Acanthaster planci on the Great Barrier Reef: Swain Reefs and Northern Surveys in 1975

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Abstract.—Surveys were undertaken in 1975 as part of a continued monitoring program of the distribution and abundance of *Acanthaster planci* and of the extent of coral damage on reefs of the Great Barrier Reef. Two extensive areas were chosen for which little or no information was previously available. A spot check technique was used which enabled us to survey vast tracts of reefs quickly and inexpensively, and which provided an index of starfish abundance. In July 1975, a 10 day survey was made of 85 of the approximately 340 charted reefs in the Swain Reefs Complex near the southern end of the Great Barrier Reef. One minute observations were made at 1205 spot checks or stations. Each observation was made from the surface on the reef perimeter, of a section of reef slope to a maximum depth of 20 m. No starfish were observed on 59 reefs (69.4%) at 858 stations (71.2%). A total of 526 starfish were observed at 84 of the 347 stations on the remaining 26 reefs. Numbers of starfish observed per reef ranged from 1 to 104 with a maximum of 54 individuals counted at one station. The majority of starfish (489) and the greatest coral damage attributable to *Acanthaster* were observed on 28 reefs surveyed in the northeast sector of the Swain Reefs (between 21°00′S, 152°10′E and 21°16′S, 152°38′E). Nineteen reefs in this sector were assessed as being extensively damaged. In November 1975, an 11 day survey was made of 68 of the approximately 350 charted reefs near the northern end of the Great Barrier Reef between 12°36′S and 10°30′S. Observations were made at 1195 stations. Only 5 *Acanthaster* were observed. Eight reefs were assessed as being extensively damaged and all were located along the outer barrier between 10°46′S and 10°33′S. This damage, while not recent, we consider attributable to *Acanthaster*. To account for starfish infestations in the Swain Reefs Complex an hypothesis involving larval transport from infested reefs north of 20°S is suggested. Future developments of the infestations to the north of the Pompey Complex and in the Swain Reefs Complex are considered.

Introduction

In a previous paper (Pearson and Garrett, 1976) data were presented on the distribution and abundance of *Acanthaster planci* in the Pompey Reefs Complex (21°02′S–21°24′S) in the southern region of the Great Barrier Reef and also for the northern region between 12°36′S and 14°00′S. *Acanthaster* was rare in both regions and there was no evidence of abnormal coral mortality. However, there are many reefs lying south of the Pompey Reefs Complex and to the north of 12°36′S which have not been systematically examined for *Acanthaster*. The surveys reported in this paper were undertaken to provide information on *Acanthaster* populations in these areas.

To the south of the Pompey Reefs Complex lie the Swain Reefs comprising more than 340 charted reefs which extend over approximately 16,000 km^2. Pearson and Endean (1969) reported finding only one starfish during a survey of six reefs in the

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Swain Reefs in June 1967, in a total observation time of 325 minutes. More recently in May 1973 and May 1974, *Acanthaster* infestations were reported for several reefs in the Swain Reefs (W. Muller, pers. comm.).

In the region between 12°36′S and the New Guinea border at approximately 9°S, there are at least 600 charted reefs and numerous uncharted ones which extend over an area of approximately 44,000 km^2. No information on *Acanthaster* is available for the northern region apart from a report of 64 starfish observed on an outer reef (10°42′S) near Yule Entrance in November 1974 (A. Birtles and L. Zell, pers. comm.).

Methods

The Swain Reefs Survey was conducted from 9 to 18 July 1975, while the Northern Survey was carried out from 5 to 15 November 1975. Figure 1 shows the general location of both surveys. The margins of individual reefs were examined using two aluminium dinghies, 3.7 m in length and fitted with 15 h.p. outboard motors. Both dinghies carried an observer (R.G.P., R.N.G.) and a helmsman. Commencing from the same starting point, the dinghies were moved in opposite directions around the perimeter of the reef until meeting on the other side. Every few hundred meters the dinghy would stop and the observer, wearing a face mask, would lean over the side and view the substratum for a period of one minute. During the one minute observation period (spot check) the helmsman slowly maneuvered the dinghy a distance of up to 50 m along the reef edge, from shallow water on or near the reef crest to deeper water over the reef slope. Depending upon the depth, a section of reef 2 m to 15 m in width could be viewed. The average area of reef surface examined was estimated to be between 500 and 750 m^2. Observations were made to the limit of visibility, usually 10–20 m. Sandy areas were avoided wherever possible. At the completion of a spot check, the dinghy was moved rapidly to the next station a few hundred meters around the reef perimeter.

