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Sea urchin management in Bolinao, Pangasinan, Philippines: Attempts on sustainable use of a communal resource

Liana T. McManus, Edgardo D. Gomez, John W. McManus, and Antoinette Juinio
Marine Science Institute
University of the Philippines
Diliman, Quezon City 1101 Philippines

ABSTRACT

The sea urchin, Tripneustes gratilla. is exploited in the reef flats of Bolinao for its roe. A high international demand for brined sea urchin gonads since the early 1980's has led to an overfished resource base. An exploitation level index of 0.6 to 0.7, and slow decline in harvest rates from 1987 to 1989 indicate the extent of overfishing. as of 1988. The adoption of an annual closed collecting season from December to January helped mitigate the status in 1989. Succeeding closed seasons however suffered from lack of effective enforcement. Changing patterns in the manpower structure of the industry from self-employment among fishermen, to one of direct dependence of fishermen on foreign buyers with increasing capital inputs, seem to have exacerbated over-harvest of sea urchins. Although the potential to draw a comprehensive management plan exists within the powers of the municipality of Bolinao, an effective village mobilization program directed at grassroots participation in resource stewardship is the recommended course of action.

Introduction

The sea urchin industry of Bolinao, Pangasinan, northern Philippines (fig. 1), is a case study of a communal resource which can sustain harvest provided that a comprehensive management intervention is drawn up. Because of an ineffective management measure adopted by the municipal council and because of shifts in the manpower structure of the industry, indices obtained from previous studies and a 4-year monitoring of catch effort statistics from a landing site indicate that sea urchins are an overfished resource, and that total daily harvest is on the down trend. This paper attempts to analyze why a fishery which showed promise for prudent management seems to be on its way to collapse. Economic, institutional, and social forces seemed to have determined the current state of the industry.

Pre-intervention State

Studies on the biology of sea urchins were initiated in Bolinao, Pangasinan, by the Marine Science Institute in 1986 until 1988, drawing from earlier studies in other localities in the Philippines. The fishery statistics were collected until May 1989, and then again in March 1990 and continuing. Thus, prior to 1986, nothing by way of formal studies nor documentation was known of the sea urchin fishery.

Based on interviews of local entrepreneurs and village officials, the collection of sea urchin roe was not initiated by local demand. Rather, the industry started as an export-oriented activity. Starting in 1983 to 1988, the industry was unregulated except by market forces; in particular, by the increasing number of on-site direct

foreign buyers. Exported mainly to countries like Japan, Taiwan, Hongkong and Korea, the roe is obtained mainly from Tripneustes gratilla (Trinidad-Roa 1988). Substitute species include Diadema setosum and Echinothrix diadema. the roe of which are less preferred. T. gratilla. in particular, inhabits seagrass beds that dominate the reef flats of Bolinao, specially those adjacent to the islands of Silaki and Cangaluyan, and in beds fringing Lucero, Santiago Island (fig. 2). Silaki and Lucero are the 2 major landing sites of harvested sea urchins.

Status of Sea Urchin Resource

Studies on the biology of sea urchins in Bolinao, Pangasinan were largely done by Trinidad-Roa and Pasamonte (1988). T. gratilla shows peak spawning in December to January, although release of gametes occur year-round. Recruitment is highest during May and June, when about half of the yearly recruitment occurs. The species reaches sexual maturity at a size of 6 cm or roughly after 15 months. In terms of annual changes in density as part of the macrobenthos, highest numbers are reached in September to October with about 4000 sea urchins ha^{-1} of seagrass cover (fig. 3) (de Guzman 1990). The peak in sea urchin density coincides with an annual decrease in seagrass cover (fig. 4a), which is more dramatic in beds with over 50% seagrass (fig. 4b) (McManus, in prep.). Herbivory by sea urchins, among others, may be causing the seasonal reduction of seagrass cover.

Examining the fishery statistics obtained from 1987 to 1990 as collected by

Trinidad-Roa and Pasamonte (for years 1987-1989) and by McManus (for year 1990), the trends are by no means encouraging. Midway during this monitoring period, the municipal council of Bolinao adopted on January 2, 1989 a seasonal harvest ban from December to February of each year. A closed collecting season was adopted mainly because of a perceived diminution of catch from 1983 to 1988 by collectors and buyers, and because of recommendations made by the U.P. Marine Science Institute based on the biological information it obtained from studies mentioned above.

