VARIATIONS IN FISH CAPTURABILITY WITH A GILL-NET GANG
Oral communication presented by V. Bénech

Introduction

We have used a gill-net gang for sampling fish communities in lake Chad Basin. Gill-nets are a very useful fishing gear in inland waters because they can be set in a lot of very different conditions (lake, rivers, pond etc...). But they have also several disadvantages. Because they are a passive gear, the catches depend essentially on fish behaviour. This is the origin of important inter- and intra-specific variations in fish capturability.

To evaluate these variations in fish capturability, we conducted an investigation into multispecies sampling in an ox-bow pond. After 30 nights fishing with 12 gill-nets, the residual fish stock was found by exhaustive fishing operations such as trawling, seining and finally by poisoning with rotenone. Thus, the initial stock of each species was found and this permitted the evaluation of capturability by the following ratio :

$$\text{Capturability} = \frac{\text{Number of catches}}{\text{Initial number of fishes in the pond just before the fishing operation}}$$

Pond and experimental design

The pond of Nangoto is an ox-bow pond filled each year by the Shari river during its flooding period. It is 400 m long, 55 m wide and 1.8 m deep.

The fish community we studied was composed of thirty four species of mainly juveniles, for this reason we only used small meshes : 10 to 30 mm meshbar.

Each net was 25 m long and 2.8 m high with a hanging coefficient of 50%.

The gill-nets hung from the water surface to the bottom of the pond and were set in the same manner for the 30 successive nights fishing. They were put out at 5 p.m. and taken in at 6 a.m.

In the context of this experimentation on fish capturability with a constant fishing strategy (called "efficiency") it would be more precise to speak about fish "vulnerability" which is a component of capturability.

- capturability
  - disponibility (all fish-gear interactions except fisherman skilfulness)
    - accessibility (presence on fishing grounds)
    - vulnerability (avoidance and escaping possibilities)
  - efficiency (fishing strategy)

Results :

First we will present the interspecific variation in fish capturability after the total catches during the 30 nights. Then we will present the different patterns for daily capturability during the fishing period.

* Total catches from the gill-net gang for the 30 nights fishing period

This is a table of species ordered following decreasing capturability which is represented by the histograms. Capturability is expressed as the percentage of the catches (C) during the 30 nights fishing period versus the initial number of fishes in the pond (N).

You can see that total catches range from less than 1% of the Tilapia stock to more than 70% for the ichthyophagous stocks of Lates or Ichthyborus.

Generally the ichthyophagous species - indicated with a star on this table - are the most vulnerable species to the gill-net gang whatever their diel rythm or ecology.

The hanging coefficient (50%) is more adapted to slender species than to species laterally compressed like Citharinus or Tilapia. Effectively these last species and especially Tilapia are not very vulnerable to gill-nets.

However, in non-predatory species with similar slender morphology, there may be a large range in capturability as you can see in comparing Alestes nurse and Alestes dentex.

Within the genus Synodontis, the capturability varies within a range 3.8 to 9.5% without a clear relationship to the species behaviour - that is to say benthic or pelagic behaviour - or to the diel activity.

The two Synodontis species situated at the bottom of the table have a capturability half of their pelagic or benthic homologous species situated higher in the table.

Fishing essentially during the night period with a passive gear whose catches depends on fish activity led us to expect a straightforward difference between day and night species. It is not clear cut. Except the ichthyophagous species which are mainly crepusclar or nocturnal, the diurnal or nocturnal non ichthyophagous species - respectively yellow and blue coloured in the table - spread along all the same range of capturability. In the case of Synodontis, in-spite of a more nocturnal behaviour H. membranaceus presented a weaker capturability than Brachysynodontis batensoda which is crepuscular.

We have just seen that the predatory regime is a major characteristic in the degree of capturability in the different species of the fish community. It is evident that gill-netted fishes attract predators ; conversely the preying action of predators might encourage the capture of prey species.

