Pacific Oyster Breeding in Hotham Sound and Ladysmith Harbour 1974 and 1975

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April 1978

Fisheries & Marine Service Manuscript Report No. 1454

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Fisheries and Marine Service

Manuscript Report 1454

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PACIFIC OYSTER BREEDING IN HOTHAM SOUND AND LADYSMITH HARBOUR 1974 AND 1975

by

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ABSTRACT

Heritage, G. D., and N. Bourne. 1978. Pacific oyster breeding in Hotham Sound and Ladysmith Harbour 1974 and 1975. Fish. Mar. Serv. MS Rep. 1454: 41 p.

Results of monitoring Pacific oyster breeding in Hotham Sound and Ladysmith Harbour in 1974 and 1975 are presented. Climatic and hydrographic conditions were generally unsuitable for successful breeding in Hotham Sound in 1974 and Ladysmith Harbour in 1974 and 1975, although some settlement occurred. Successful breeding of Pacific oysters did occur in Hotham Sound in 1975.

Key words: Natural breeding; seed collecting; oyster, Crassostrea gigas (British Columbia).

RÉSUMÉ

Heritage, G. D., and N. Bourne. 1978. Pacific oyster breeding in Hotham Sound and Ladysmith Harbour 1974 and 1975. Fish. Mar. Serv. MS Rep. 1454: 41 p.

Nous présentons les résultats de contrôles de la reproduction de l'huître creuse (Crassostrea gigas) dans le détroit Hotham et la havre Ladysmith, en 1974 et 1975. Malgré des conditions climatiques et hydrographiques généralement peu propices dans le détroit en 1974, et dans le havre, en 1974 et 1975, nous avons pu observer une certaine implantation. L'élevage de l'huître creuse, dans le détroit Hotham, en 1975, a été reussi.

Mots clés: Reproduction naturelle; collecte du naissain; huître, Crassostrea gigas (Colombie-Britannique).

INTRODUCTION

Since 1959 the Pacific Biological Station has provided a Pacific oyster spatfall prediction service for the British Columbia oyster industry. In 1973 sampling was begun in Hotham Sound (Bourne, in press) and continued in 1974 and 1975. Monitoring was also continued in Ladysmith Harbour in 1974, and in 1975 the Province of British Columbia, Marine Resources Branch, Ministry of Recreation and Conservation took over this service for Ladysmith Harbour.

Because of other commitments, only minimum surveillance was undertaken in the two areas during these 2 yr, and the data collected are summarized here.

1974 - HOTHAM SOUND

A raft anchored at Station 1 (Fig. 1) on June 27 served as the main sampling station in Hotham Sound in 1974.

HYDROGRAPHIC OBSERVATIONS

Continuous water temperature measurements at the 1 m depth at Station 1 were made from June 27 to September 16 using a Ryan, 30-day, temperature recorder. During the breeding season periodic temperature and salinity profiles were made at all three stations using a Beckman RS5-3 portable salinometer.

Mean daily water temperatures at 1 m remained below 20 C until July 29 and then were 20 C, or higher, for only 8 days (Fig. 2). Surface water temperatures declined rather suddenly in early August to a minimum of 17 C on August 24, then increased in late August and early September. Surface water temperatures never attained 20 C again during the 1974 breeding season. Water temperature profiles on July 30 and August 9 show the presence of a thermocline at 2 m at Station 1, and on August 9 at 1-2 m at Station 2 (Table 1). On August 21 the thermocline had disappeared.

Salinity measurements show the presence of a halocline at a depth of 5 m at Stations 1 and 2, and at 2 m at Station 3 on June 27 (Table 1). On July 30 the halocline was more pronounced and was 2 m deep at Station 1 and on August 9 it was closer to the surface at both Stations 1 and 2. The halocline had virtually disappeared on August 21.

The limited hydrographic data indicate the presence of a warm surface layer for only a brief period at the end of July and early August.

SPAWNING AND LARVAL DEVELOPMENT

Surface plankton samples were taken during daylight hours with a standard plankton net (Heritage et al. 1976). Four samples were taken at Station 1 and two at Station 2.

