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BACKGROUND PAPER

presented by

R. GRANDPERRIN and B. RICHER de FORGES,
ORSTOM Center, B.P. A 5, NOUMEA, New Caledonia

EXPLORATORY TRAWLING ON SOME SEA MOUNTS IN NEW CALEDONIA

SUMMARY

There are many seamounts within New Caledonia's Exclusive Economic Zone (EEZ). In respect of some of them, simplified mapping has already been done and also two exploratory trawling trips, one by the Japanese in 1980, the other by the French (ORSTOM) in 1986. In the course of these trips, samples were taken at depths between 220 and 690 m., both by day and by night, with trawls of different sizes. The catches in relation to the area of sea bottom being sampled ranged from 8 to 1,429 kg/hectare depending on the size of the trawl, the depth and the time at which the samples were taken. Night fishing trips proved much more productive than day time ones. At depths greater than 500 m., the specific composition of the ichtyofauna changed completely. On the basis of a very rough assessment, it is estimated that the MSY for the whole EEZ would amount to several thousand tonnes of fish a year. Detailed mapping of the area should be carried out, for use as a basis for more complete fisheries surveys.

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INTRODUCTION

Many strings of islands are scattered all over the Pacific. Usually they are the visible evidence of intense volcanic activity around hot spots. This activity led to the erection of basaltic structures which were then, in the course of geological time, subjected to erosion and subsidence and simultaneously to the slow drift of the ocean plates towards the subduction zones (Scott and Rotondo, 1983). Some of these structures emerged from the Ocean as high islands. Others are submerged either because they are still in the process of formation, or because they are slowly sinking as a result of isostasic adjustments; these then form sea mounts or guyots (Figure 1). When their summit is not too far below the surface of the water, these formations are of considerable fishing value for they act both as "fish aggregation devices" for pelagic species and as a habitat for a typical bottom-dwelling ichtyofauna. There must be, in all, several tens of thousands of such formations seamounts in the Pacific (Scott and Rotondo, 1983). Although some have already been located many others have yet to be discovered. Means used to locate them include conventional bathymetry and some modern techniques in particular the use of satellites. Detailed mapping is carried out using multibeam echo-sounders. An international co-operative effort isin the process of being set up in this regard with the object, in respect of fisheries, of determining the position and the topography of the seamounts that could be fished in the EEZ of each of the island countries and territories.

PROSPECTIONS CARRIED OUT IN NEW CALEDONIA

There are many submerged seamounts in New Caledonia's EEZ. The ones situated on the Norfolk and Lord Howe ridges (Figure 2) have already been recorded in preliminary mapping in the course of two exploratory trawling trips, one Japanese, the other French.

In 1980, the Japanese ship Kaimon-Maru spent two weeks surveying trawlable bottoms in the bathyal zone (Barro, 1981; Golc'hen, 1981; Anonymous, 1981). It took samples using a large bottom trawl with a headrope of 80 m. Thirty-nine tows were effected by day and night at depths varying between 220 and 690 m. The total catch for all the hauls amounted to nearly 170 tonnes of marketable species, including *Beryx splendens*, *B. decadactylus*, *E. carbunculus*, *Etelis coruscans*, *Pseudopentaceros japonicus* and *P. richardsoni*. In Table 1, the catches have been broken down into catches per unit of area trawled (in hectares). These areas have been calculated by taking into account the duration of the tows, the speed of the vessel and the actual sampling width of the trawl; this width was estimated to be equal to half the length of the headrope. It will be seen that night fishing produced much more than day fishing at the same depths. The catches taken in deep hauls (i.e. 500 to 690 m. depth) were much larger than those taken in medium depths (220-480 m.). At depths beyond 450-500 m., *Beryx* spp. and *Pseudopentaceros* spp. became the dominant species instead of *Etelis carbunculus* and *E. coruscans*.

In 1986, the CHALCAL 2 dredging and trawling survey conducted with the R.V. Coriolis was devoted entirely to the seamounts of the Norfolk ridge. Six hauls were made out at varying depths, from 220 to 600 m. with two small trawls, a shrimp trawl and a fish trawl, whose headropes were respectively 14 and 17 m. long. 1,325 kg of marketable species were taken. The catches per hectare were smaller than those effected with the large trawl of the Kaimon Maru. As before, deep fishing and especially at night gave the best results.

DISCUSSION

Table 1 shows that the volume of catches depends on the trawl used, the fishing depth and the time of day at which the sampling is done.

While the trawl may be considered the most suitable gear for estimating the biomass of bottom species, the results obtained are nevertheless very much affected by the numbers of fish that escape through the mesh and especially manage to avoid the opening. A large trawl is therefore much more efficient than a small one for the same area of sea bottom sampled. This is probably the main reason for the much greater catches per hectare made by the Kaimon Maru compared with those of Chalcal 2, fishing in identical conditions.