In our experimentation the elimination of a high proportion of ichthyophagous predators (50% within 8 days in Ichthyborus) might

induce an important reduction in the preying effort. The prey species becoming less disturbed might become more careful to avoid gill-nets.

Species relationships certainly play a major role in their capturability with gill-nets. And the probability of catching species X in a fish community might not be necesserily the same as in the case of another fish community with a different species composition.

We will see now the different patterns of daily capturability during the 30 nights fishing period. Unfortunately the effect of the change in the community structure cannot be dissociated from the fishes experience of avoiding gill-nets.

* Patterns of daily capturability

The fishes experience for gill-net avoidance is certainly influential in such an experiment in a confined area submitted to a constant and relatively intensive fishing effort during 30 successive nights.

In predatory species the capturability is very high on the first night (more than 10%). Then chronologically two different patterns emerge :
- In Lates, the capturability remained relatively constant from the second night onward
- The capturability decreased both in Ichthyborus and Schilbe but more straightforwardly in Schilbe (from 10% to less than 1% within 5 days).

In non-predatoy species which were less vulnerable to gill-nets, the evolution of capturability has no straightforward tendency.
- There is a decrease in Alestes nurse and Alestes baremoze during the first nights.
- but in Citharinus citharus and Synodontis schall there is no tendency of decreasing capturability and there is especially an absence of higher capturability in the first night.
- In Labeo senegalensis there are two peaks which are associated with a half lunar period. In other sampling programs we have noted that L. senegalensis is a species whose activity is related to moon phases.
- Finally we note the original case of Brachysynodontis batensoda with its slight tendency for increasing capturability.

Conclusion

In conclusion we emphasize the magnitude of variation in fish capturability with a gill-net gang.

The interspecific variation could lead to large biases in estimation of community structure with an overestimation of predators.

At the intraspecific level, with the change in community structure and/or development of fish experience, the induced variation of capturability could lead to non comparable CPUE in space or time. We note too the inadequate method of De Lury when using gill-nets.

Finally, it is interesting to note that fish capturability with gill-nets originates in factors of different nature and level of integration, whose interaction gives rise to an overall very complex picture.

Fish capturability depends on fish morphology which is an individual and mechanistic aspect. It depends on behaviour integrated in life history and at the populational level. And lastly it depends on interactions of different species integrated behaviour in the community structure.

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INTER- AND INTRA-SPECIFIC VARIATIONS IN FISH CAPTURABILITY WITH A GILL-NET GANG