Straight hinge Pacific oyster (Crassostrea gigas) larvae were first recorded on July 30 at a relative abundance of 2 (Table 2) indicating light spawning had occurred during the last week of July. Very small numbers of early umbone larvae were found on August 9 and on August 31 a few late umbone larvae were found. Relative numbers of Pacific oyster larvae never reached a value of 6 during 1974 (see Heritage et al. 1976 for details of calculating relative abundance).

SPATFALL

Two strings of test cultch were exposed at Station 1 on August 21 and examined when equipment was removed on September 16. Mean spat counts per shell on the two strings were 3.8 and 4.1.

ABUNDANCE OF OTHER BIVALVE SPECIES

Mytilus edulis larvae were found in all samples and ranged in abundance from 1-5 (Table 2). A fairly heavy set occurred. Bankia setacea larvae were found in similar abundance to M. edulis larvae. Ostrea lurida larvae occurred in low abundance as did clam larvae until the August 31 sample when relative abundance increased suddenly to 12.

SUMMARY

The Pacific Biological Station began monitoring Pacific oyster breeding in Hotham Sound in 1973 to determine its reliability as an oyster breeding area and whether it could be used as a secondary seed collecting area. Heavy settlement occurred there in 1973 (Bourne, in press) but in 1974 cool, wet weather produced unsuitable hydrographic conditions for oyster larval development and survival. The set was below commercial levels.

LADYSMITH HARBOUR

Because of extensive commitments in Pendrell Sound only limited surveillance work was carried out in Ladysmith Harbour in 1974.

WEATHER

Daily weather observations were not taken at Ladysmith Harbour. Rainfall data for Nanaimo Airport, approximately 5 km from Station 2 (Fig. 3), were provided by the Regional Climate Data Center, Atmospheric Environment Service, Victoria, British Columbia. Considerable rainfall in the first half of July was followed by dry weather with little rainfall until the end of the sampling program (Fig. 4). Total rainfall for the sampling period was 51.6 mm.

HYDROGRAPHIC MEASUREMENTS

Continuous water temperature measurements, were taken from July 2 to September 3 at a depth of 1 m at Station 4. Water temperatures remained below 20 C until July 28 after which they were at, or above, 20 C for 15 days (Fig. 5). A sharp decline in water temperature occurred after a maximum of 22.7 C was reached on August 5. Water temperatures then fell to 16.3 C; then increased to above 19 C in late August.

SPAWNING AND LARVAL DEVELOPMENT

Weekly 5-min surface plankton tows were taken during daylight hours at Station 4 using a standard net (Heritage et al. 1976). Straight hinge Pacific oyster larvae were first observed on July 30 (Fig. 6), relative abundance 12, indicating spawning occurred about July 26.

On August 6 the relative abundance of straight hinge larvae was 15, indicating further spawning occurred about August 4. Numbers of early- and mid-umbone larvae were 25 and 10, indicating survival of larvae from the July 26 spawning had been good.

On August 13 relative abundance of Pacific oyster larvae had declined to 10 but modest numbers of all larval stages, except the eyed stage, were found in the plankton (Fig. 6).

On August 15 extensive plankton sampling was carried out in Ladysmith Harbour. Tows were taken at Sibell Bay (Station 6), off Slag Point (Station 5), Manana Lodge (Station 3), Limberis' shucking plant (Station 2), Wedge Point (Station 1), and at the head of the Harbour (Fig 3). Relative abundance of *C. gigas* larvae of 3, 3, 3, 5, 4, and 4, respectively, were found at the sampling sites. Off Manana Lodge only mid-umbone larvae were found; off Sibell Bay straight hinge to late umbone larvae occurred. At all the other locations larvae from straight hinge to the eyed stage were found.

SPATFALL

Test cultch (oyster shell) was exposed at Station 4 on August 20 and removed on September 11. No spat were found on the test cultch. However, small sets (less than 5 spat per piece of cultch) were reported from isolated locations in the intertidal area of Ladysmith Harbour.

ABUNDANCE OF OTHER BIVALVE SPECIES

M. edulis larvae were found in all plankton tows (Fig. 6). Relative numbers reached a maximum of 30 on July 9 and then declined during the remainder of the summer.

