In the Eastmonsoon a stock of so-called eastlajang swims into the Java-sea from the Flores-sea, reaches its most western parts and may even leave it through the Sunda-, Karimata- and Gaspar Straits. This last however is only hypothetical so far.

5. In the Westmonsoon a stock of so-called westlajang enters the Java-sea through the Sunda Straits from the Indian Ocean. It will be found near the shores of West Java only.

6. In the Westmonsoon a stock of northlajang may occur in the Java-sea too. This northlajang will enter the Java-sea through the Gaspar- and Karimata Straits and has its origin in the South Chinese-sea. It is rather hypothetical thus far but some arguments speak in favour of its existence.