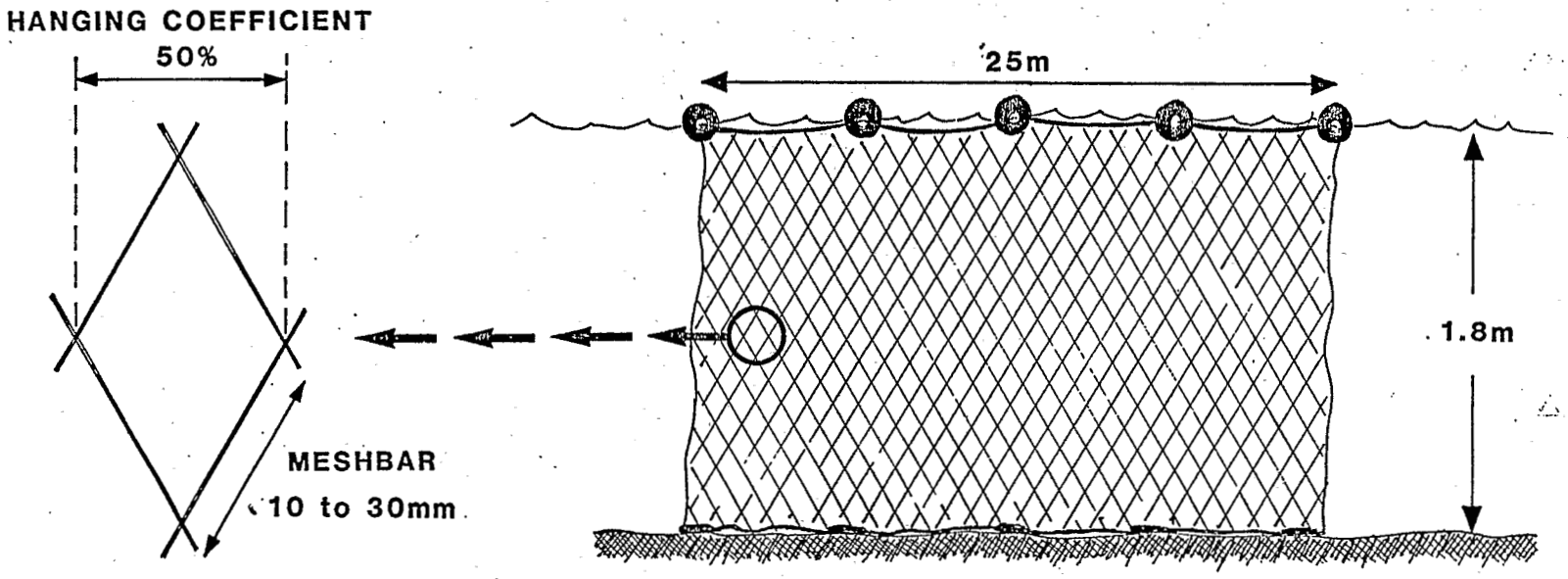
An investigation about multispecies sampling with a gill-net gang was conducted in a tropical ox-bow pond (Chari River, Chad) populated mainly with juveniles. After 30 nights fishing with 12 gill-nets (10 to 30 mm meshbar), the pond was poisoned to evaluate total stock of each species. Total catches by gill-nets ranged from 1% of the "Tilapia" stock to more than 70% of the ichthyophagous stocks (Lates, Ichthyborus). The Synodontis catch varied within a range from 3.8% to 9.5% without a clear relation to the species behaviour (i.e. benthic, pelagic) or to diel activity. There were five patterns for daily capturability during the fishing period : a) rapidly decreasing within 5-10 days, b) stable, c) slowly increasing, d) changes without any apparent trends and e) peacks coinciding with moon phases. Rapidly decreasing capturability (a) could depend on fish experience to avoid gill-nets. The difference between patterns might originate in species interaction, which in turn implies a relationship between species capturability and the fish community structure.

SPECIES	C	N	C / N (in %)
*Lates niloticus	553	643	86.0
*Ichthyborus besse	677	948	71.4
*Gymnarchus niloticus	5	9	55.6
*Polypterus endlicheri	36	70	51.4
*Polypterus bichir	5	12	41.7
*Schilbe mystus	205	496	41.3
*Hydrocynus forskalii	24	82	29.3
Petrocephalus spp.	107	367	29.0
*Malapterurus electricus	6	22	27.3
Distichodus rostratus	89	362	24.6
*Polypterus senegalus	86	380	22.6
*Bagrus bayad	55	247	22.3
Labeo coubie	19	90	21.1
Synodontis eupterus	55	298	18.5
Labeo senegalensis	587	3511	16.1
Alestes nurse	311	2680	11.6
*Clarias spp.	53	486	10.9
Synodontis schall	213	2245	9.5
*Hydrocynus brevis	19	212	9.0
Marcusenius spp.	46	575	8.0
Heterobranchus spp.	2	27	7.4
Brachsysynodontis batensoda	155	2161	7.2
Alestes macrolepidotus	22	335	6.6
Synodontis clarias	13	228	5.7
Auchenoglanis spp.	18	334	5.4
Chrysichthys auratus	9	174	5.2
Hyperopisus bebe	5	96	5.2
Citharinus spp.	345	7136	4.8
Synodontis nigrita	153	3366	4.5
Alestes baremoze	759	16721	4.5
Mormyrus rume	5	131	3.8
Hemisynodontis membranaceus	78	2041	3.8
Alestes dentex	43	3047	1.4
Tilapia spp.	12	2795	0.4

Variations in fish capturability with the gill-net gang after the catches during a 30 night fishing period.