Effort in terms of persons/day (assuming 6 hrs of fishing in a day) show an overall increasing trend from 1987 to 1989 with about 32 persons landing their catch daily in Silaki alone in March 1989 (fig. 5a). Levels in 1990 were lower than those for 1989. Total harvest (sea urchin roe in kg/day) exhibits similarities in trends for 1987, 1988 and 1990 (fig. 5b). The dramatic increase in harvest after the institution of the ban in January 1989 may have been both fortuitous and real. It was the only closed season that was observed closely by the municipal government, the collectors and the buyers. Why the catch in 1990 immediately after the closed season was not high may be attributed to changing patterns in the manpower structure of the industry as will be explained later, and the increasing lack of close monitoring for erring collectors and buyers. Daily (fig. 6a) and hourly (fig. 6b) harvest rates per person show a slow decline from 1987 to 1988. Again, rates after the first ban rose to a peak in March 1989. Rates in 1990, even after the closed season, did not approach the 1989 peak.

Estimates of the exploitation level of the sea urchin resource is based on mortality values obtained by Trinidad-Roa and Pasamonte (1988). Exploitation level

is the ratio of fishing to total mortality. Ratios greater than 0.5 indicate an overfished resource. For Tripneustes gratilla in Bolinao, estimates vary from 0.6 to 0.7. Coupled with declining trends in harvest rates, data indicate an overfished resource as early as 1988. The closed fishing season was adopted when the resources base was already overfished.

Manpower structure

The sea urchin industry of Bolinao centers around buyers who essentially determine the fishing pressure on the resource. Collectors who fish mostly using bamboo rafts or non-motorized dug-out canoes (bancas) gather the sea urchins and bring them to the landing site (either Silaki or Lucero) where they are soaked in seawater by the beach overnight. Shuckers who may also be the collectors or their kin break the shells to obtain the gonads or roe, which are then sorted out according to color and texture, and then brined. The middlemen, who are natives of the town, record the catch and attempt to meet quotas imposed by the exporters. The latter which include local, out-of-town and foreign entrepreneurs, buy sea urchin roe from the middlemen and transport them to Manila for immediate export. Also called buyers, they pay taxes to the municipality when they secure permits to gather and catch sea urchins (currently priced at P234.40/year or $8.70/year) and when they transport roe out of Bolinao (P1.50 or $0.06 for every kg brought out from Bolinao). (Conversion rate: Philippine Peso 28.00 = US$1.00)

The structure described above allows for self-employment among collectors,

middlemen and the buyers, each earning income from sale of the sea urchin roe. This arrangement is patterned from existing fisheries practices in terms of catch distribution, with the fishermen getting the least, and the exporters, earning the most, since the latter have the capital and means to transport the commodity from the fishing ground to major markets.

In mid-1990, a new pattern began to evolve. Foreign buyers needed a more efficient system through which harvesting, shucking and transport can be done in the least amount of time to ensure freshness of the roe upon reaching the foreign market, thereby maximizing their profit. Japanese buyers, in particular, began contracting with collectors for a ready market of their catch, employing shuckers on an hourly basis, and totally avoiding having to deal with middlemen. The catch is brought in either in the morning or late afternoon, after which urchins are immediately shucked, sorted and packed in wooden boxes with minimal amount of preservatives. Currently, collectors are paid P68.00 for every kg of roe. Buyers, on the other hand, sell the processed product (locally, that is) at P120 for a large box that contains 5 grams of roe and P110 for a small box that contains 4 grams of roe. Assuming 20% spoilage, for every kg of roe bought from the fishermen, 800 grams can be packaged into 160 5-gram boxes worth P 19,200. Deducting the price paid to the collectors, the wages of 4 shuckers working 8 hrs (P 120.00 X 4 shuckers), the cost of 160 wooden boxes at P1O/box, and the cost of preservatives (P1000/kg roe); the net profit comes to P16,052. The low taxes imposed by the municipal government (P234.40/year for the permit and transport fee of P1.50/kg) hardly reduces the profit, and essentially make the resource

free for the taking. The disparity between the value of the resource at the fishermen's (collectors') end and the processed commodity the buyers sell, magnify the marginalized position of fishermen.

The consequences of the new manpower structure not only maximizes returns for the buyers. It also facilitates the exploitation of the natural sea urchin population in the area. According to some shuckers interviewed in Picocobuan where a Japanese-owned operation is based, non-SCUBA trained collectors have started to venture beyond the reef flats unto deeper seagrass beds, where sea urchins are collected using an improvised air compressor and hose (locally termed "compressor" diving). The added costs incurred in the use of motorized boats and air compressor are presumably taken on by the buyers. Thus, the overall fishing pressure is expected to increase.

Institutional Arrangements and Jurisdictions: Current linkages and Recommendations

The only organized group involved in the sea urchin industry is the municipal government. Collectors, middlemen and buyers are not organized by any formal occupational associations. These three economic and social categories have only the market forces to regulate the income they derive from their role in the industry.

