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PA-ALING: AN ALTERNATIVE TO MURO-AMI?

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INTRODUCTION

The Philippines' coral reefs have been world renowned for their beauty and diversity of species, comprising over 400 coral species and may be over 1,000 of the 2,300 fish species found in the country's territorial waters. Coral reef fisheries have been estimated to contribute from 15% to 25% of the total municipal fisheries in the country. More than 50% of the 62 million Filipinos are dependent on fish as the main source of protein. With an annual growth rate of around 2.8%, the coastal areas have experienced increasing fishing pressure on their marine resources. The intense fishing activity in these areas has oftentimes brought undesirable fishing practices which are either destructive (e.g., blastfishing and cyanide poisoning) or overly efficient (e.g., payaws). One of the fishing methods which have been subjects of controversy due to their deleterious impact on the coral reefs is **muro-ami**.

Muro-ami is a drive-in fishing gear, originating from Japan, which utilizes a rock-weighted scareline to herd the reef-associated fish toward the net. This has elicited protests from various sectors of society concerning the damage to fragile coral colonies and the possible depletion of the fish stocks. Aside from the ecological and technical gear considerations, other socio-economic issues have been brought forth like those regarding child labor, inadequate health and shipboard sanitary conditions as well as the inequitable profit sharing system practiced by the fishing corporation. These concerns brought about the banning of commercial muro-ami fishing in 1986. Subsequent gear modifications, like the two-linked chain weight used at the end of the scareline, have brought about less than satisfactory results due to instances wherein the muro-ami company reverted to the original rock-weighted method. This experience indicated that for a viable alternative for muro-ami to be adapted, it must be attractively efficient in catching fish and yet non-destructive to the coral reef habitat. In addition, there was a need to quantify the gear efficiency so as to provide for regulatory measures in the fishing effort to assure sustainability of the resources.

With the foregoing considerations, PA-ALING was proposed as a modification. This was evaluated by the Interagency Task Force coordinated by the Bureau of Fisheries and Aquatic Resources (BFAR).

PA-ALING: THE NEW BFAR DRIVE-IN NET TECHNIQUE

The term **pa-aling** refers to the fishing technique modified from the otoshi-ami method as a substitute to muro-ami. This technique entails the use of bubbles, generated by surface-supplied air through plastic hoses, to scare fishes toward a set-net. The **pa-aling** was conceptualized by Mr. Exequiel Aguilar, Senior Gear Technologist of the BFAR.

The Air Hose Scareline

A series of 50-m plastic hoses are used as scarelines (Fig. 1). These are attached to air compressors installed in the air boats. The hose has plastic strips placed at various intervals along its length, and a copper tubing is placed as sinker at around half a meter from its tip. Compressed air blown from the compressors forms a wall of bubbles which are used to herd the fish to the set-net.

The Set-Net

The set-net is a type of bagnet which has a rectangular mouth opening. The inner portion of the net is made to bulge using a polyethylene (PE) netting with an elasticity of 15% or more, depending on the strength of the current. The center of the net body where the fish are impounded is made of nylon netting (210/36). The set-net has an opening with purse rings, to release excess tension in strong current shearing, so as to avoid the tearing of the net. This hole is also used for transferring the catch to smaller nets which are tugged to the mother boat.

The Fishing Operation

Prior to the fishing operation, the mother boat searches for a shoal/reef. A flag marker is dropped after determining the current direction and speed. As the mother boat stops, the four airboats and four net boats are lowered. In the area of the marker buoy, two anchor weights are dropped and thus open the net which is positioned facing the current. This takes only around five minutes. The length of the drive depends on the shoal or reef. It was estimated that the effective drive area is around 200 m x 200 m (i.e., effective drive distance x width of the net). Around 100 fishermen in curvilinear formation guide the fish toward the net. The whole drive operation takes around 30-45 minutes.