* Ichthyophagous species

GILL-NET CHARACTERISTICS



		Meshbar
Twine	13400 m/kg	10 11 12 13 14 mm
	10000 m/kg	15 16 18 20 mm
	6660 m/kg	22 25 30 mm

Interspecific variation in fish capturability

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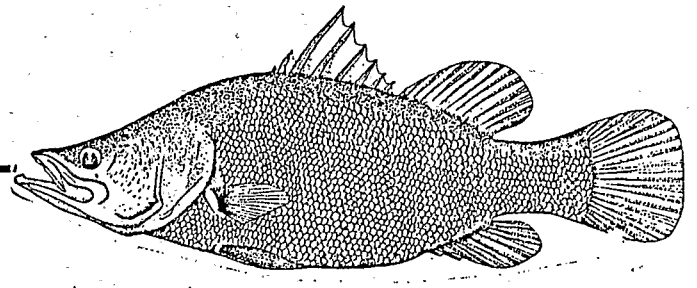
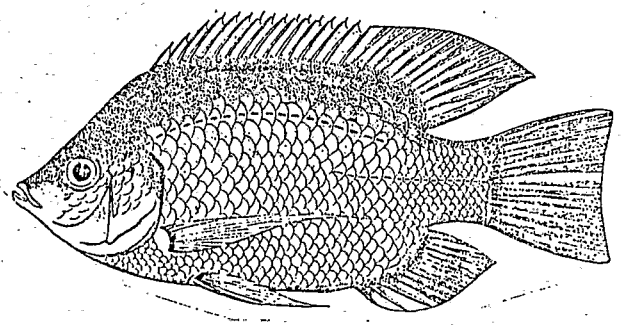
CAPTURABILITY

0 10 50 100%



LATES (Ichthyophagous)



TILAPIA (Non Ichthyophagous)

C : Catches with the gill-net gang during the 30 nights fishing period

N : Initial number of fishes in the pond

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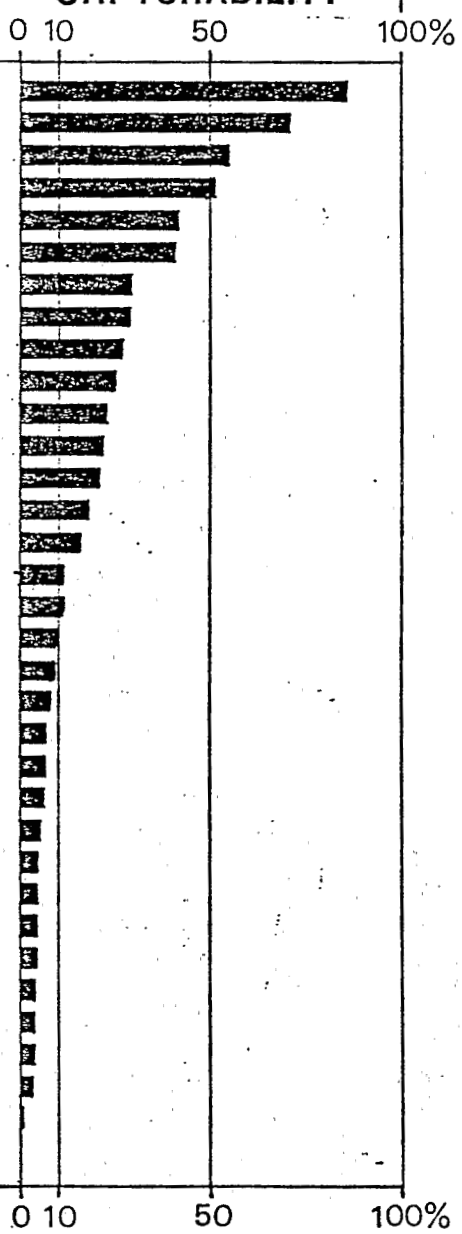