The composition of the ichtyofauna depends on the depth; it seems also that it depends on the shape and size of the summit platform of the seamount as well as on its distance from a land mass (Fujii, 1986). Other factors, such as the hydrological characteristics of a body of water (Uchida and Hayasi, 1986) could have an effect too. The catches obtained with a given type of trawl seem to vary greatly from one seamount to another (Sasaki, 1986), from which it may be deduced that the production potential may also vary greatly from one to another. Such differences are very marked in respect of the Norfolk ridge mounts which appear to be much richer than those of the Lord Howe ridge (Richer de Forges et al. 1986; Richer de forges et al. 1987).

On a given seamount, catches vary greatly depending on whether they are taken by day or by night. These differences reflect the variations in behaviour of fish in the course of the nycthemeral cycle (Humphreys and Tagami, 1986); there are in fact many species which scatter and move away from the bottom during the day and return again as soon as night falls. In addition Seki and Tagami (1986) have shown that the sizes of Beryx splendens caught by handline on the slopes of the seamounts of the Hawaii Islands chain were greater than those caught when trawling on the summit areas of the same seamounts.

The slow growth rate of the species in question (Brouard and Grandperrin, 1985; Koami, 1986), together with the fact that their habitat is often very remote, which means that their numbers are not liable to be swollen by migration, makes some of the species very vulnerable to intensive fishing. This would certainly be the case of the Pseudopentaceros spp. (Sasami, 1986; Koami, 1986; Wetherall and Yong, 1986). Therefore extreme care should accompany decisions to fish favourable sites. Precautions should be taken either in the form of a prior setting of quotas which must not be exceeded or by establishing a system of revolving reserves as advocated by Koami (1986). Moreover, any commercial fishery must of course be based on the results of research to define the biological parameters, which is essential for sound management of the resources.

If one uses the very approximate equation proposed by Gulland (1971) to calculate the maximum sustainable yield (MSY) applicable to virgin stock (1), the data contained in Table 1 leads to quantities ranging from 1 kg/ha/year to 170 kg/ha/year. Making a quick extrapolation of these figures to all the seamounts in the New Caledonian EEZ, but excluding the outer reef slopes bordering the main land and the islands (the area between isobaths 200 and 600 m. is roughly 20,000 square kilometres - i.e. 2 million hectares), one arrives at an overall MSY (maximum sustainable yield) which would be between 2,000 and 340,000 tonnes/year !

The foregoing extrapolation does not take into account the ichtyofauna living below 700 m. It is known, however, that in some nearby areas, in particular in New Zealand, resources fished at these greater depths are considerable. They are essentially made up of Hoplostethus atlanticus (orange roughy), 40,000 tonnes of which were taken in 1985 by 54 fishing vessels (Anonymous, 1987). The fact that a few specimens of these species have been caught on the Norfolk ridge at 500 metres and by day (Richer de Forges and al., 1987), one suggests that it is also present in New Caledonia. Deep trawling exploratory surveys (at depths of 700 to 1,200 m.) will give us an idea of its abundance.

CONCLUSION

Although the tonnages given are certainly open to discussion, the wide range between the highest and lowest values does mean that one can make due allowance for all the reservations mentioned and yet assert that the seamounts of New Caledonia's EEZ have considerable fishery potential. Even bearing in mind the distance and the difficulties of fishing, with gear that is both fragile and costly, on bottoms that are often extremely rugged and for which available bathymetric data is very incomplete, the fact remains that they harbour as yet untapped resources. In point of fact they may already be regarded as areas for occasional longline fishing from light craft in good weather. It is however more likely that they will be fished in the future on an industrial scale with heavy gear. In any event, detailed mapping of the seamounts should be undertaken as of now, so that more complete fisheries surveys can be carried out in the future.

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(1) MSY = 0.5 x Bm x M., where Bm is virgin biomass and M natural mortality. For M, we have taken the figure 0.237 which was obtained by Brouard and Grandperrin (1986) for Etelis coruscans in Vanuatu.

