2. OPERATION OF THE INDUSTRY

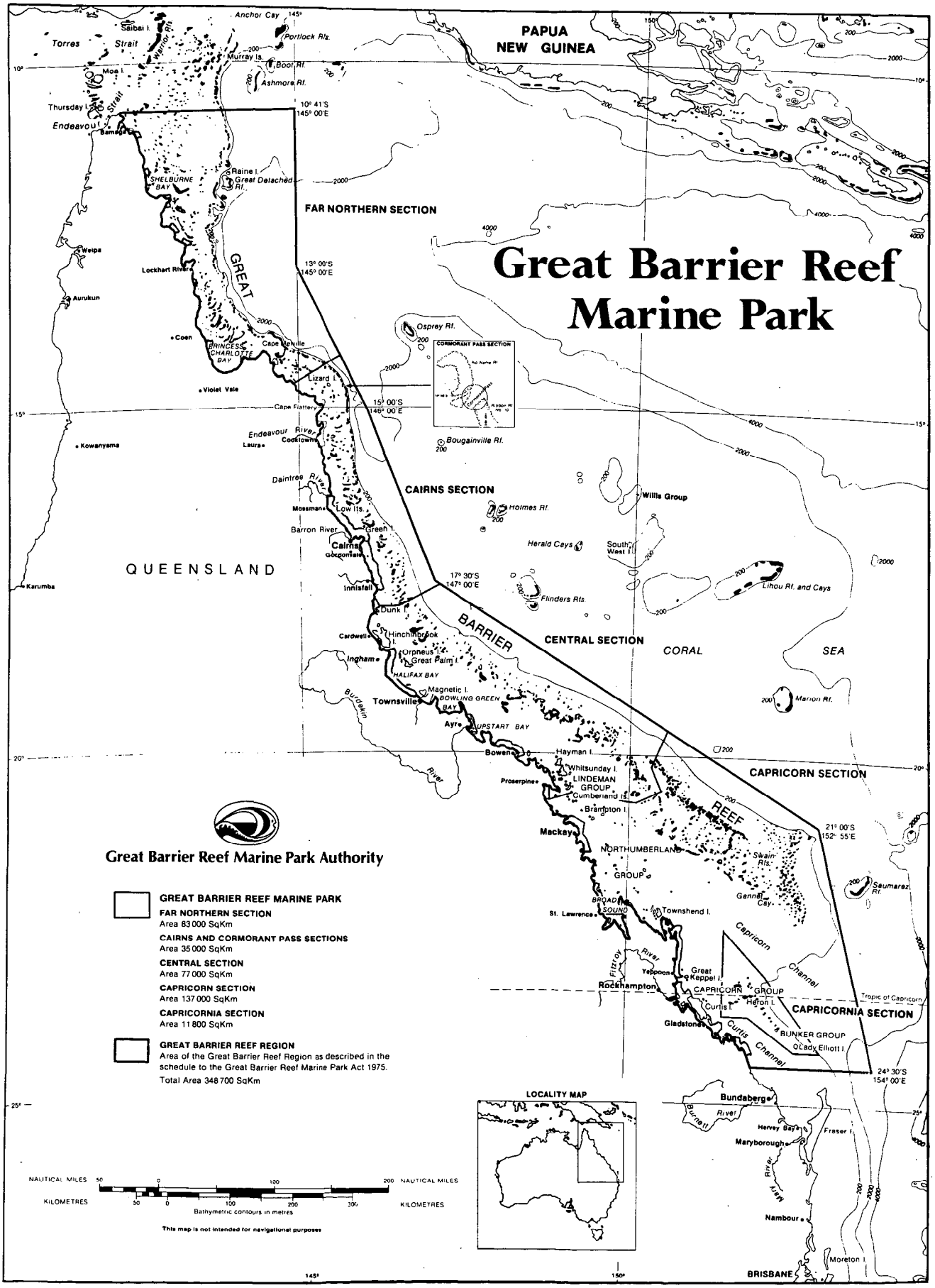
No consistent long term records are available of numbers and species of fish captured for the aquarium trade. The only information recorded at the present time has been voluntarily supplied by collectors. However, because not all collectors supply information, an exact record of the number, location and species of fish captured is not available. The total number of fishes captured obviously depends upon the number of collectors, the number of trips made by each collector and environmental factors such as weather and turbidity.

The precise number of collectors is unknown. This is because; until 1985 commercial collectors could operate under master fishermans licences, some collectors operate without permits, and, to date, amateur collectors do not require a permit in unzoned areas of the Great Barrier Reef Marine Park. Available records however, indicate that at present there are a small number of amateur collectors spread through the GBRR, approximately 40 commercial operations in the Great Barrier Reef Marine Park; about 10 in the Capricornia Section of the Park, up to 16 commercial operations in the Cairns and Far Northern Sections, and approximately 10 operators in the Townsville and Mackay areas.