★ ICHTHYOPHAGOUS SPECIES

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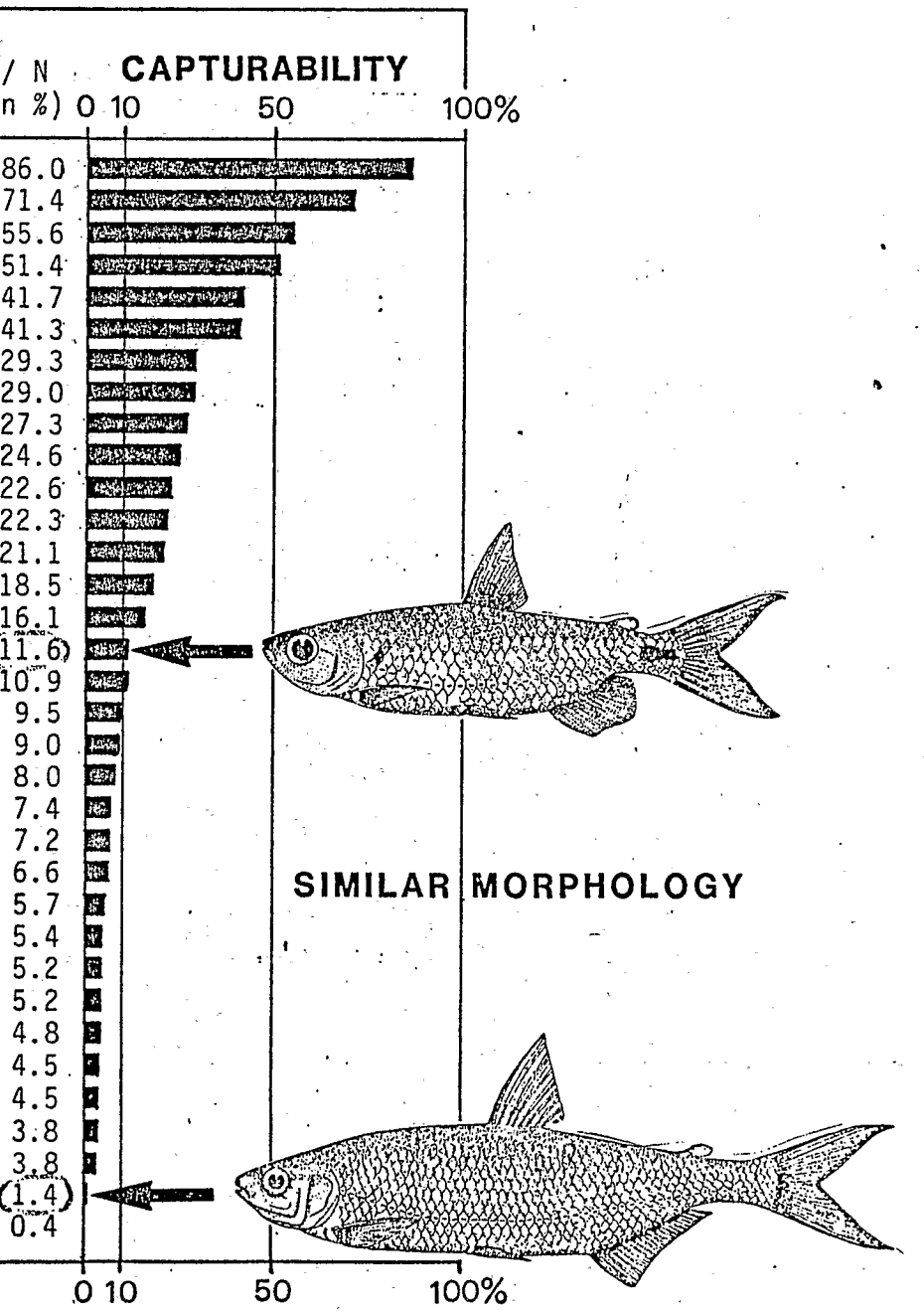