The role of the municipal government in the management of the industry reflects the lack of environmental and economic valuation of the resource base, both as an economic commodity and an environmental asset. It also shows in a microcosm a common malady that the government faces, at any level of hierarchy, in managing

a natural resource. In the Philippines, municipal governments are empowered to pass resolutions regarding the disposition of the natural resources within their geo-political boundaries. For municipal waters, these include areas up to 7 kilometers from the mean tidal mark. Such town laws need only to be approved by a cabinet level official, namely the Secretary of the Department of Agriculture. Thus, the potential to carry on a comprehensive management program exists.

In this study, three intervention measures were recommended by the U.P. Marine Science Institute: (1) the imposition of an annual closed collecting season (December to January); (2) the restriction of harvestable size to no less than 6 cm, the size of first reproduction; and (3) the design of a marine reserve, within which natural sea urchin populations may flourish to replenish depleted fishing grounds. These measures are by no means comprehensive, but together, they support one another in ensuring that natural populations are maintained, given that harvest does not exceed reproductive, recruitment and growth rates of the urchins. As it is, only the first measure was passed as a resolution, violation for which hardly fetches significant punitive consequences. Furthermore, police efforts on the part of the local police or barangay officials are barely sufficient to forcefully implement this. In effect, the closed season was an ineffective measure, save perhaps when it was first imposed.

To plan what may be considered comprehensive, additional provisions which address social needs have to be taken into account (McManus 1989). First, a vigorous community mobilization program has to be drawn. Such program aims to organize

a sea urchin collecting community into various groups that can police collecting grounds, bargain for more reasonable prices of unprocessed roe, assess natural stocks within their area, and educate their community members regarding the value of the organisms and their habitats. These objectives may seem unachievable but have been successfully met in small-island scale of resource management (White and Savina, 1987; McManus et al. 1988).

Second, a program to restrict access to the resource needs to be drawn. These can be effected by granting territorial use rights (sensu Ferrer 1989) to particular villages or groups. The latter will have to pay a significant sum for exclusive use of a portion of a collecting ground, and which can be obtained initially through a loan. The reason, however, for restricted access is mainly to endow a group direct charge over a resource, internally motivating it to safeguard the latter's optimal use (Panayotou 1982).

The idea of establishing a marine park has been very attractive. However, local governments have had difficulty establishing them because they are part of a superstructure that seems inadequate to respond to, much less anticipate, specific needs of maintaining a viable marine park. Village management appears to be the more realistic entity to take on the task, provided it has at least the legal sanction of the municipal government. Examples of island communities setting a portion of their waters as effective reserves exist, e.g. Sumilon Island in the Central Philippines. Thus, the crucial step of conducting a successful community mobilization program may be the bottleneck in implementing an effective resource management scheme.

Technical and Scientific Issues

To back up institutional measures as enumerated above, studies germane to the management program for the Bolinao sea urchin industry need to be done. These include basic biological studies such as proper resource stock assessment, recruitment and growth studies (there is sufficient information on reproductive cycles), and mariculture and seeding techniques. Appropriate market and manpower structures need to be designed by a multi-disciplinary group of anthropologists, sociologists and economists with the major goal of alleviating the marginally economic and occupationally immobile group that is the municipal fishermen.

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Figure Legends

Fig. 1. The municipality of Bolinao is located on the northwestern tip of Lingayen Gulf, one of two major embayments on the western coast of northern Luzon, Philippines.