The spot check technique was used because it is a simple, inexpensive and rapid way to examine vast tracts of reefs as occur on the Great Barrier Reef. Comparison of the results obtained using this technique with those obtained using the time-consuming, costly and intensive, tow technique adopted by Kenchington and others on the Great Barrier Reef, are given in Pearson and Garrett (1975, 1976), Kenchington (1976), and Kenchington and Morton (1976). The spot check method provides an index of starfish distribution and abundance and indicates where more detailed surveys should be undertaken.

Data recorded at each spot check included: the actual number of *Acanthaster* observed in one minute; and estimates of live hard coral cover, of the number of fresh feeding scars, and of the proportion of dead hard coral in situ. Starfish numbers were grouped in four categories of abundance: 0, 1, 2–10, and 10 plus. While there have been several attempts to quantify "normal" populations and "infestations" (see Table 1) we regard abundance levels in excess of 10 starfish per one minute spot check, i.e., 200 per 20 minutes observation time, as constituting an infestation (Pearson and Garrett,

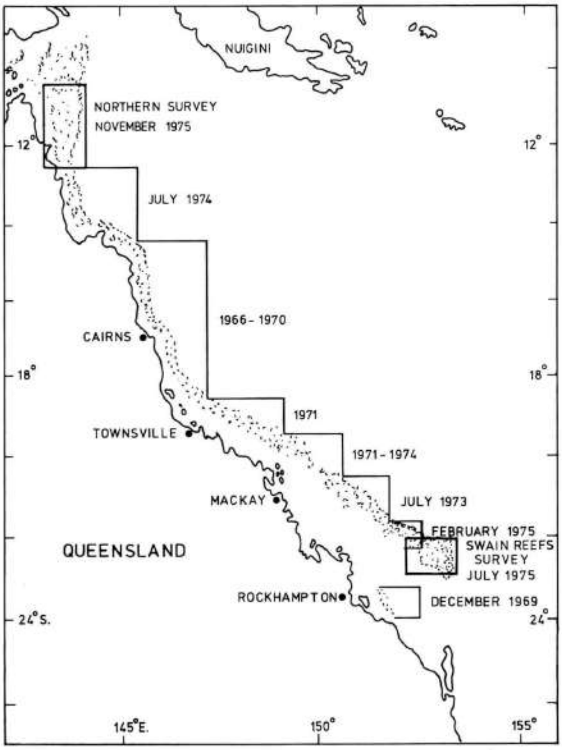

Fig. 1. Chart showing general location of both the Swains and Northern Surveys and the year and location of previous surveys by Queensland Fisheries Service personnel.

Table 1. Attempts at quantifying population levels of *Acanthaster*.

"Normal"	"Infestation"	Source
< 10 per 20 min swim*	> 40 per 20 min swim	Pearson and Endean, 1969
< 20 per 20 min swim	> 100 per 20 min swim or tow	Chesher, 1969
5–20 per km		Ormond et al., 1973
	> 10 per one min spot check	Pearson and Garrett, 1976

* Approx. 200 m of reef front.

1976). This number would represent a population of more than 10 per 50 m of reef front (200 per km) or more than 10 per 750 m^2 (133 per ha).

Accurate estimates of live coral cover and of damage to coral assemblages were not possible due to the nature of the survey. Available time would not permit use of line transects or other quantitative methods. Visual estimates of live coral cover and of coral damage (the proportion of dead standing hard coral expressed as a percentage of the existing hard coral cover) were recorded at each station and assigned to one of three categories: 0–10%, 10–50%, and 50–100%. Estimates of damage at each station were then grouped to provide an assessment of overall coral damage for the entire reef. Three categories were recognized:

1. Nil or slight damage—reefs where less than 20% of the stations had 10–50% dead standing hard coral.

2. Moderate damage—reefs where more than 20%, but less than half, of the stations had 10–50% dead standing hard coral, or where only a few stations had 50–100% dead standing hard coral.

3. Extensive damage—reefs where at least half the stations had either 10–50% or 50–100% dead standing hard coral, generally with more stations in the latter category. In some borderline cases, reefs were assessed subjectively with the aid of field notes. Particular care was taken to view the condition of tabular growth forms of *Acropora* on the deeper sections of the reef slope at the limit of visibility. It is our experience that if most of these colonies are dead then there is every reason to believe that *Acanthaster* is responsible, and that aggregations may be still active elsewhere on the reef or on nearby reefs.