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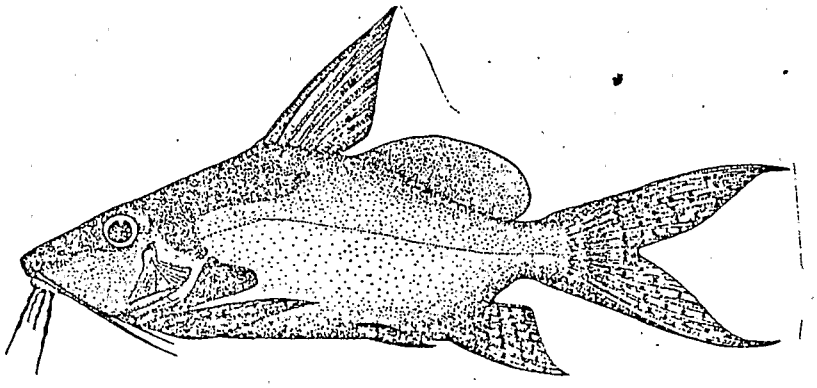
COMPARISON OF THE SYNODONTIS



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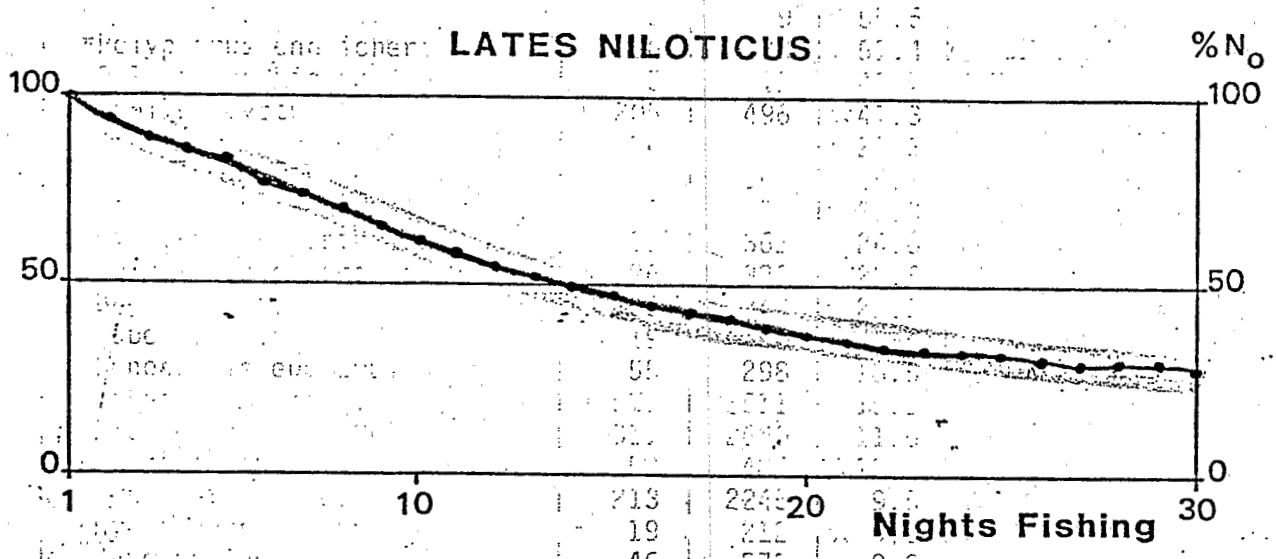
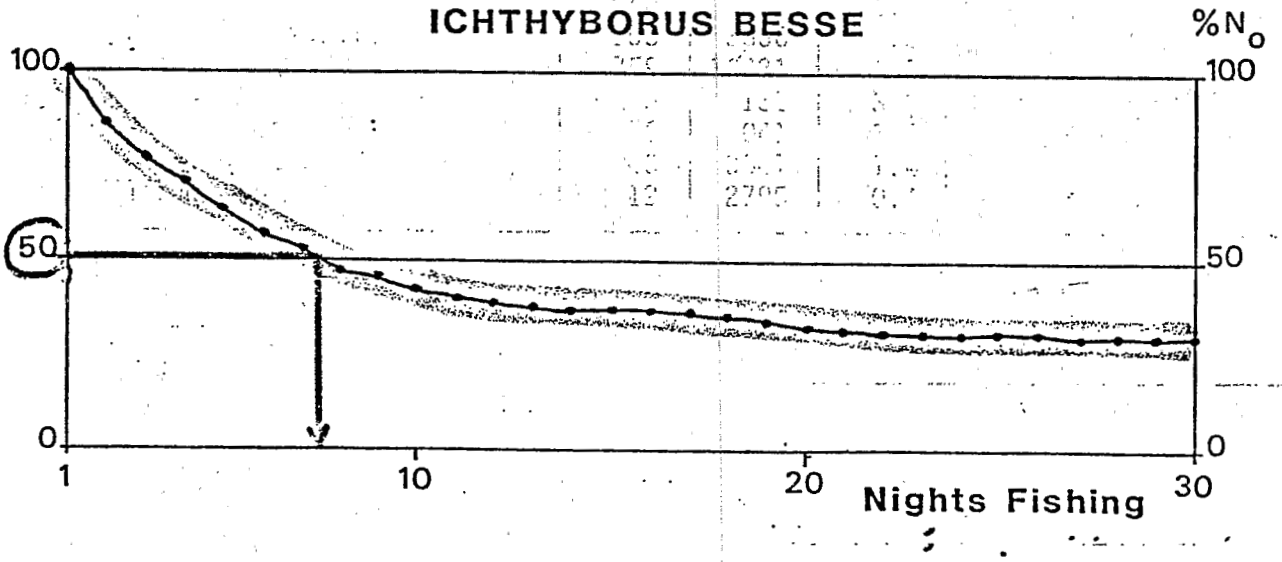
DIURNAL