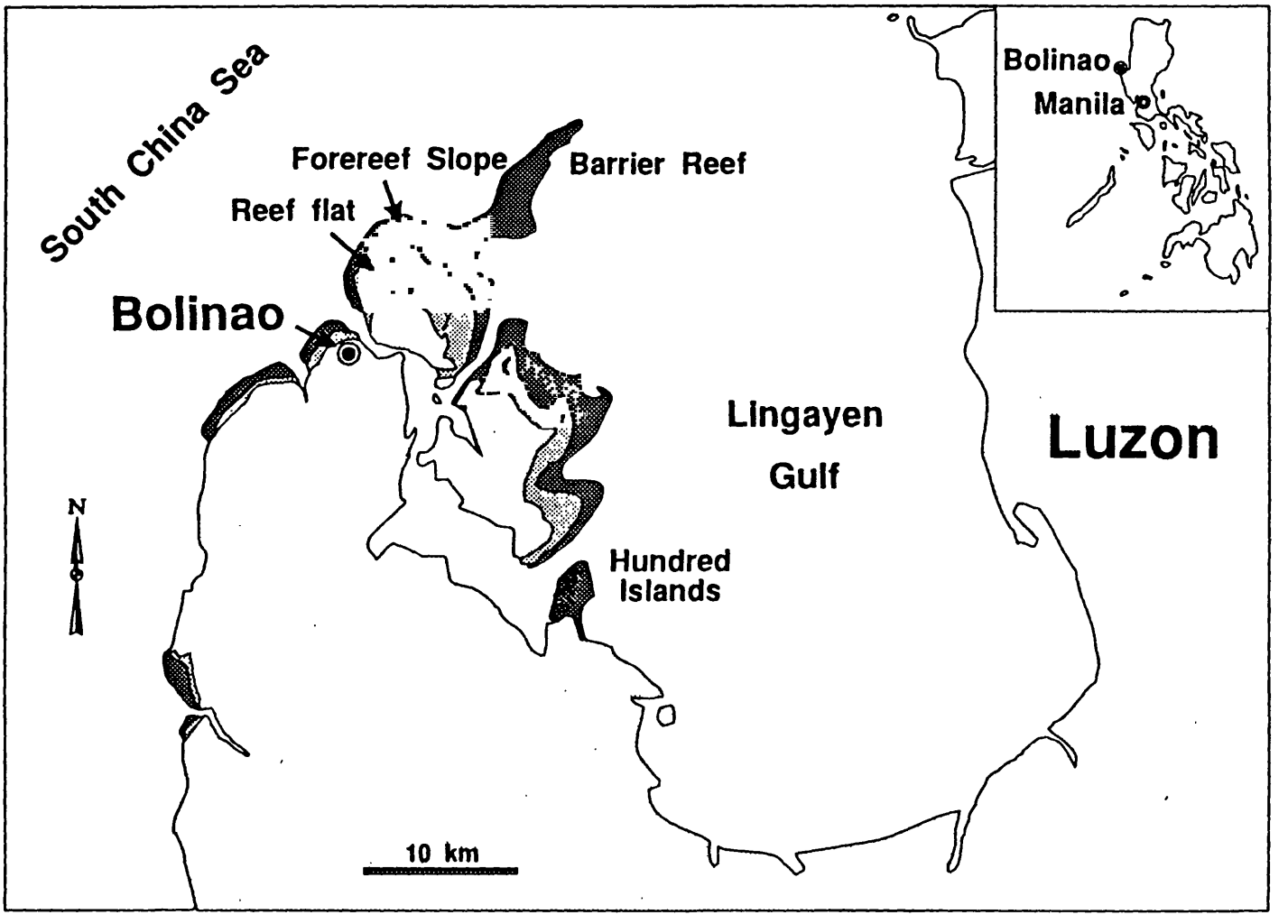
Fig. 2. . The town of Bolinao includes the islands of Santiago, Silaki and Dewey. The two major landing sites for sea urchin harvest are Silaki Island and Lucero, a village on Santiago Island.

Fig. 3. Seasonal changes in the density of sea urchin as part of seagrass-based macrobenthos. Peak concentrations occur in September and October. (Data from de Guzman 1990.)

Fig. 4. (a) Seasonality of seagrass cover in Santiago reef flat, (b) Seasonality of seagrass cover broken down to categories of percent seagrass cover. Changes are most dramatic in quadrats with over 50% seagrass.

Fig. 5. (a) Effort (persons/day) from January 1987 to November 1990. Data gaps from December 1988 to Feb 1989 was due to the implementation of the first closed collecting season; those from June 1989 to February 1990 was due to time interval between monitoring projects. Effort increased from 1987 to 1989, and again decreased in 1990. (b) Harvest (kg roe/day) was similar in ranges in 1987, 1988 and 1990. A peak was observed in 1989 immediately following the first closed season.