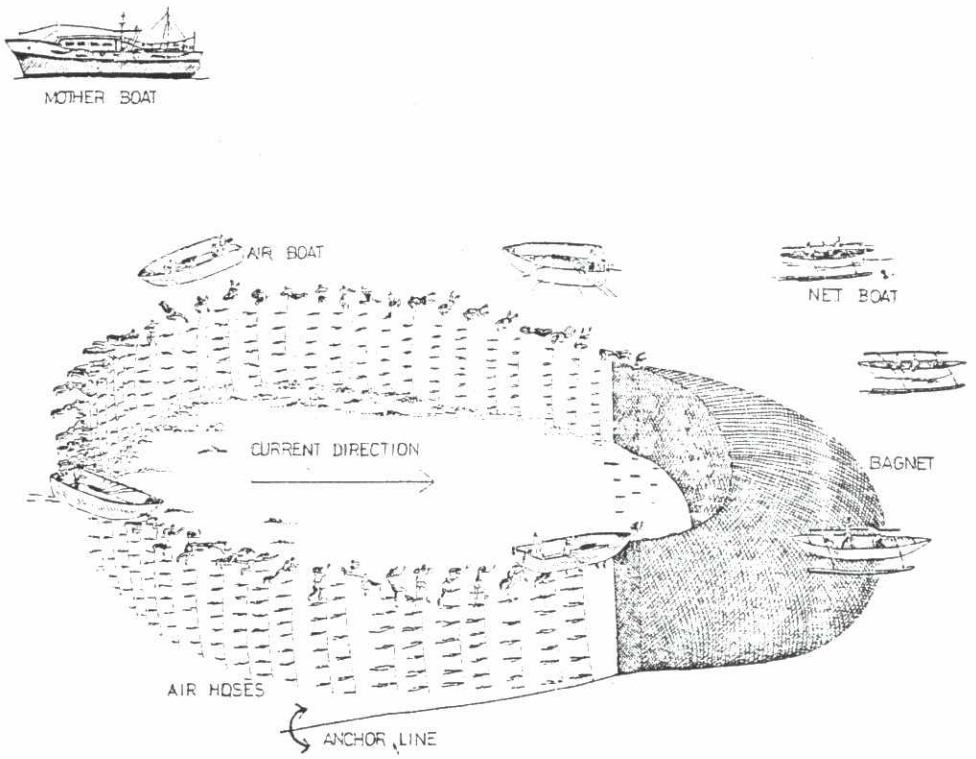

Fig. 1. An illustration of the pa-aling operation.

ASSESSMENT OF GEAR EFFICIENCY

Evaluation of the fishing technique was based on the potential destructiveness of the gear on the coral reef habitat and its efficiency in catching the fish stock in the area.

Fixed one-square meter quadrats were positioned in the area of the drive path to determine whether corals were broken after the drive was made. A quadrat is demarcated by a 1-sq m grid made of flexible nylon rope marked with buoys in two of its corners. The coral community lifeforms were characterized using the lifeform line transect intercept.

On the 5 m x 5 m corrridor of the two 50-m transects, fish visual census observations were made to estimate the number of fish present and their estimated sizes. From these records, estimates of fish stock biomass for the area were made. The difference between the biomass of fish caught and the estimated biomass present in the area is the gauge for the efficiency of the gear, i.e., in percent biomass caught of the potential stock (Table 1).

Table 1. Estimate of gear efficiency based on the proportion of biomass of commercial species caught relative to the standing stocks gauged through underwater fish visual census (May 25-28, 1990).

Area	Biomass estimate (tons/km^2)	Catch estimate (tons/km^2)	Efficiency (% caught of standing stock)
Hart Reef	35.9	3.0	8.4
Fondeado Island	18.2	3.6	19.8
Green Island (South)	90.7	16.0	17.6
Green Island (North)	15.8	2.4	15.2

From the assessment of the coral communities sampled (i.e., based on the coral quadrats sampled), it was shown that the damage is seemingly negligible. Some damage, however, was observed in the net ribs and anchorage areas. It was generally observed that there was a variation of fish composition and abundance which may be attributed to the different types of reef areas fished. Coral cover was mainly in a fair condition, that is, within 25% to 50% live coral cover.

The catch composition for the new BFAR **pa-aling** modification revealed that the most abundant fish species were the fusiliers (84% of the catch) such as *Pterocaesio pisang*, *Caesio cuning* and *Pterocaesio tile* (Table 2). The composition is practically the same as that of muro-ami, even with respect to the "high quality or highly priced" species such as carangids and lutjanids. Based on the difference of the fish catch subtracted from the standing stock based on visual census observations, the efficiency may range from around 8% to 20%, i.e., a drive catch around 8% to 20% of the biomass in a reef area at a given time.

Table 2. Catch composition based on abundance by percent weight of top five families from the experimental fishing.