Reefs to be examined were selected on a day-to-day basis. This was largely dependent on local conditions, especially weather. Every effort was made to ensure that as large an area of reefs as possible was sampled during the time available. On the Swains Survey, aerial photographs of individual reefs were used to pin-point the location of each spot check. On the Northern Survey, where aerial photographic coverage of reefs was limited, LANDSAT imagery of reef areas was also used, but this was not as helpful in identifying topographical features because of the much smaller scale—1:250,000 cf. 1:64,000 for aerial photography.

Results

SWAIN REEFS SURVEY

Eighty-five reefs were examined during the ten day survey, representing about 24% of all charted reefs in the Swains Complex. As the vast majority of reefs in the complex are unnamed, we numbered those surveyed in chronological order from 1 to 85 (Figure 2). Observations were made at 1205 stations with a mean of 14.2 stations per reef (range 3 to 37). Based on different levels of coral damage and *Acanthaster* abundance, the reefs surveyed can be separated into three geographic regions; the southern/western, the eastern and the northeastern. Reefs in the southern/western region (nos. 1–23, 71–85) were essentially undamaged and *Acanthaster* was virtually absent. Some reefs in the eastern region (nos. 24–42) had suffered moderate damage and some *Acanthaster* were present. Most reefs in the northeastern region (nos. 43–70) were extensively damaged and *Acanthaster* was abundant. The data are summarised in Table 2.

(i) ACANTHASTER ABUNDANCE. Table 3 shows the distribution of reefs and stations with respect to *Acanthaster* abundance. There were no starfish observed on 59

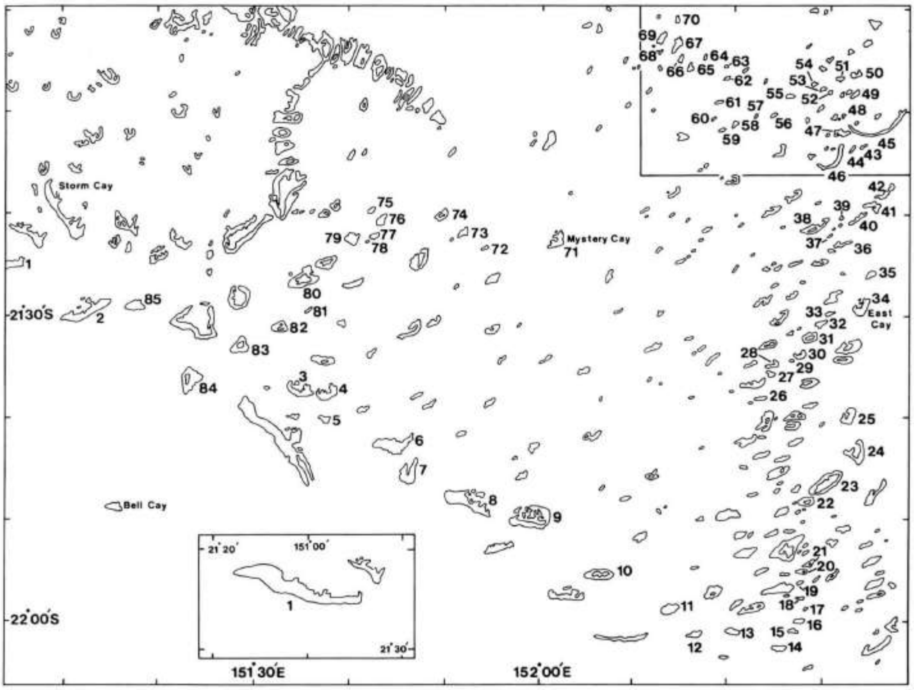

Fig. 2. Chart showing location of reefs surveyed, Swain Reefs, July 1975. As most reefs are unnamed, they are numbered chronologically from 1 to 85. Marked area in the northeast sector locates where starfish infestations and extensive coral damage were observed (Reefs 43 to 70).

Table 2. Summary of coral damage assessments and *Acanthaster* abundance, Swain Reefs Survey, July 1975.