Fig. 6. (a) Daily harvest rate (kg roe/person/day) showed a slow decline from 1987 to 1989, and in 1990. An increase was observed in 1989, again following the first closed season, (b) Hourly harvest rates show a similar trend except for a peak in monthly mean of May 1990.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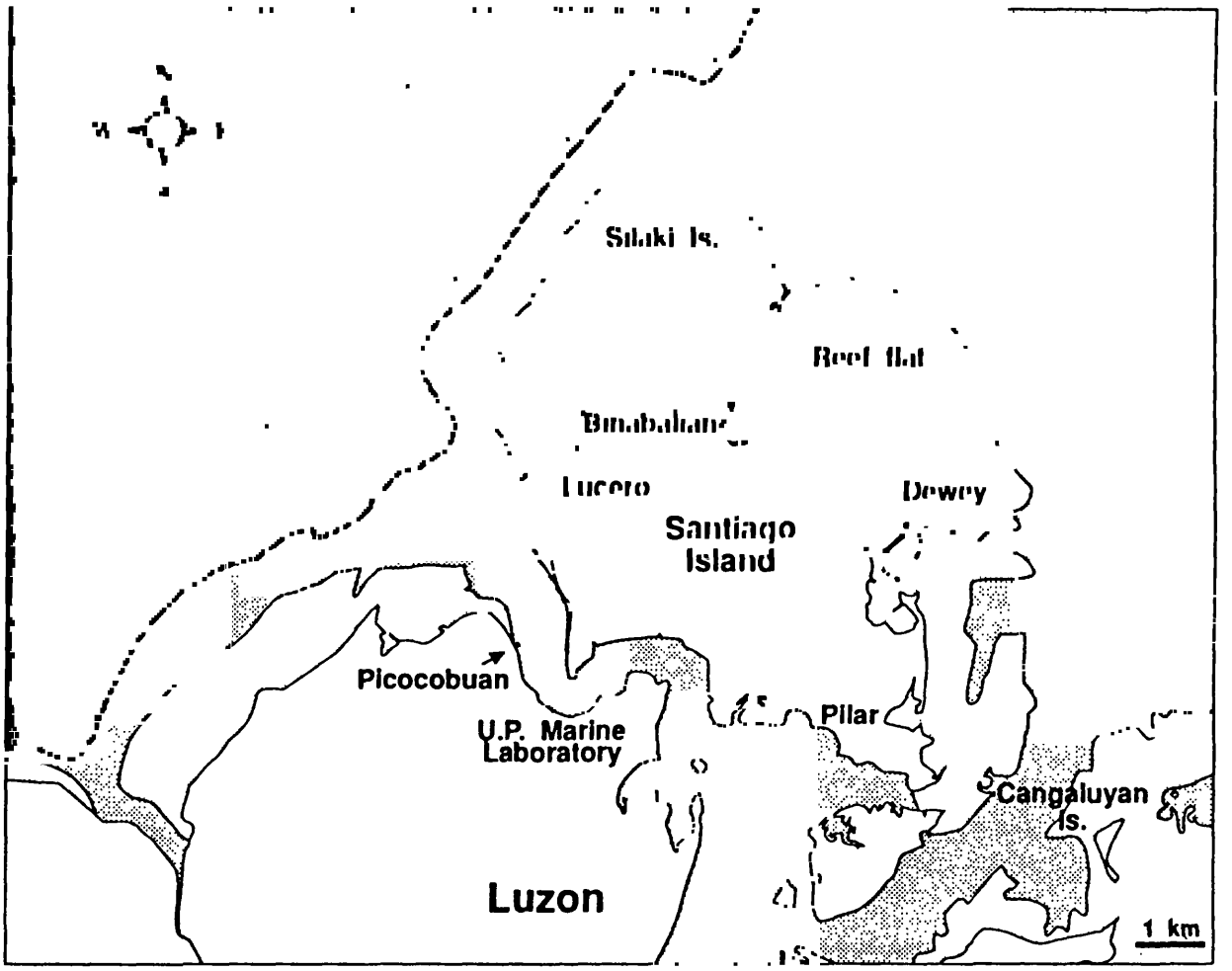