Family	Common Name	Abundance (% wt)
Caesionidae	Fusiliers	83.7
Nemipteridae	Thread-fin breams	5.9
Acanthuridae	Surgeonfishes	3.8
Balistidae	Triggerfishes	2.5
Carangidae	Jacks/Trevallies	.9

LESSONS AND RECOMMENDATIONS

The general findings of the Interagency Monitoring Team indicate that **pa-aling** or the new BFAR modified drive-in fishing technique incurs minimal damage on the coral communities. However, highly efficient fish catching ability would need to be regulated.

Figure 2 shows the various policy considerations regarding the permission of the continued operation of the new BFAR method. As can be seen, one of the critical aspects in the flow chart is the importance of monitoring so that continued assessment of the

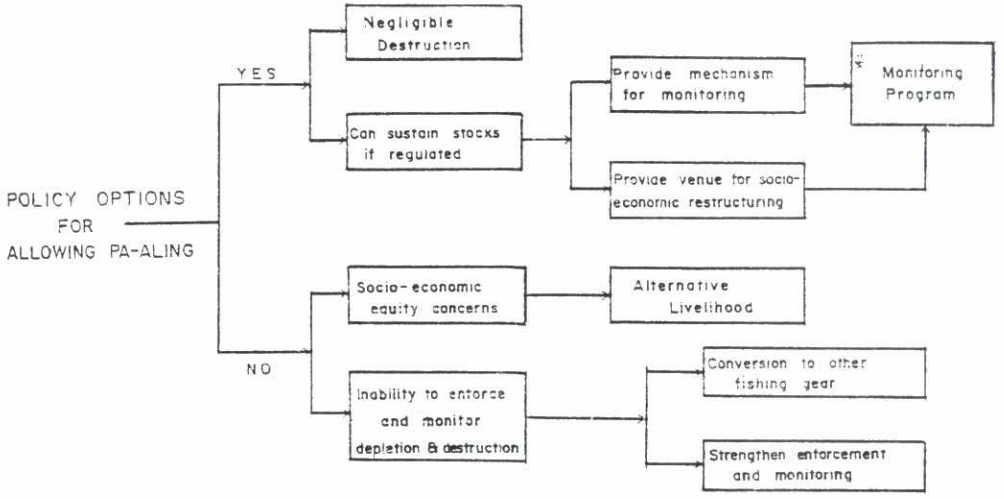

Fig. 2. Flow diagram of various policy options which may be pursued for allowing pa-aling.

fishery is inherent in the whole management of the fishery. If coral destruction is considered minimal, the aspects which would need to be monitored would relate to the amount of fish caught in the reef areas so as to determine the maximum (ideally optimum) sustainable yield (MSY) in these areas. Since the present data base may still be inadequate to determine this "MSY" amount for this new method, some approximations can still be made. This can serve as an initial guide for the monitoring and regulation of the fishing effort of **pa-aling**. This would involve using information from the lessons learned from the previous muro-ami technique. This can serve as a good basis since the technique is very similar and the resources being exploited are the same.

There is, however, a trend to get lower average annual production per unit vessel (Fig. 3). Furthermore, through the years of the muro-ami operation there are indications that after the period 1970-1974, an overfishing situation of the fishery has occurred (Fig. 4). Based on the MSY estimate of 10% of the initial slope of this curve, it is proposed that the annual allowable catch per unit vessel is around 530 tons.

Some initial estimates on the number of drives which is allowable in an area can also be explored. This can be based on the initial information of the **pa-aling** test fishing operation made from April to May 1990. Around five drives a day may be optimum for an area (Fig. 5). Obviously, there would be a lot of variation depending on the complexity of the reef area and its size. Based, however, on a five drives-per-day estimate, the daily allowable catch should be around 5.25 tons. Thus, if a limit has to be conservative, the regulatory measure should be a quota of five drives per day or 5.25 tons (approximately 125 tubs) per day, depending on which quota is first reached.

Based on the estimated efficiency of the gear reaching around 25%, these areas should be harvested at most twice a year, with an interval of at least six months.

Other concerns such as the potential learning factor in the gear technology can potentially improve the efficiency of the gear. With such considerations, there should thus be some limit in future gear modification and design. Offhand, though the mesh size of the net may not be a problem at present, this may need further investigation. There may also be a need to limit the number of airboats and fishermen used. For the moment, we are left to assume that the present system of four airboats with 100 fishermen using the scareline would be optimum. Also, the release of threatened, endangered or exotic species (such as turtles, manta rays and dolphins) should be strongly adhered to.