B. setacea larvae were found in small numbers in all samples except two.

O. lurida larvae were found only in the first sample.

Relative abundance of clam larvae was above 9 in all samples and reached maxima of 25 and 30 on July 16 and August 13.

SUMMARY

The complete lack of a set on the experimental cultch is rather surprising in light of the fact that modest numbers of late-stage larvae were found in plankton tows. The sudden decrease in water temperatures in early August may have caused heavy mortalities. Another explanation may be that test cultch was exposed in a poor location, since some spatfall (less than 5 spat per piece of cultch) was reported on shell in the intertidal area in various locations in the Harbour.

1975 HOTHAM SOUND

Limited monitoring of Pacific oyster breeding was undertaken in Hotham Sound and Ladysmith Harbour in 1975.

WEATHER

No weather observations were made in Hotham Sound in 1975, but weather observations were made at Malibu (Jervis Inlet) about 31 km from Hotham Sound. It is felt that weather conditions at Malibu provide a general picture of weather patterns at Hotham Sound (Heritage et al. 1977).

Cloud cover and rainfall data collected at Malibu were supplied by the Regional Climate Data Center. During the 86-day study period there were 32 clear days, 38 partially overcast days, and 11 completely overcast days; cloud cover data were not available for the period August 13-17 (Fig. 7). Total precipitation for the period was 259.9 mm; there was a daily mean of 1.93 mm in July, 5.86 mm in August, and 0.18 mm for the first 16 days of September.

HYDROGRAPHIC OBSERVATIONS

Continuous temperature measurements were made at depths of 1 and 3 m at Station 1 from June 26 to September 9 using Ryan 30-day temperature recorders. No temperature and salinity profiles were undertaken.

Surface waters in Hotham Sound warmed quickly to 20 C, or above, by July 6 at 1 m and July 9 at 3 m (Fig. 8). Water temperatures remained above 20 C for about 12 days at 1 m and about 13 days at 3 m, fell below 20 C for a short period at 1 m and then rose to 20 C, or above, for another 6 days. Water temperatures at both depths then declined steadily until a minimum of 14.6 C was recorded at 1 m on August 30. After this, water temperatures went through a brief warming trend and then declined until the end of the sampling period.

SPAWNING AND LARVAL DEVELOPMENT

Surface plankton tows were carried out on only two occasions in 1975 (Table 3). On July 23 early, mid-, and late umbone C. gigas larvae were present in samples from Stations 1 and 2 indicating spawning had occurred during the 2-wk period prior to sampling. Samples taken on August 21 at Stations 1 and 2 had C. gigas larvae at only Station 1. These larvae were in the straight hinge and mid-umbone stages indicating further spawnings occurred about the second week of August.

SPATFALL

No test cultch was immersed in Hotham Sound in 1975 but a sample of shell from the beach was examined for C. gigas spat on August 21. This shell had a mean spat count of 3.6 per shell with a range from 0 to 12.

If hanging cultch had been exposed, spatting of commercial intensity could have occurred, since the set on suspended cultch can be 3 to 10 times as great as beach cultch (Quayle 1969).

ABUNDANCE OF OTHER BIVALVE SPECIES

The sampling data are limited and little can be said about the occurrence of other bivalve larvae. M. edulis larvae were moderately abundant at all three stations on both sampling dates. B. setacea larvae were absent from samples at Station 1, rare at Station 2, and only a few were found at Station 3 on July 23. O. lurida larvae were only found at Station 1 on July 23. Clam larvae occurred in modest numbers at the three stations.

SUMMARY

Meterological and hydrographic conditions were not very suitable for Pacific oyster breeding in Hotham Sound in 1975. Generally, the weather was cool and wet and the resulting water temperatures cool. However, light spawning did occur and survival of the larvae was sufficient to produce a light set.

LADYSMITH HARBOUR

In 1975, monitoring of Pacific oyster breeding in Ladysmith Harbour was undertaken by the Province of British Columbia, Marine Resources Branch, Ministry of Recreation and Conservation. In an attempt to improve the accuracy of the spatfall prediction service and to gain further insight of factors affecting Pacific oyster breeding, the effort was greatly increased. Sampling was undertaken twice a week and sampling sites were established at Stations 2, 3, 4, 5, and 6.