Region	Reefs	Total reefs	Total stations	Estimated % dead standing hard coral per station			Overall damage assessment per reef*			Total *Acanthaster*
				0–10	10–50	50–100	0	+	++	
Southern/ western	1–23, 71–85	38	642	572	66	4	30	8	0	1
Eastern	24–42	19	292	226	57	9	10	11	0	36
North-eastern	43–70	28	271	81	70	120	1	6	19	489
		85	1205	879	193	133	41	25	19	526

* 0—nil or slight; +—moderate; ++—extensive.

of the 85 reefs (69.4%). Starfish were recorded from only 84 of the 1205 stations (7.0%). Of the total of 526 *Acanthaster* observed on 26 reefs, 478 (90.9%) were encountered on only 13 reefs. Infestations, i.e., more than 10 starfish per spot check, were observed on 12 of these 13 reefs at a total of 15 stations. The actual numbers of starfish at the 15 stations were: 13 (Reef 24); 11, 14, 17, 24 (Reef 48); 14 (Reef 49); 27 (Reef 52); 30 (Reef 54); 24 (Reef 57); 14 (Reef 58); 16 (Reef 63); 54 (Reef 64); 39 (Reef 67); 11 (Reef 68); and 17 (Reef 69).

Table 3. Distribution of reefs and stations with respect to *Acanthaster* abundance, Swain Reefs Survey, July 1975.

Acanthaster abundance per reef	Reefs	Stations *Acanthaster* abundance per station				Total	Total *Acanthaster*
		0	1	2–10	10 plus		
0	59	858	—	—	—	858	0
1	4	55	4	—	—	59	4
2–10	9	86	10	11	—	107	44
10 plus	13	122	9	35	15	181	478
	85	1121	23	46	15	1205	526

With the exception of Reef 24, all reefs which supported infestations were located in the northeast section of the Swain Reefs (between 21°00′S, 152°10′E and 21°16′S, 152°38′E). Twenty-eight reefs were surveyed in this region. *Acanthaster* was observed on 21 of them and of the total number of starfish counted on the survey, 489 (93.0%) were found on these reefs. The number of *Acanthaster* recorded at individual stations on several of these reefs is shown in Figure 3a.

Acanthaster was much less abundant on the 57 reefs surveyed outside the northeast section. A total of 37 starfish were observed on five reefs, including 19 at 3 of the 37 stations on Reef 24.

(ii) CORAL COVER ESTIMATES AND REEF DAMAGE ASSESSMENTS. Live hard coral cover estimates for the vast majority of stations fell in the category 10–50%, except at stations where a high proportion of dead standing hard coral was recorded. There were few stations on normal reefs where live hard coral cover estimates were either 0–10% or 50–100%. Of the 1205 stations, 73% were estimated to have 0–10% dead standing hard coral, 16% of stations were in the 10–50% category and 11% had 50–100% dead standing hard coral. Overall damage assessments based on these estimates, for reefs in each of the three regions are shown in Table 2. All of the 19 reefs assessed as extensively damaged were located in the northeast section (Nos. 49, 52–54, 56–70). The 25 reefs assessed as moderately damaged were Nos. 8, 12, 13, 15, 24–28, 34, 35, 38, 40–42, 44, 47, 48, 50, 51, 55, 71–73, and 80. Figure 3b shows coral damage records for individual stations on several reefs in this area. We attribute the observed damage to *Acanthaster* (see Discussion).

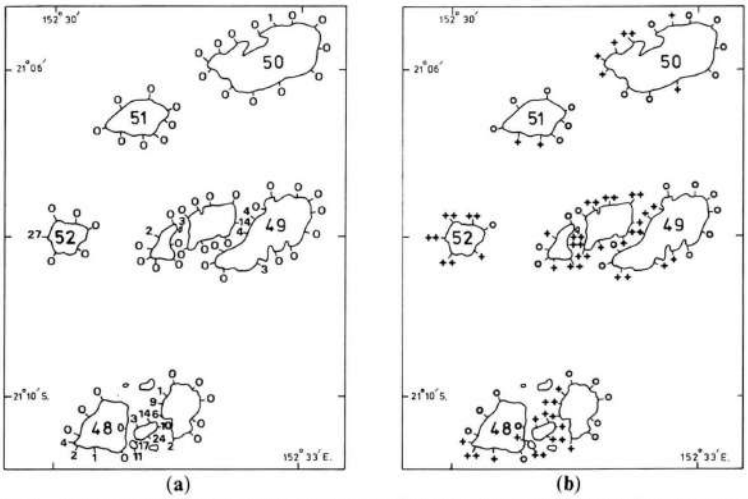

Fig. 3. Several reefs in the northeast sector of the Swain Reefs showing location of, and data recorded for each station
(a) number of starfish
(b) estimates of proportion dead standing hard coral 0, 0–10%; +, 10–50%; ++, 50–100%.