Silaki Is.
Reef flat
Binabalian
Lucero
Dewey
Santiago
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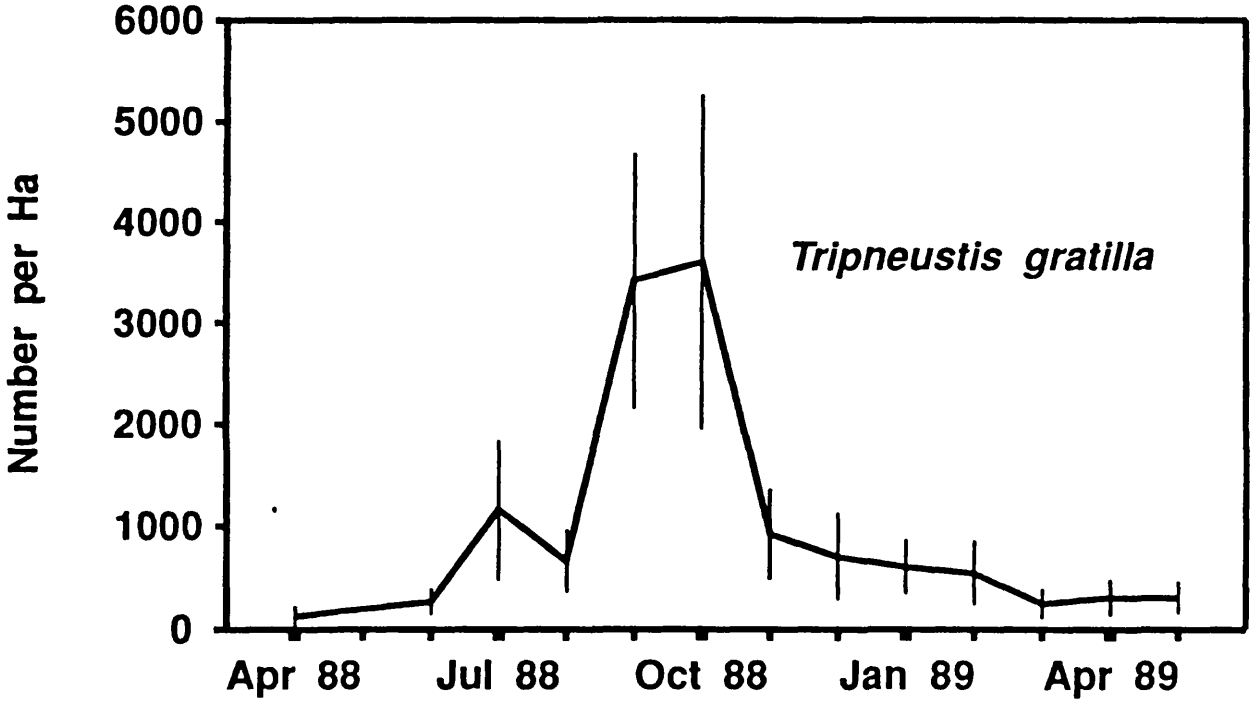
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Number per Ha
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Jul 88