WEATHER

Rainfall data for Nanaimo Airport (Cassidy) was supplied by the Regional Climate Data Center (Fig. 9). Total precipitation for the study period, June 18 to September 9, was 152 mm; mean daily rainfall was 3.01 mm for the last 3 days of June, 0.65 mm in July, 2.99 mm in August and no rain fell during the first 9 days of September.

HYDROGRAPHIC MEASUREMENTS

Surface water temperatures were measured at a depth of 1 m at Station 2 with a 7-day Ryan temperature recorder. No temperature and salinity profiles were carried out in 1975.

The data are incomplete but indicate surface water temperatures rose to 20 C on July 10 (Fig. 10). Surface water temperatures probably remained above 20 C until early August. Water temperatures were generally below 20 C during most of August.

SPAWNING AND LARVAL DEVELOPMENT

Surface plankton tows were carried out in daylight hours at least twice a week at Stations 2 and 6 in Ladymsith Harbour during 1975. Straight hinge and early umbone Pacific oyster larvae were first observed in samples taken on July 14 (Fig. 11, 12) indicating spawning probably occurred about July 7. Two additional spawnings occurred about July 29 and August 13 as can be seen by the increased numbers of straight hinge larvae in the plankton; this is more evident at Station 2 than 6.

Larvae from the first spawning developed through to the eyed stage in approximately 17 days. Larvae from later spawnings did not reach the eyed stage although some did reach the late umbone stage in mid-August (Fig. 11, 12).

SPATFALL

Test cultch (oyster shell) was first immersed on July 24 at Stations 2, 3 and 6. Subsequent cultch samples were exposed at all five sampling stations at roughly weekly intervals. Most were removed after having been exposed for only a week but some were left until equipment was removed on September 9.

Spatfall was light on all cultch. The highest mean count per piece of shell was 1.1 spat on cultch exposed on July 31 and August 14 and removed September 9 (Table 4). In both cases the cultch had been sampled at an earlier date and had lower counts which indicates most of the spatfall occurred in late August.

ABUNDANCE OF OTHER BIVALVE SPECIES

M. edulis larvae were abundant in the plankton throughout the sampling period (Fig. 13, 14). A maximum relative abundance of 40 was found at Station 2 on three occasions (Fig. 13) and once at Station 6 (Fig. 14).

Relative numbers of B. setacea larvae reached maxima in early July at both stations. Numbers then declined and during the remainder of the sampling period were generally low with many samples containing no shipworm larvae.

Relative abundance of O. lurida larvae was below 10 for the entire sampling period; half the samples at each station had no larvae.

Several species of clam larvae occurred in relative numbers ranging from 0 to 32 at Station 2 and from 0 to 28 at Station 6. Maximum abundance occurred on June 26 and July 10 at the two stations.

SUMMARY

Although summer temperatures were cool, hydrographic conditions were generally favourable for Pacific oyster spawning and larval development. Spawning occurred and some larvae developed but spatfall was light and well below commercial intensity.

The last commercial spatfall in Ladysmith Harbour occurred in 1971 (Bourne, in press); from 1926 to 1968 only 15 commercial sets occurred (Quayle 1969). Spatfall in Ladysmith Harbour is too erratic for the industry to rely on it for their seed requirements but the occasional sets here are used by the local industry. The increased use of this area for log booming and sorting operations may have produced conditions which are now unsuitable for Pacific oyster breeding and spatfall could be even more erratic than experienced in past years. The effects of log booming on Pacific oyster breeding warrants further study.

ACKNOWLEDGEMENTS

Thanks are gratefully extended to Dr. D. B. Quayle for his advice and assistance and to Mr. D. W. Smith and personnel of the Province of British Columbia, Marine Resources Branch of the Ministry of Recreation and Conservation for their assistance and use of their data.

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Table 1. Water temperature and salinity profiles, Stations 1, 2, and 3, Hotham Sound 1974.