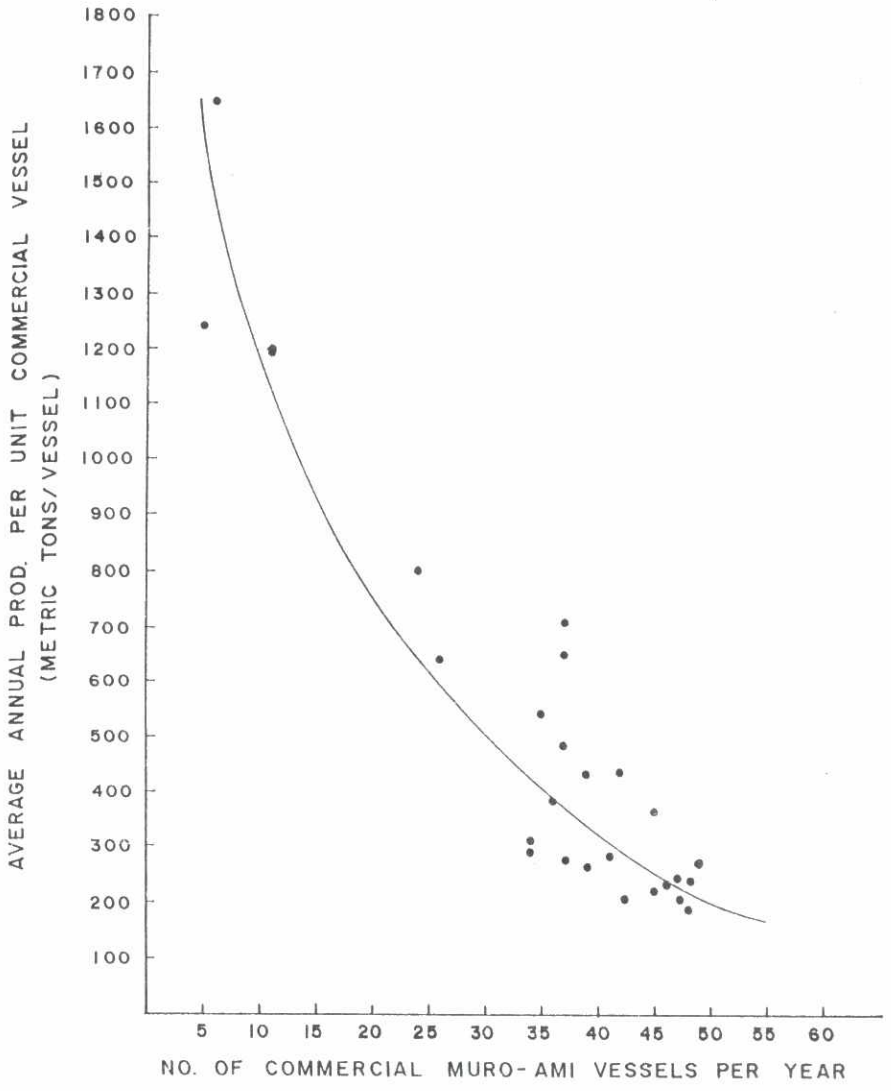

Fig. 3. Fitted curve (by eye) showing decrease of average annual production per unit vessel with increasing number of muro-ami vessels.