Table 4. Comparison of damage estimates for leeward and weather stations of 19 reefs* assessed as extensively damaged, Swain Reefs Survey, July 1975.

	Stations with estimated proportion dead standing hard coral	
	10–50%	50–100%
Leeward	21	58
Weather	22	57

* Reef Nos. 49, 52–54, 56–70.

There was no difference in the degree of coral damage between the leeward and windward sides of extensively damaged reefs (Table 4). However, it was noted that on most of the extensively damaged reefs, coral growths on the upper two or three meters of reef slope, particularly on the windward side were generally undamaged.

NORTHERN SURVEY

A total of 68 reefs were visited during the 11 day survey. This represents approximately 19% of all charted reefs between 12°36′S and 10°30′S. The survey did not include any of the 300 or so charted reefs which occur between 10°30′S and the northern extremity of the Great Barrier Reef at approximately 9°S. Because of the lack of aerial photographic and LANDSAT coverage of other areas, most reefs surveyed were located along the almost continuous chain of outer barrier reefs.

Reefs surveyed have been numbered chronologically as the vast majority of them are unnamed (Figure 4). In summarizing the data (Table 5) reefs have been separated into three groups; outer barrier reefs south of 11°S (Nos. 1–42), outer barrier reefs north of 11°S (Nos. 43–61), and patch reefs (Nos. 62–68).

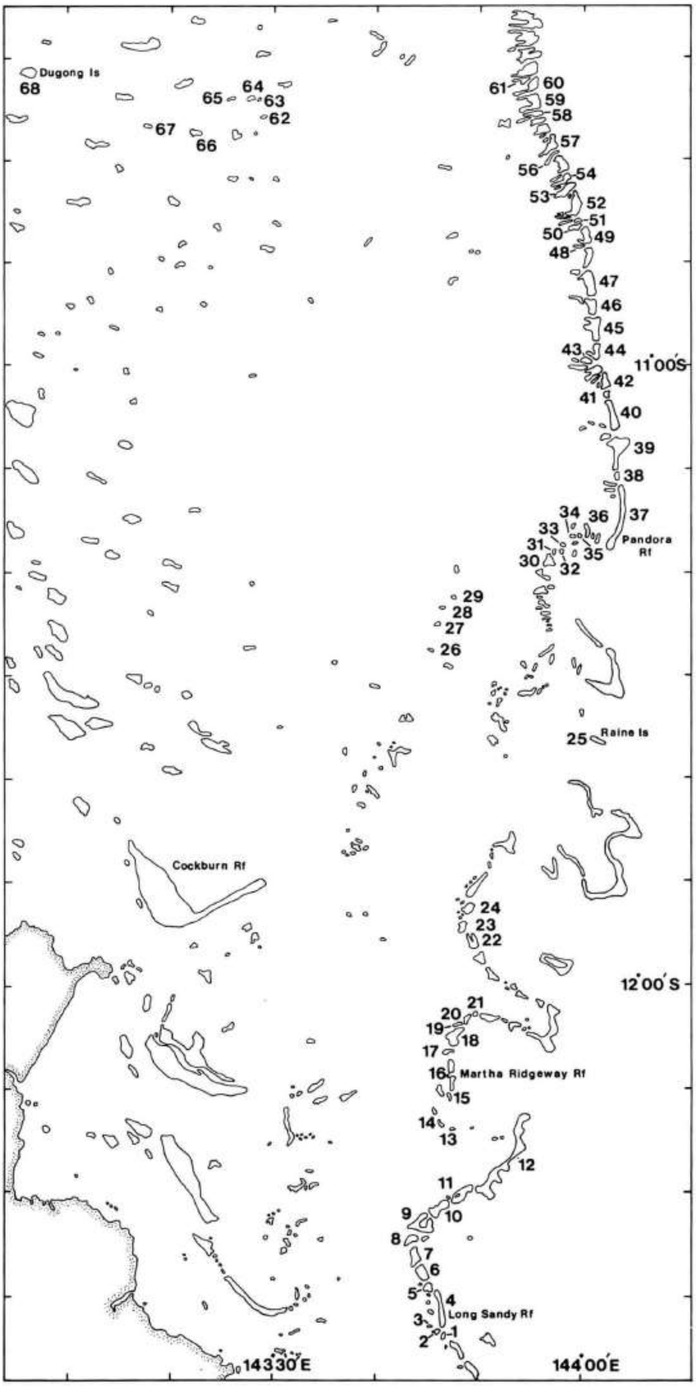

Fig. 4. Chart showing location of reefs surveyed, Northern Survey, November 1975. As most reefs are unnamed, they are numbered chronologically from 1 to 68.