2.1 Collecting areas

The most intensive commercial collection from the Great Barrier Reef occurs on reefs out from Cairns, although the fringing reefs of the Keppel Islands and reefs in the Capricornia Section are also important collection sites (Figure 1). This is due to the proximity of these reefs to populated areas and the mainland, as well as the numbers and variety of fish present. Most operators collect from reefs near their base, as large runabouts (5 to 6m in length) appear to be the preferred mode of access, although increases in collecting activity are encouraging some operators into larger vessels.

Figure 1. The Great Barrier Reef Marine Park.



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In the Cairns Section, reefs subject to heaviest collection are Michaelmas Reef, Upolo Reef and the flats of Arlington Reef. Other reported collecting sites in the Cairns Section vary, depending on the base for the collecting operation:

- Ex Port Douglas - Rudder, Undine, Batt, Tongue and Saint Crispin reefs.
- Ex Cairns - Arlington, Euston, Oyster, Sandy, Michaelmas, Hastings, Nicholas, Hope, Tetford, Moore, Elford, Sudbury, Spier, Franklands Island, St. Crispin and Agincourt reefs.
- Ex Mission Beach - Eddy reef.

In the Capricornia Section of the Great Barrier Reef Marine Park, most reefs except Heron and Wistari are believed to have been long-term collecting areas for aquarium fishes. Collection is known to have occurred at North, Wilson, Tryon and North West Reefs in the northern parts of the Section and at Llewellyn, Boult, Hoskyn, Fairfax and Lady Musgrave Island Reefs of the Bunker Group in the southern parts of the section. Collecting at Heron, Wistari, Wreck, Llewllyn and One Tree is not permitted under the Capricornia Zoning Plan and, currently two other reefs (Boult and North) are closed as Replenishment Areas.

2.2 Techniques of fish collecting

2.2.1 Breathing systems

Collecting fishes without damaging them is both time consuming and hard work. The use of underwater breathing apparatus makes the task somewhat easier. 'Hookah' and SCUBA equipment are both used by collectors, although some collectors still snorkel to catch fish in very shallow water.

Collecting is usually carried out in relatively shallow water, because of the limited time the diver can spend on the bottom and the need to decompress fish as they are brought to the surface.

2.2.2 Nets

The most popular apparatus for aquarium fish collection in the GBRR is a fence or barrier net. It is generally made of nylon monofilament, with a mesh size of roughly 12 to 18mm. The fence net is usually 9 to 10m long with a 1 to 2m drop. These dimensions may vary, and may partly depend on the type of breathing apparatus the collector is using. Small lead weights along the bottom of the net (lead line) keep the net negatively buoyant while rubber or plastic floats along the top (float line) keep the net upright. These nets do not gill the fish, but the small size of the mesh contains them by creating a barrier.

The net is set up in a crescent or V-shaped arrangement in the desired area and the collector positions himself so that the fish are between him and the net. The diver swims slowly toward the net ushering, without alarming, the fish toward the net. Between 2 and 3m from the net, the diver moves in quickly and hopefully traps the fish against the fence net with a small hand-net. With this approach, only one or two fish are caught in each 'run' at the fence net, as the fish are only impeded momentarily before they speed off in all directions. However, the efficiency of the system is easily increased by setting the fence net up in a horseshoe shape and herding the fish in. The net is then closed to form a ring and the required fishes are selected and then collected with a hand net.

2.2.3 Hooks and lines

Small barbless hooks have been used with some success to catch the larger aquarium fishes. This method may damage the fish and may result in secondary infection, so care must be taken to

ensure survival. These fishes are more commonly used in large display aquaria rather than by the hobbyist.

2.2.4 Chemicals and expolsives

There is no evidence that explosives are used in the Great Barrier Reef Region for the collection of aquarium fishes, although the practice occurs in other parts of the world (Lubbock and Polunin, 1975). Chemicals such as quinaldine and rotenone with potassium permanganate, chlorinated lime or methylene blue used as a detoxicant, are known to be in use (Robinson, 1981; Bellwood, 1981). Under the Queensland Fisheries Act, 1976; prior written permission from the Minister is required for the use of either explosives or chemicals.

2.2.5 Transportation

Once fish have been collected, the collector transfers them to a holding bucket which may be on a weighted line hanging from the boat or by his side. Upon returning to the boat, the diver will raise the bucket and, depending on the depth of collection, the fish may be decompressed on the trip to the surface. Fish decompression is a factor often overlooked by collectors, and failure to decompress fish can lead to incresed mortalities. As a result, a number of different procedures have been proposed (Daigle, 1978; Siri and Barnett, 1980).