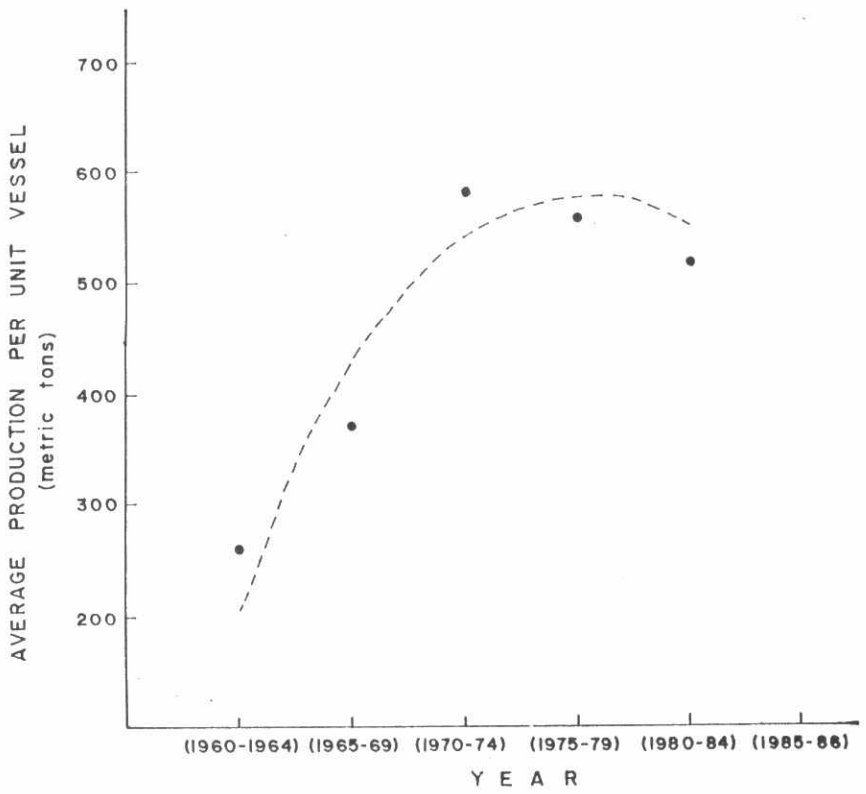

Fig. 4. Fitted curve (by eye) of muro-ami average catch per unit vessel in five yearly intervals showing decline after 1970-1974 (after an average of 600 tons/vessel).

With these in mind, various mechanisms can be explored so as to provide for an effective monitoring program. This requires: (a) a set-up whereby a participatory process amongst different interest groups concerned in reef fisheries is made; (b) legislative provisions and support, especially with regard to licensing, taxation and other regulatory measures; (c) financing support for the monitoring activities -- this may require government funding (in the immediate short-term horizon, e.g., from the Fisheries Sector Program) or budgetary allocations from the taxes on the industry's receipts; (d) enforcement through DA-BFAR regional offices with NGO collaboration and military/police support; and (e) information/education programs geared toward conscientisizing the industry and other agencies on the processes involved in achieving sustainable development for the future.

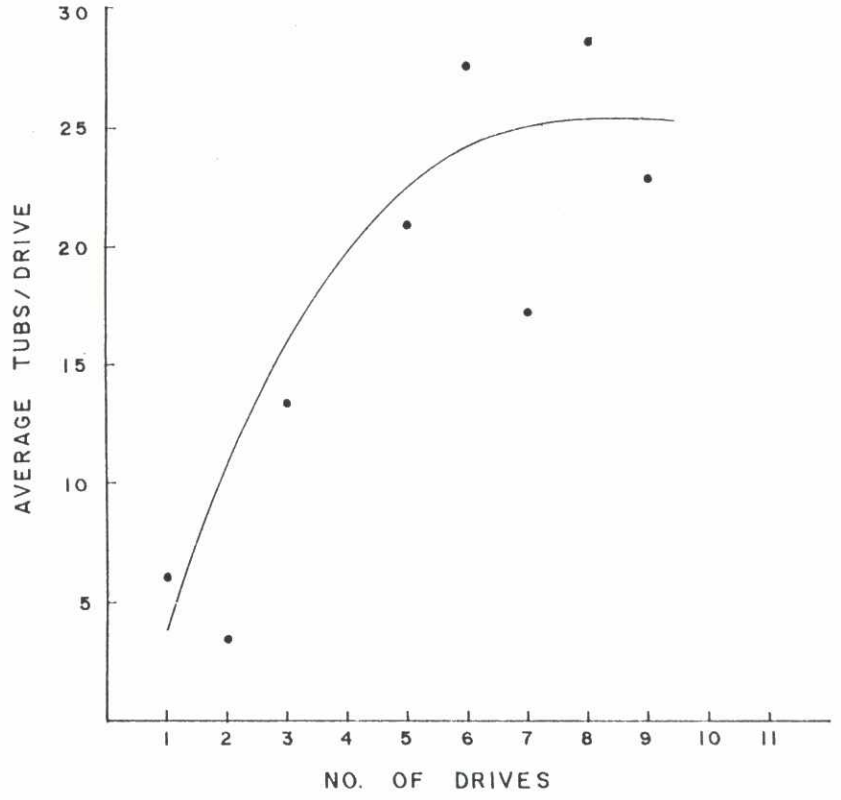

Fig. 5. Fitted curve showing asymptote of average number of tubs caught by pa-aling method after five drives (25 tubs = 1.05 tons) in one shoal area.

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