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(1) – Volcan sous-marin en formation au dessus d'un point chaud = stade mont sous-marin. *Active submerged volcano at "hot-spot"*

(2) – Volcan émergé formant une "île haute" autour de laquelle se développe un récif frangeant. *Raised volcanic "high island" with fringing reef.*

(3) – L'île redescendue par subsidence est entourée d'un recif barrière délimitant un lagon. *"Sinking" of the island by subsidence. Lagoon surrounded by a barrier-reef.*

(4) – L'ancien volcan a disparu sous la mer. Les coraux constructeurs ont formé un atoll. *The original volcanic core continues to subside and reef keeps growing. Atoll*

(5) – Si la subsidence est plus rapide que la croissance corallienne, l'atoll s'enfonce et devient un guyot. *Subsidence is faster that reef growth. Guyot.*

(6) – Lorsq'un guyot arrive au niveau de la zone de subduction. Il y disparait par accrétion. *When reaching the subduction zone guyots disappear by accretion*

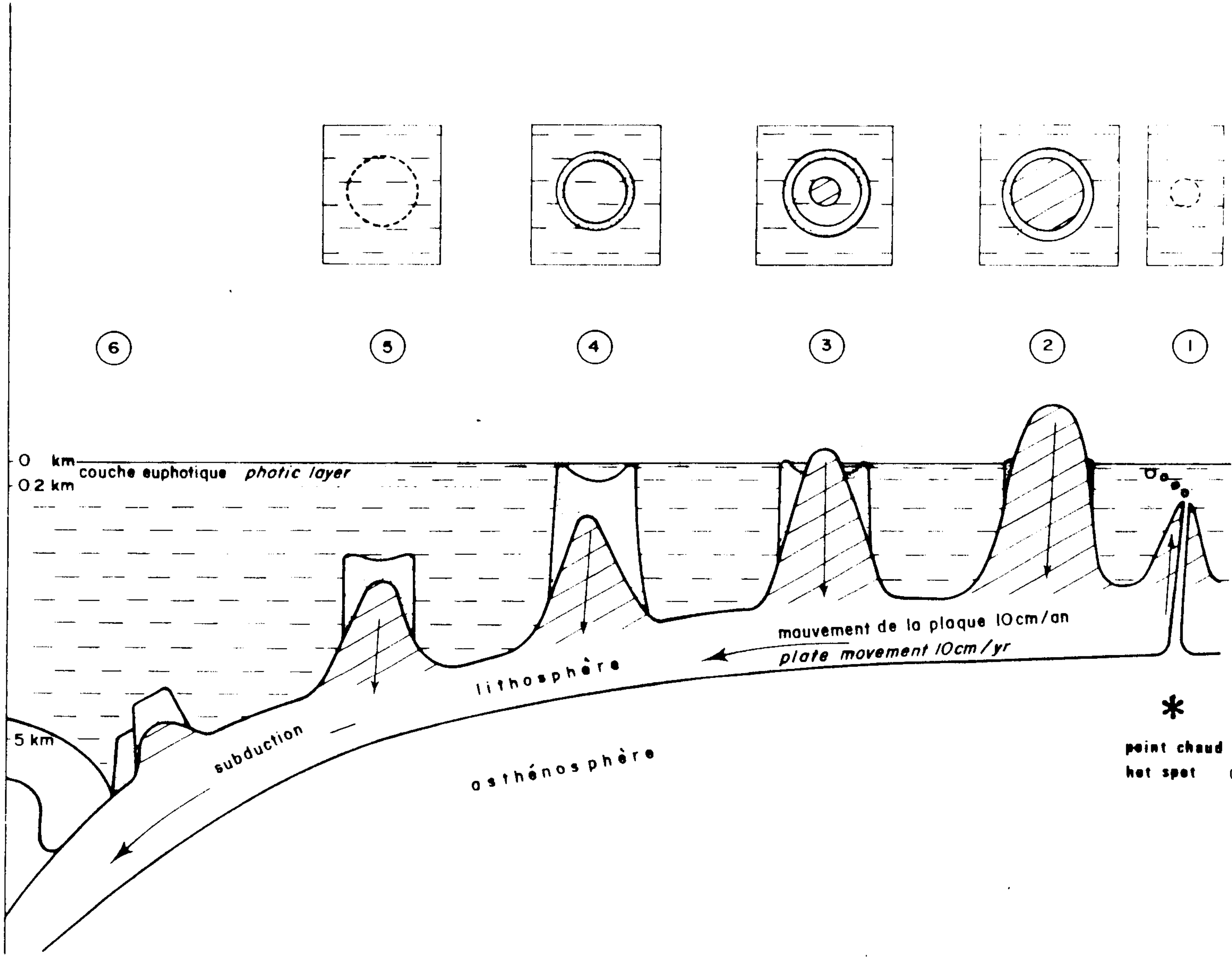

Fig.1 - ÉVOLUTION DES ÉDIFICES VOLCANIQUES ISSUS D'UN "POINT CHAUD"
Fig.1 - EVOLUTION PATTERN OF VOLCANIC STRUCTURES ISSUED FROM A "HOT SPOT"