	Station 1							
	June 27		July 30		August 9		August 21	
Depth	Temp. C	Sal. ‰	Temp. C	Sal. ‰	Temp. C	Sal. ‰	Temp. C	Sal. ‰
0	16.2	17.2	20.3	16.1	20.4	18.9	18.1	20.6
1	16.1	17.2	20.4	16.1	19.7	20.9	17.9	22.6
2	15.8	17.4	20.3	16.5	18.0	23.4	17.8	23.1
3	16.3	17.6	16.5	21.2	15.3	24.5	17.7	23.4
4	15.4	19.7	14.3	23.2	14.5	24.9	17.7	23.4
5	14.8	22.8	13.3	24.1	13.5	25.4	17.7	23.4
6	14.6	23.0	13.0	24.4	13.0	25.8	17.7	23.7
7	14.0	23.4	12.2	24.8	12.8	25.8	17.4	23.9
8	14.2	23.3	12.6	25.0	12.2	26.1	17.2	23.9
9	14.2	23.5	11.7	25.5	12.0	26.4	17.0	24.3
10	13.8	24.5	11.1	25.8	11.4	26.4	16.8	24.5
11	-	-	-	-	11.3	26.7	16.8	24.6
12	-	-	-	-	11.2	26.9	15.8	25.2
13	-	-	-	-	11.1	27.1	15.7	25.4
14	-	-	-	-	10.9	26.8	15.4	25.5
15	11.7	25.1	10.1	27.6	-	-	-	-
20	9.9	26.4	9.8	28.1	-	-	-	-

Table 1 (cont'd)

Depth	Station 2				Station 3	
	June 27		August 9		June 27	
	Temp. C	Sal. ‰	Temp. C	Sal. ‰	Temp. C	Sal. ‰
0	16.5	17.8	20.9	18.7	16.2	18.5
1	16.6	18.0	20.0	21.1	15.9	19.0
2	16.6	17.8	18.3	23.6	15.8	19.5
3	16.5	17.8	16.2	24.7	15.4	21.2
4	16.3	18.1	15.4	24.9	14.7	23.1
5	16.5	18.3	13.6	25.7	13.9	23.2
6	15.7	19.2	13.4	25.7	13.9	23.6
7	15.5	21.8	12.4	26.2	13.2	24.1
8	15.1	21.7	12.0	26.3	13.2	24.2
9	15.4	21.7	11.5	26.3	13.2	24.4
10	14.7	22.3	11.4	26.3	12.8	24.5
11	-	-	11.1	26.1	-	-
12	-	-	11.4	24.6	-	-
13	-	-	11.8	25.4	-	-
14	-	-	11.9	24.4	-	-
15	14.1	24.3	-	-	11.9	25.3
20	11.9	25.3	-	-	11.0	26.0

Table 2. Relative numbers of bivalve larvae in surface plankton tows, Stations 1 and 2, Hotham Sound 1974.

Date	*M. edulis*	*B. setacea*	*O. lurida*	Clams	*C. gigas*
		Station 1			
June 27	5	5	0	0	0
July 30	2	2	2	2	2
August 9	1	1	1	1	6
August 31	2	2	0	12	4
		Station 2			
July 30	2	2	2	2	2
August 9	1	1	1	1	6

Table 3. Relative numbers of bivalve larvae, Stations 1, 2, and 3, Hotham Sound 1975.

Date	*M. edulis*	*B. setacea*	*O. lurida*	Clams	*C. gigas*
		Station 1			
July 23	5	0	5	5	35
August 21	6	0	0	2	2
		Station 2			
July 23	6	0	0	3	21
August 21	9	1	0	0	0
		Station 3			
July 23	6	3	0	3	18

Table 4. Mean number of Pacific oyster spat on cultch exposed for varying periods in Ladysmith Harbour 1975.