For transport from the colecting site, the fishes are kept in either a specially designed holding tank or a plastic garbage bin. Sea water is fed into the holding tank and, in some cases, sophisticated recirculating units are used to help maintain the fishes. Small, battery operated oxygenating units may be used in some cases, and some collectors use air remaining in SCUBA cylinders.

The collector usually has his warehouse close to the docks or other major transport facilities to minimize handling and time in transit. Holding tanks in warehouses are usually

large and have elaborate water quality control devices, including different types of filters and sterilizers.

If fish are to be transported long distances; interstate or overseas, they must be specially packaged. Double or triple polyethylene bags are used, one fish to each bag, and they are inflated with oxygen at a water:oxygen ratio of 1:3. The plastic bags are usually transported in cardboard cartons. This method appears suitable for up to 24 hours (Daigle, 1978).

For fish to survive in captivity, many factors must be considered, including temperature, salinity, pH, turbidity and diet. Hardy fish may survive for up to 10 years in a home aquarium if well looked after. Fragile fishes may not cope with life in an aquarium and if the fish do not die shortly after being introduced they may gradually lose condition and succumb to diseases. Little is documented on the longevity of aquarium fishes in captivity (or, indeed, under natural conditions), and most of the information that is available comes from collectors and public aquaria. The varying details imply that both the maintenance and collection methods are decisive factors. Many collectors prefer juvenile stock as their survival rate is likely to be higher. This is important as the collection of juvenile individuals may prevent the depletion of the natural breeding population and may allow for quicker recovery of collected species.

Longevity figures for some aquarium species which have survived for lengthy periods in Taronga Park Zoo Aquarium have been supplied by John West, Senior Aquarium Keeper. The figures are presented in Table 1.

Table 1. Longevity records for some aquarium species of more than five years of age (J. West, pers comm., 1981).

Common Name	Scientific Name	Total Years
Butterfly Cod	Pterois volitans	6
Longnose Butterfly fish	Forcipiger flavissimus	5
Banner fish	Heniochus acuminatus	8
Black Backed Butterfly Cod	Chaetodon melanotus	6
Threadfin Butterfly fish	Chaetodon auriga	6
Dusky Butterfly fish	Chaetodon flavirostris	5
Moorish Idol	Zanclus canescens	6
White Spot Humbug	Dascyllus trimaculatus	6
Blue Pullers	Chromis caeruleus	6
Cleaner Wrasse	Labroides dimidiatus	6
Moon Wrasse	Thalassoma lunare	5
Blue Striped Surgeon	Acanthurus bleckeri	5
White Blotched Triggerfish	Balistoides conspicillum	13
Black Triggerfish	Odunus niger	5

2.3 Economics of collecting

A great number of species are presently collected (Appendix I) however, the figures supplied by collectors concerning the numbers of fish collected vary greatly. For example, two collectors operating in the Capricornia Section both make 1 or 2 trips of approximately 2 weeks duration each year and report catching between 20 and 30 fish per day. A fairly substantial operation in the Cairns Section collects up to 200 to 300 damsels (Pomacentridae) and 100 to 150 Chaetodons per diver. The operation reportedly collects in the vicinity of 25 000 fish per year and estimates of mortality are approximately 1 percent.

If these figures are accurate, it could be calculated that between 3 000 and 6 000 specimens per week may be sent out of the Cairns area. The average price for a fish is approximately $3.50, (ranging from $0.70 to $40) which would mean that this

industry may generate between $500 000 and $1 million annually (in the Cairns district alone), from the sale of fish to other parts of Australia and overseas.

The overseas trade in marine aquarium fishes is still largely undeveloped, as is the potential of the local market. This is evident when one considers that Australia is one of the main aquarium fish importers. In 1975 Australia imported 1 601 boxes of marine aquarium fish from the Philippines (each box containing between 30 and 50 fish) with an estimated value of approximately $20 000. Australia also imports marine aquarium fish from Singapore, Fiji and Indonesia, although the extent of importing is unknown.

At present, about 80 percent of marine aquarium fish are collected from the Philippines, with a further 16 percent from Hawaii and Florida. Australia's contribution to the world trade is currently negligible (Siri and Barnett, 1980).

With increasing freight charges, it has been suggested that the local industry may become more economically viable and may expand and capture some of the import market. The Australian export of marine aquarium fish is also minimal. However, Lubbock and Polunin (1975) list Australia as an exporter of marine aquarium fish. There is currently an overseas market for species endemic to Australia which could be greatly expanded. At present, the export of these species is almost entirely limited to America and West Germany.

Species included are:

Harlequin Tuskfish (Choerodon fasciatus)
Black Angel (Chaetodontoplus personifer)
Rainfords Butterfly (Chaetodon rainfordi)
Scribbled Angel (Chaetodontoplus duboulayi)