NOCTURNAL

Pelagic Synodontis

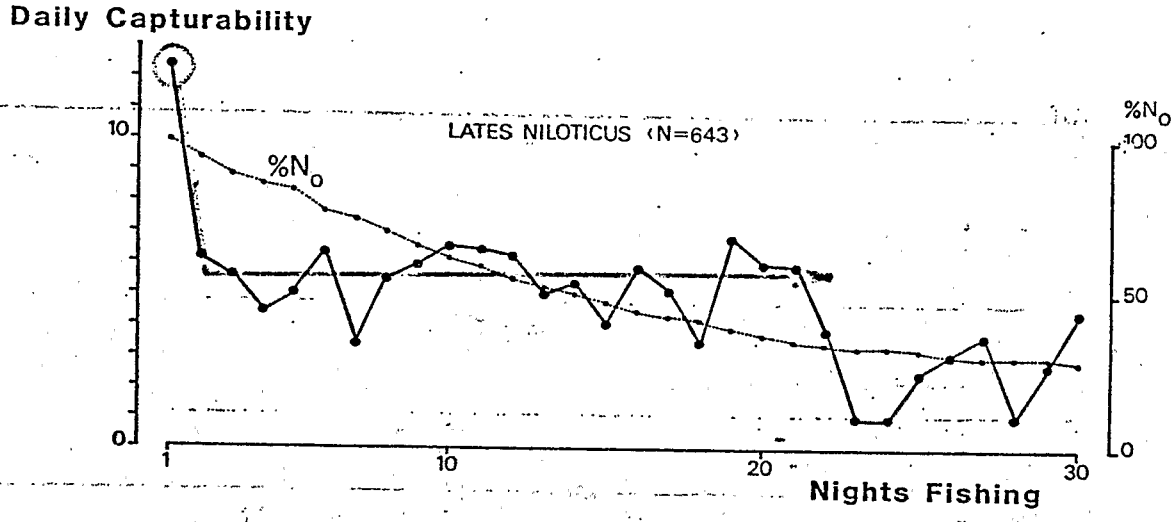
Elimination of ichthyophagous species with the gill-net gang