		First examined		Final count	
Station	Date in	Date	$\bar{X}$ spat count	Date	$\bar{X}$ spat count
2	July 24			July 31	0.4
2	July 31	Aug. 8	0.5	Sept. 9	1.1
2	Aug. 8			Aug. 14	0.0
2	Aug. 14	Aug. 21	0.0	Sept. 9	1.1
2	Aug. 21			Aug. 28	0.7
3	July 24			July 31	0.3
3	July 31			Aug. 8	0.3
3	Aug. 8			Aug. 14	0.0
3	Aug. 14	Aug. 21	0.0	Sept. 9	0.3
3	Aug. 21			Aug. 28	0.4
4	July 28			Aug. 5	0.5
4	Aug. 5			Aug. 11	0.3
4	Aug. 11			Aug. 18	0.0
4	Aug. 18			Aug. 25	0.4
5	July 28			Aug. 5	0.3
5	July 31			Sept. 9	0.0
5	Aug. 5			Aug. 11	0.1
5	Aug. 11			Aug. 18	0.0
5	Aug. 14			Sept. 9	0.2
5	Aug. 18			Aug. 25	0.1
6	July 24			July 31	0.2
6	July 31			Aug. 8	0.2
6	Aug. 14	Aug. 21	0.0	Sept. 9	0.3
6	Aug. 21			Aug. 28	0.1