(i) ACANTHASTER ABUNDANCE. In marked contrast to the Swain Reefs Survey only five *Acanthaster* were observed during the entire survey. Out of a total of 1195 stations, starfish were observed at only four stations on three reefs. These were inner patch reefs located between the tip of Cape York and the outer barrier.

Table 5. Summary of coral damage assessments and *Acanthaster* abundance, Northern Survey, November 1975.

Region	Reefs	Total reefs	Total stations	Estimated % dead standing hard coral per station			Overall damage assessment per reef*			Total *Acanthaster*
				0–10	10–50	50–100	0	+	++	
Outer barrier south of 11°S	1–42	42	645	613	26	6	39	3	0	0
Outer barrier north of 11°S	43–61	19	457	215	99	143	2	9	8	0
Patch reefs	62–68	7	93	73	18	2	3	4	0	5
		68	1195	901	143	151	44	16	8	5

* 0—nil or slight; +—moderate; ++—extensive.

(ii) CORAL COVER ESTIMATES AND REEF DAMAGE ASSESSMENTS. As for the Swains Survey, few stations on normal reefs fell outside the category 10–50% live hard coral cover. Of the 1195 stations, 12% were estimated to have 10–50% dead standing hard coral, while 13% had 50–100%. Apart from locations where starfish were observed, none of this damage appeared to be recent. Dead corals which remained in situ were generally encrusted with a variety of organisms, including small corals and were often eroded. In contrast, recent damage is regarded as ranging from the presence of numerous, fresh feeding scars to the existence of a matt of filamentous, grey-green algae on dead coral. Based on the estimates of dead standing hard coral for each station, eight of the 65 reefs were assessed as being extensively damaged (Nos. 51–54, 57–60), and 16 were assessed as being moderately damaged (Nos. 6, 36, 37, 43, 44, 47–50, 55, 56, 61–63, 65, 66). All eight extensively damaged reefs were located along the outer barrier between 10°33′S and 10°46′S. Damage was restricted to the leeward reef slopes and to the almost vertical walls of the deep (40 m plus), narrow (100 m or less) channels which separate outer barrier reefs in this region. No damage was observed on the gently sloping, seaward slopes of these reefs to depths of 20 m, which was the limit of visibility.

Discussion

The two surveys reported here provide data on coral damage and *Acanthaster* abundance for reefs in two large sections of the Great Barrier Reef where previous information was either meager or lacking altogether. A total of 44 reefs (52%) were assessed as moderately or extensively damaged in the Swain Survey area compared with 24(35%) for the Northern Survey. Even though many more starfish were encountered on the former survey (526 to 5) we consider *Acanthaster* to be primarily responsible for the damage encountered on both surveys. Very recent damage due to *Acanthaster* is indicated by fresh feeding scars. In most instances where large numbers of feeding scars were noted on reefs in the Swain Reefs, these occurred at stations where *Acanthaster* was common (Table 6). These included 13 of the 15 stations where

Table 6. Relationship between fresh feeding scars and abundance of *Acanthaster*, Swain Reefs Survey, July 1975. (for those stations where the number of scars was estimated to be at least 20)

Acanthaster abundance per station	Estimated number fresh feeding scars	
	20–50	>50
0	1	2
1–2	5	1
>2	21	22

infestations were present. There was no record of the number of scars associated with one infestation and only isolated scars were noted for the remaining infestation. At three stations on different reefs (Nos. 50, 53, and 62) large numbers of scars but no starfish were observed. Previous surveys of other areas of the Great Barrier Reef indicate that this situation is not uncommon as large numbers of *Acanthaster* were found concealed under large colonies of tabular *Acropora* on which there were numerous feeding scars. Yet on nearby reefs most *Acanthaster* were exposed during the day and were feeding on the same species. On several other occasions large numbers of starfish have been observed moving over the reef without feeding. No explanation is offered to account for these differences in feeding behavior of aggregations. Other evidence for attributing damage to *Acanthaster* included: the occurrence of live colonies of branching and massive *Porites* spp. and *Diploastrea* in extensively damaged areas (these species are usually avoided by *Acanthaster*); the presence of many dead tabular *Acropora* in deep water; the tendency for corals near the reef crest to survive where wave action inhibits feeding activity; and the occasional survival of branch tips of staghorn *Acropora* thickets.