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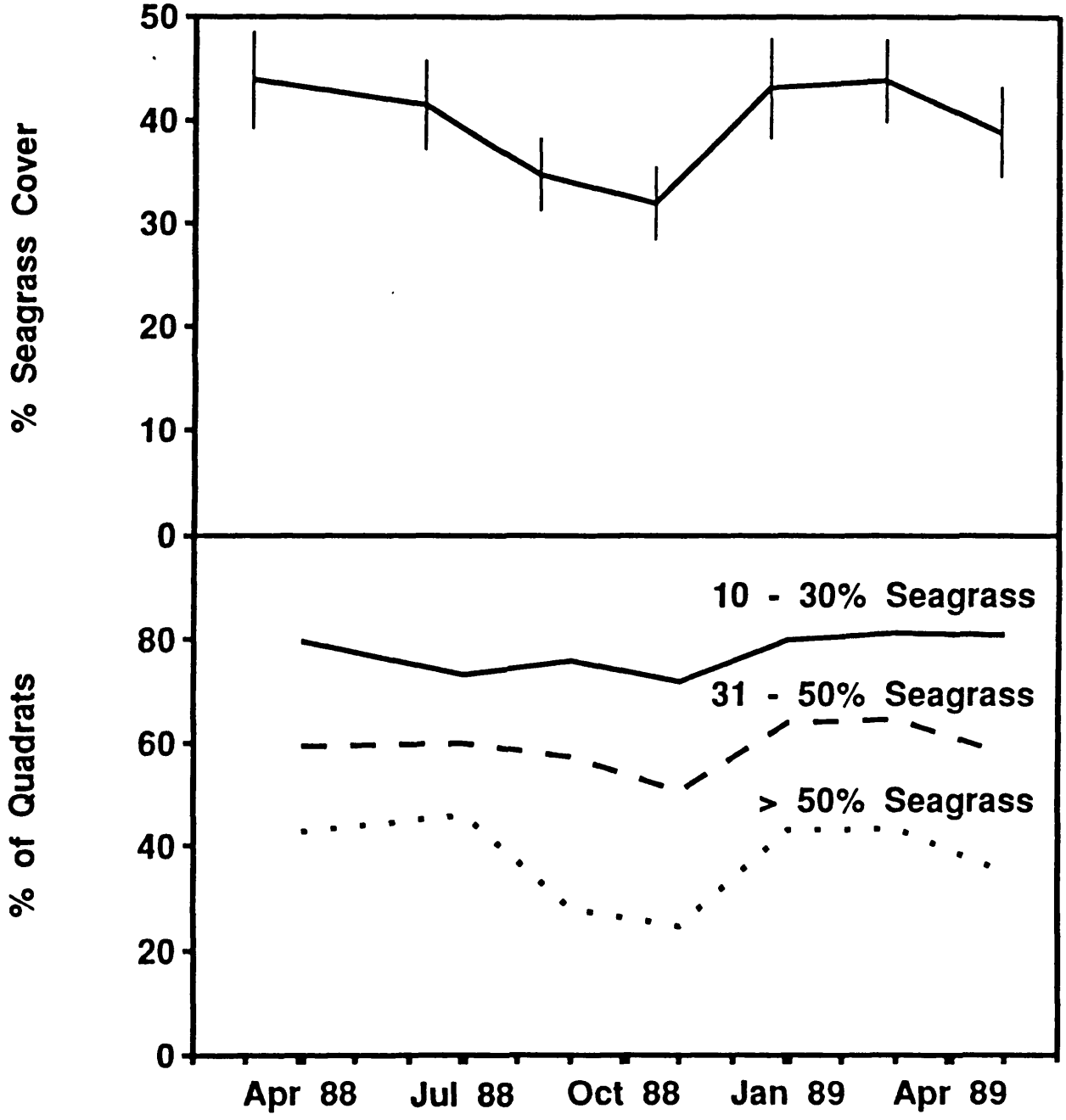
Jan 89
Apr 89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40
30
20
10
0
% of Quadrats
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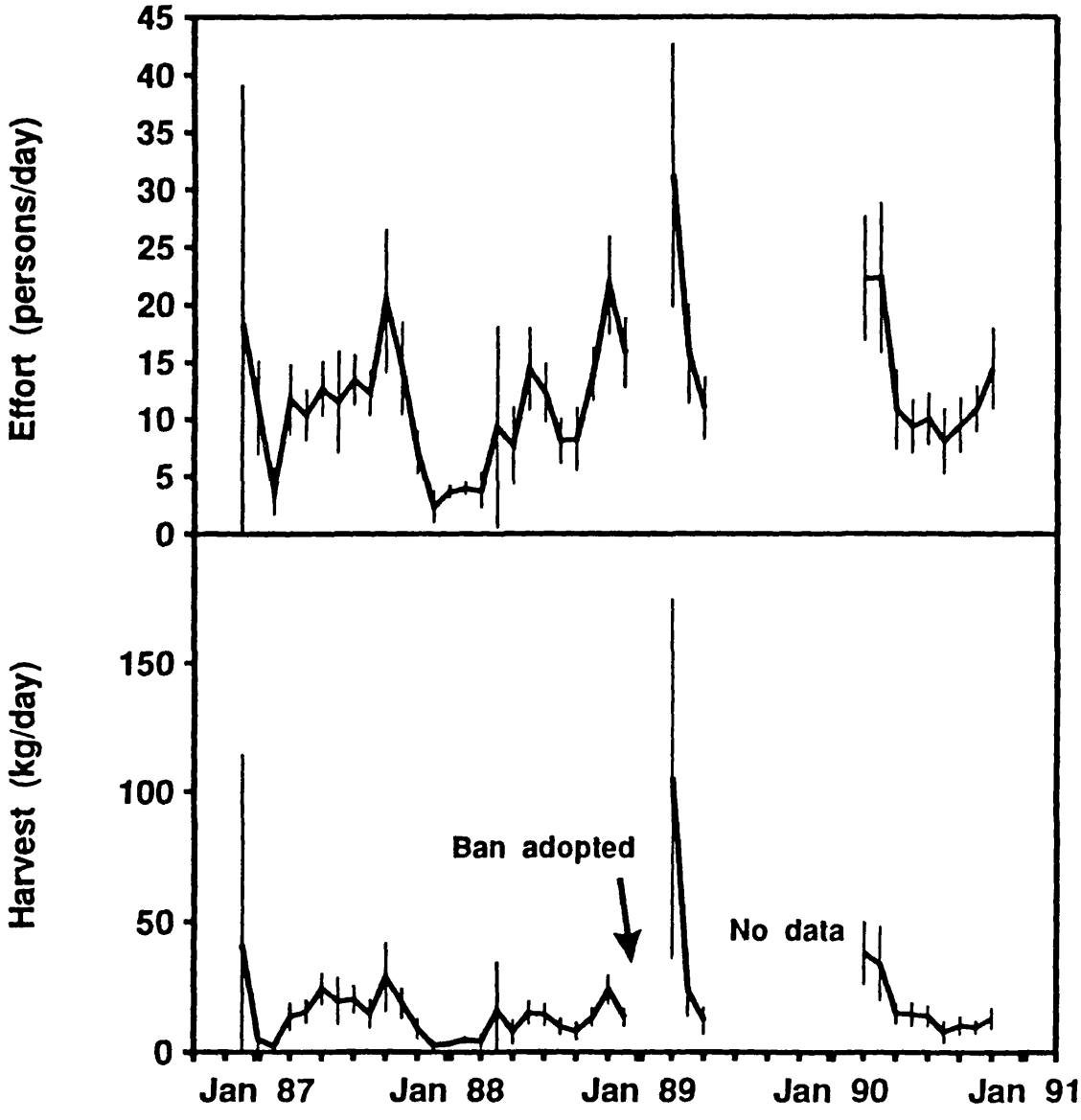
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30
25
20
15
10
5