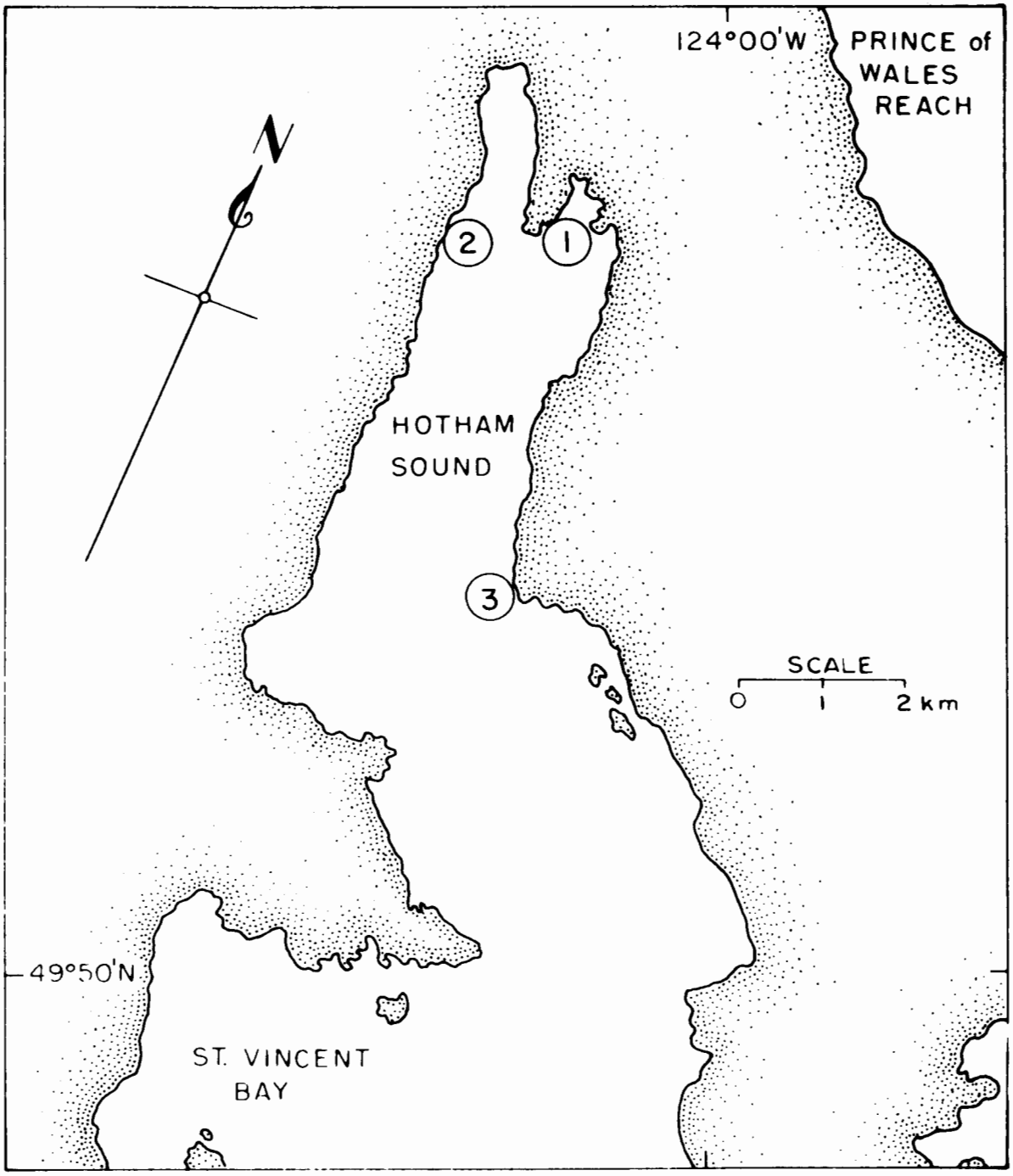

Fig. 1. Map of Hotham Sound showing sampling stations.

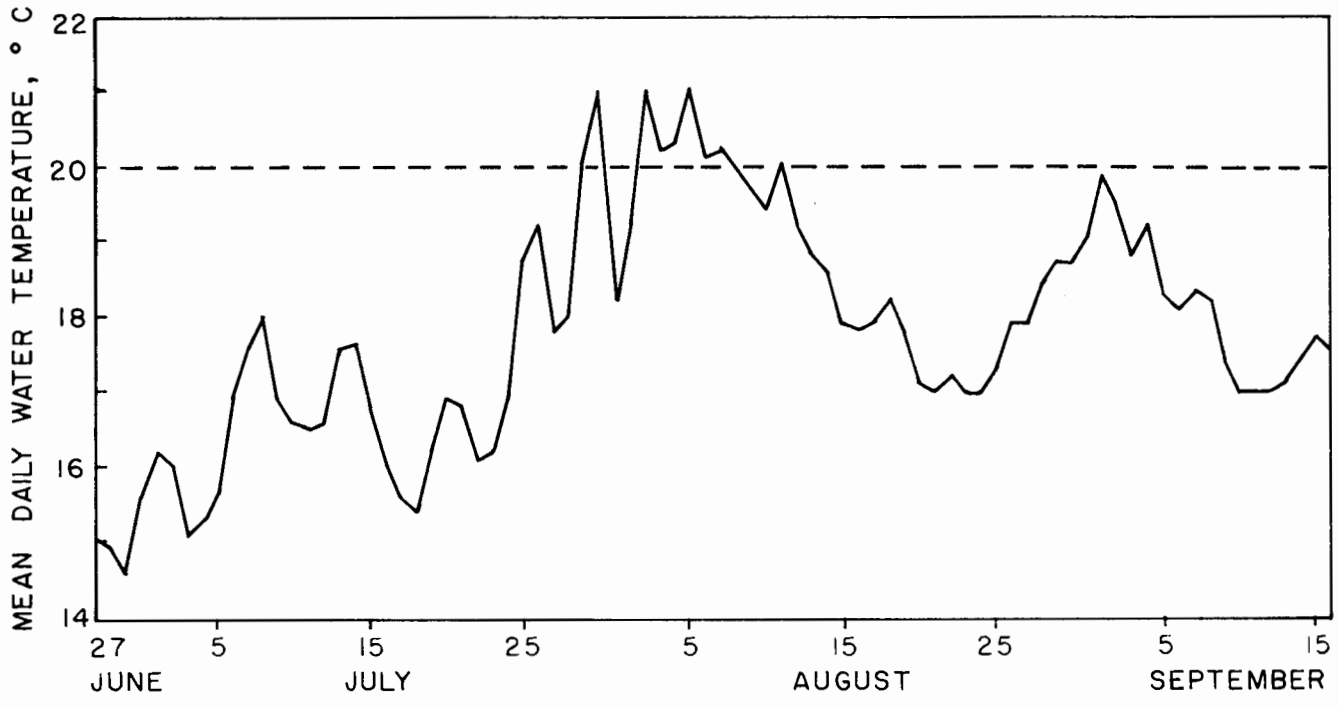

Fig. 2. Mean daily water temperature at 1 m, Station 1, Hotham Sound, June 27-September 15, 1974.