Coral damage around the perimeter of reefs was sometimes patchy as can be seen in Figure 3b. This variation can be related to the stage and severity of the infestation. Initially a heavy infestation may be restricted to a small section of reef but as it proceeds more and more coral is consumed. Eventually the food requirements of the population are no longer satisfied and the starfish either die out or perhaps migrate to another reef, although to our knowledge no direct observations of either behavior have been made.

Although direct evidence in the form of starfish aggregations and fresh feeding scars was lacking for the Northern Survey, there was some indirect evidence. Birtles and Zell (pers. comm.) reported sighting in November 1974, a total of 64 *Acanthaster* in a channel between two outer barrier reefs at 10°42′S. A year later we observed extensive damage in the same area. We are unable to offer an alternative explanation for the damage observed on the channel walls of the outer barrier reefs, particularly at depths greater than a few meters. If *Acanthaster* is responsible then there needs to be some explanation for the apparent rarity of starfish on the northern outer barrier reefs. Firstly aggregations could have either dispersed or died out considering that the damage did not appear to be recent. The disappearance from a reef of large aggregations, sometimes without the destruction of the bulk of living corals, has been reported by several workers (Pearson and Endean, 1969; Kenchington, 1976): but whether the animals die or migrate to another reef has not been established. However, a relatively small population would have been capable of destroying the corals on the channel walls. While coral cover in two dimensions is often high on these walls, there is only a small three-dimensional component as most of the corals are either small heads or encrusting sheets. Secondly the spot check method may be unsuitable for the detection of starfish in areas where the reef slope is more or less vertical, dropping rapidly away into deep water beyond the limit of visibility from the surface. Starfish in such situations would be less obvious than if they were distributed over a gently sloping reef face. If starfish were active at the time of survey then fresh feeding scars should have been detected, at least to depths of 20 m. Obviously a more thorough survey of the northern outer barrier reefs using scuba is required.

There is no doubt that adult *Acanthaster* can withstand the strong tidal currents which can exceed six knots in the narrow, deep channels separating the northern outer barrier reefs (Maxwell, 1968). We have observed a large aggregation of starfish and extensive patches of dead standing coral in a deep (60 m), narrow (300 m) channel between Line Reef and Hardy Reef (19°44′S, 149°11′E) where tidal currents exceed four knots. Although *Acanthaster* can contend with such strong tidal currents, it is unable to cope with heavy surge action which easily dislodges starfish from exposed surfaces, and restricts feeding activity to sheltered areas or to periods of calm water (Chesher, 1969 and 1970; unpublished data). The absence of damage on the windward slopes of the northern outer barrier reefs is not surprising considering that they are located within a few kilometers of the continental slope and are thus exposed to heavy seas. On the other hand most reefs in the Swain Reefs are not exposed to extreme open sea conditions. As a result *Acanthaster* infestations and coral damage have not been restricted to the leeward slopes.

The distribution and abundance of *Acanthaster* south of 20°S is unusual. While starfish aggregations have been recorded on reefs as far south as 20°S, *Acanthaster* is rare on reefs between the Pompey Complex and the Swain Reefs at 21°S, a distance of over 200 km. In a previous paper (Pearson and Garrett, 1976) we suggested that because only isolated aggregations had been reported in the Swain Reefs, they probably arose from a combination of unknown local conditions rather than from the transport of larvae, or the migration of adults from aggregations located north of 20°S. However, in view of the extensive nature of the aggregations and associated coral damage encountered by us in the northeast Swain Reefs, an alternative hypothesis of larval transport from reefs north of 20°S is suggested to account for these aggregations, and for the rarity of *Acanthaster* on reefs between 20°S and the Swain Reefs. We postulate that larvae from aggregations on outer reefs north of 20°S are transported southeastwards and seawards of the Pompey Reef Complex and Hard-line reefs onto the northern Swain Reefs. These reefs project some 60 km seaward of the general southeasterly trend of the outer barrier in this region. In the summer months (December–March) when spawning and larval development in *Acanthaster* occurs (Pearson and Endean, 1969; Lucas, 1973), southerly currents are reported to flow outside the Great Barrier Reef (Maxwell, 1968; Brandon, 1973). However, precise details of the velocities and directions of these currents are unavailable for the region in question i.e., 18°S to 22°S. If it is assumed that a southerly current flows at 1 knot then larvae could be transported to the northern Swain Reefs in five days from infested reefs at 20°S, and in approximately 10 days from infested reefs at approximately 19°S. Given favorable conditions of temperature, salinity and food supply, larvae could complete their development in this time, as Lucas (1975) has shown in the laboratory that larvae complete their development in 9 to 11 days. Unfortunately field studies of larval behavior and settlement are lacking.