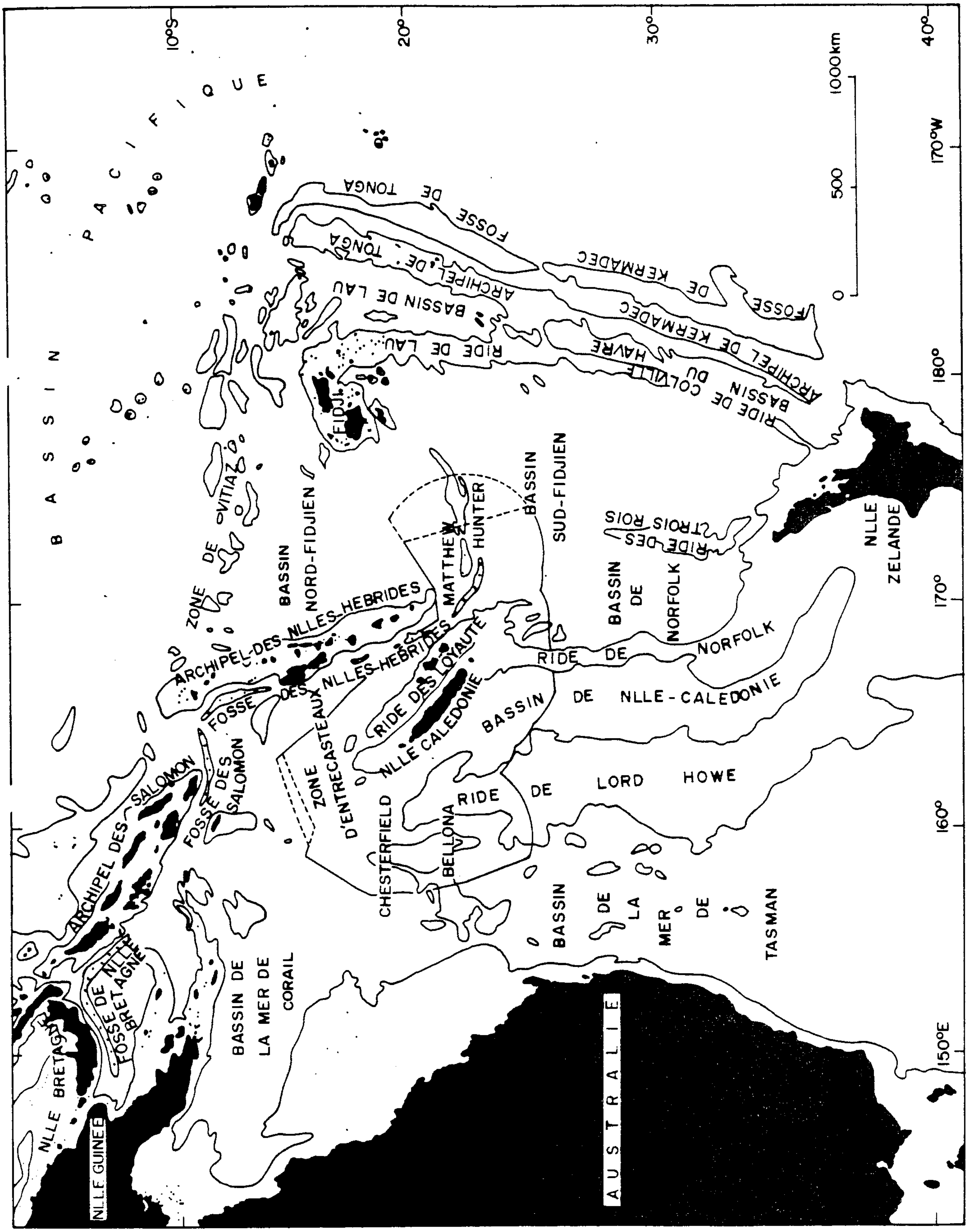

Fig. 2 - Carte bathymétrique du sud-ouest Pacifique avec tracé de la Z.E.E. de Nouvelle-Calédonie.
South-West Pacific seabed mapping and limits of the E.E.Z. of New-Caledonia.

Tableau 1 - Chalutages exploratoires sur quelques monts sous-marins des rides de Norfolk et de Lord Howe.

Table 1 - Exploratory trawlings on some sea mounts located on Norfolk and Lord Howe ridges.

		Campagne du KAIMON MARU		CHALCAL 2	
		Jour *Day*	Nuit *Night*	Jour *Day*	Nuit *Night*
Profondeurs 220 - 480 m *Depths*	Nb. de traits *No of hauls*	15	7	5	1
	Captures (kg) *Catches*	4041	41535	73	352
	Captures/ha *Catches/ha*	16	263	8	95
Profondeurs 500 - 690 m *Depths*	Nb. de traits *No of hauls*	11	6	2	1
	Captures (kg) *Catches*	42145	79030	123	777
	Captures/ha *Catches/ha*	274	1429	59	247