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Harvest (kg/day)
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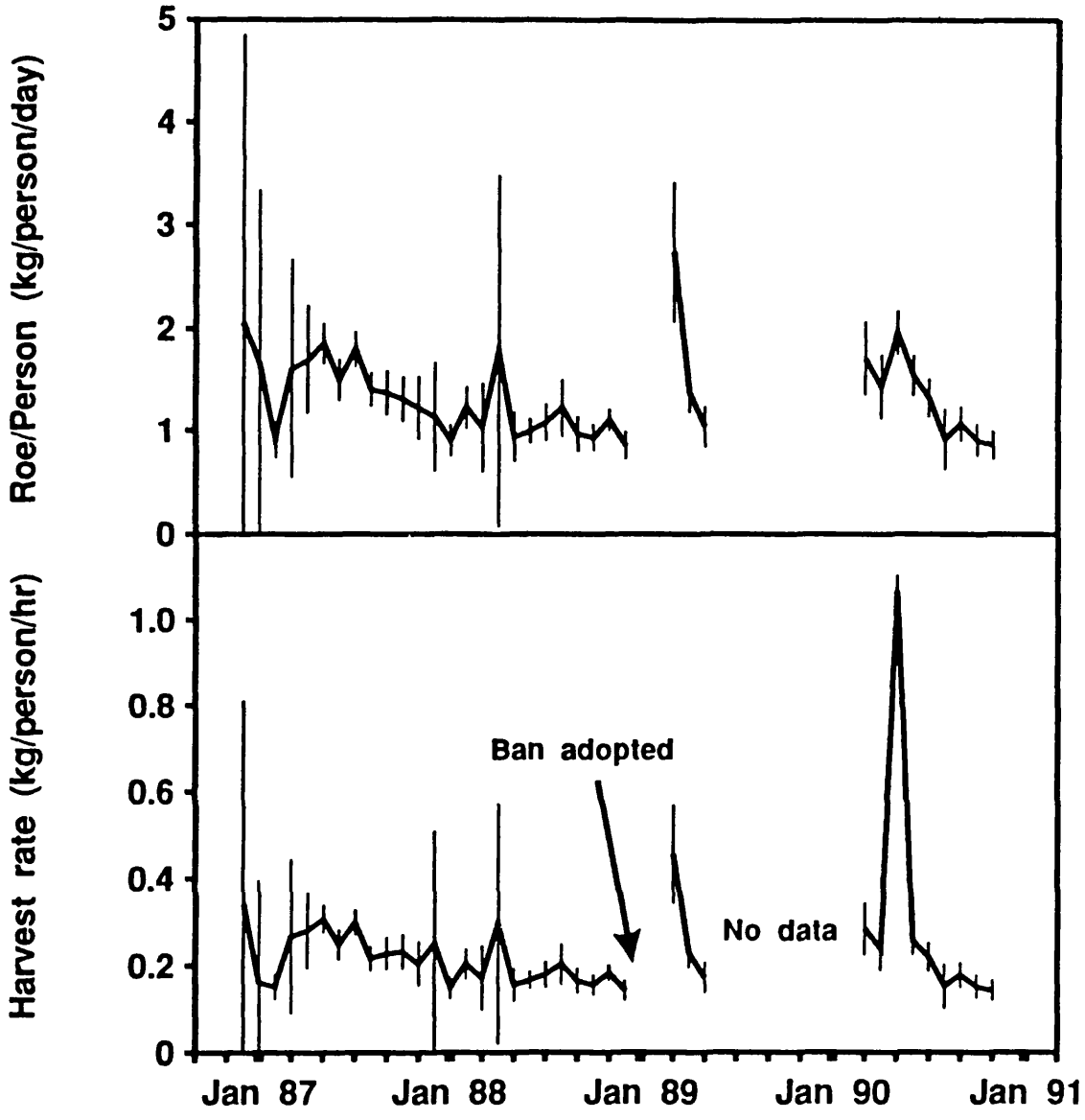
No data
Jan 87
Jan 88
Jan 89
Jan 90
Jan 91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0.2
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Ban adopted
No data
Jan 87
Jan 88
Jan 89
Jan 90
Jan 91