If larvae have been transported onto the northern Swain Reefs, then it is likely that the first reefs to have become infested would be those in the extreme northwest region of the Swain Reefs near 21°S, 152°E. Unfortunately this could not be confirmed as none of these reefs were visited during the survey. We suspect that some larvae were transported further southwards beyond the Swain Reefs to the Suamarez Reefs which lie approximately 100 km to the southeast of the infested section of the Swain Reefs. Endean and Chesher (1973) reported that the Suamarez Reefs appeared free of *Acanthaster* in 1970, well before reports of aggregations of *Acanthaster* in the Swains were made. If infestations are found in the Suamarez Reefs, it may not be possible to determine if they originated from larvae transported from infested reefs north of 20°S, or from infested reefs in the Swain Reefs.

To account for the rarity of *Acanthaster* on reefs between 20°S and the Swain Reefs, we suggest that in this region conditions for larval settlement and survival are unfavorable. It is postulated that because of the high tidal range (5 m) and the narrow channels through reefs of the outer barrier, complex currents are generated within the region which scatter larvae arising from aggregations north of 20°S. Furthermore we postulate that the presence of strong tidal currents and associated wind-tide turbulence, which occur between the tightly packed reefs of the outer barrier between 20°S and 21°S, make conditions generally unfavorable for the settlement and/or survival of larval starfish. Support for this view comes from the observation of Lucas (1975) that larval starfish settle only where there is little water movement.

Within the next few years we expect infestations to spread slowly southeastwards through the Pompey Reefs Complex, from infested reefs north of 20°S either by adult migration or by larval transport. We expect infestations in the northeast Swain Reefs to spread more rapidly southwards through the eastern section of the Swain Reefs. The reefs there are small and it will not take long for the bulk of corals to be killed. In many cases the reefs are so close together than adults would have little difficulty in migrating from one reef to another, although it should be noted that direct observations have not been made of such behavior. We consider it unlikely that the infestations in the Swain Reefs will spread to the Capricorn-Bunker Group. Adult migration can be ruled out because of the great distance (110 km) and deep water (140 m) separating the two reef complexes. Larval transport is unlikely because of the complex currents in the area (Woodhead, 1970). As for the northern region of the Great Barrier Reef, recent starfish activity appears to be at a low level. Within the next few years there may be a further opportunity of examining the situation in both the Swain Reefs and the northern regions.

In a series of surveys by ourselves and others since 1966, data have been accumulated gradually for the entire length of the Great Barrier Reef apart from the section between 10°30′S and the border with New Guinea at approximately 9°S (Pearson and Endean, 1969; Pearson, 1972; Endean, 1973; Endean and Stablum, 1973; Pearson and Garrett, 1976; Kenchington, 1976). In our opinion there is now a need for follow-up surveys to assess the current situation in terms of starfish abundance, coral damage and possible coral recolonization in certain regions as it is known that large changes in *Acanthaster* populations can occur in the course of a few months (Kenchington, 1976). For instance information gained from surveys in the central region of the Great Barrier Reef (14°S–18°S) is now out of date as many were done prior to 1970.

The spot check technique has proved to be of considerable value in surveying vast tracts of the Great Barrier Reef both rapidly and inexpensively. The method has been used to locate areas where aggregations of *Acanthaster* have been active and where coral damage has been extensive, on reefs in two large sections of the Great Barrier Reef where almost no information was previously available.

Destruction of corals in the Swain Reefs, in particular on reefs in the northeast sector where most aggregations were encountered in July 1975, is expected to continue over the next few years. Monitoring of these aggregations is desirable.

The apparent rarity of *Acanthaster* on reefs of the northern outer barrier and the absence of any recent damage indicates that starfish are no longer active in the area examined. A more thorough survey of these reefs is warranted.

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