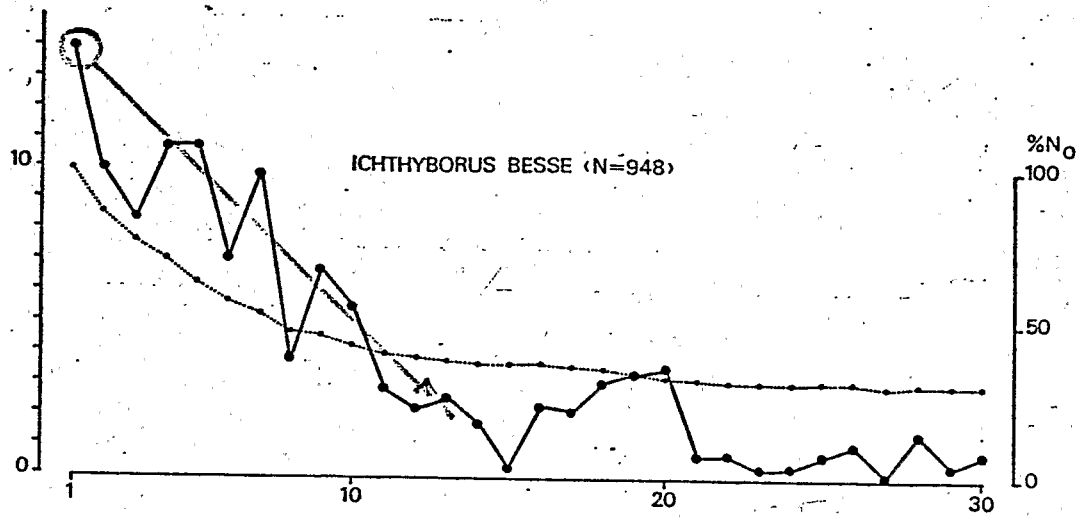


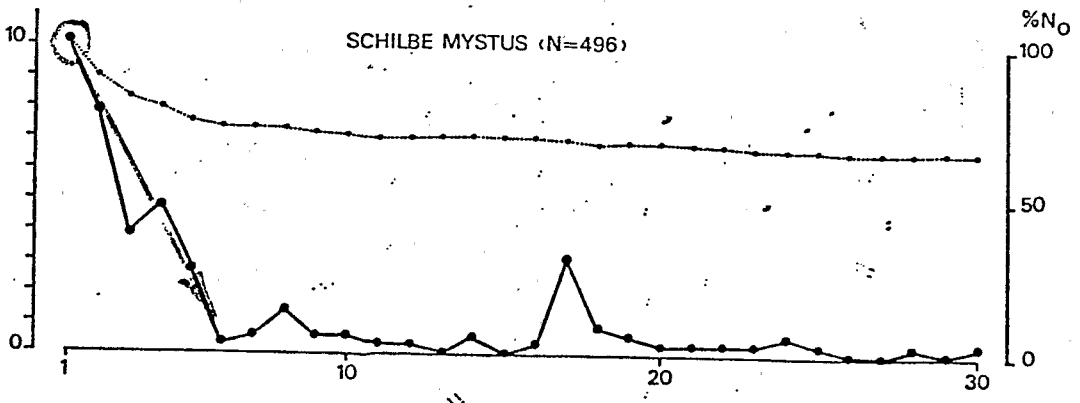


Patterns of daily capturability

ICHTHYOPHAGOUS SPECIES







Patterns of Daily Capturability

NON ICHTHYOPHAGOUS SPECIES