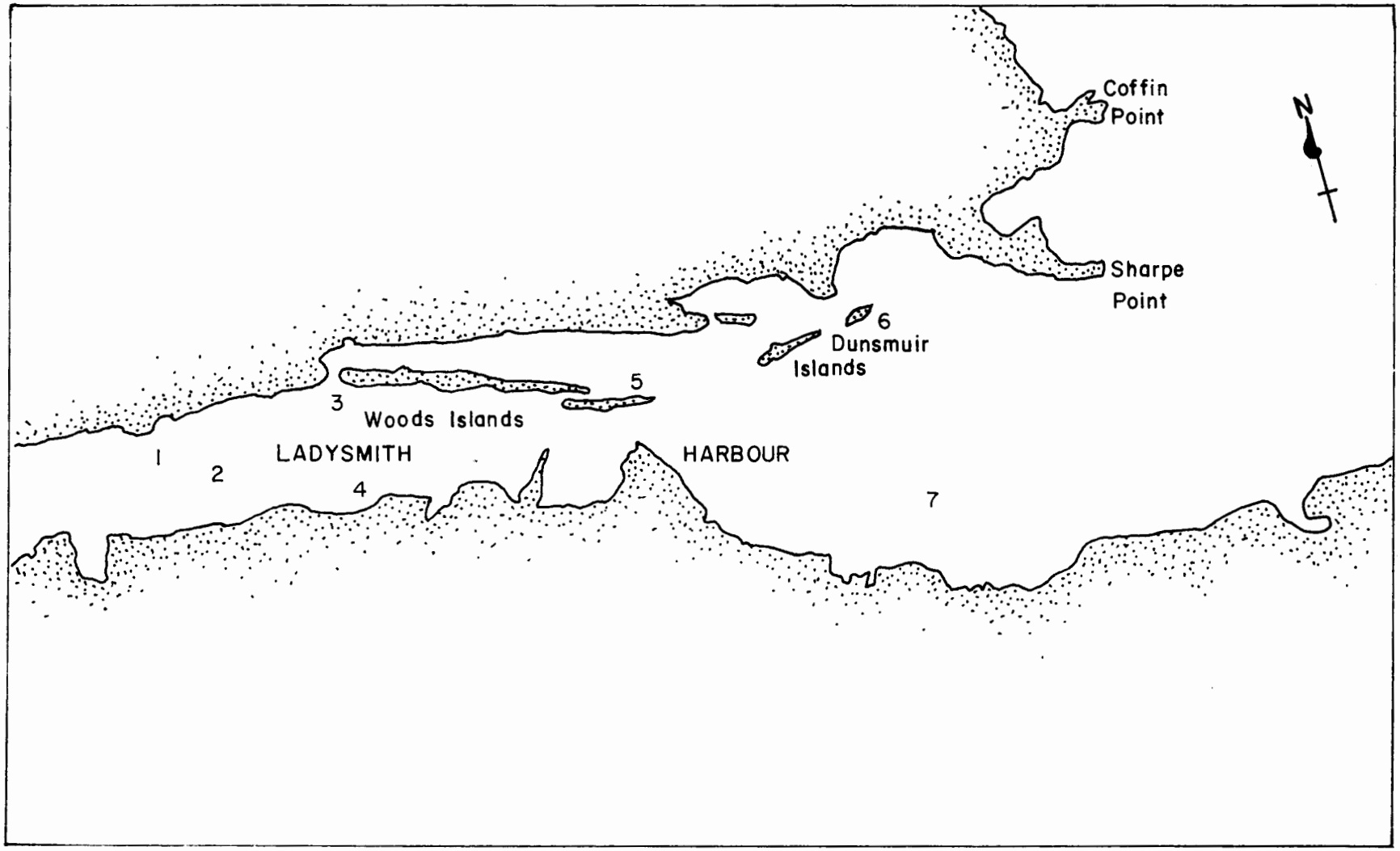

Fig. 3. Map of Ladysmith Harbour showing sampling stations.

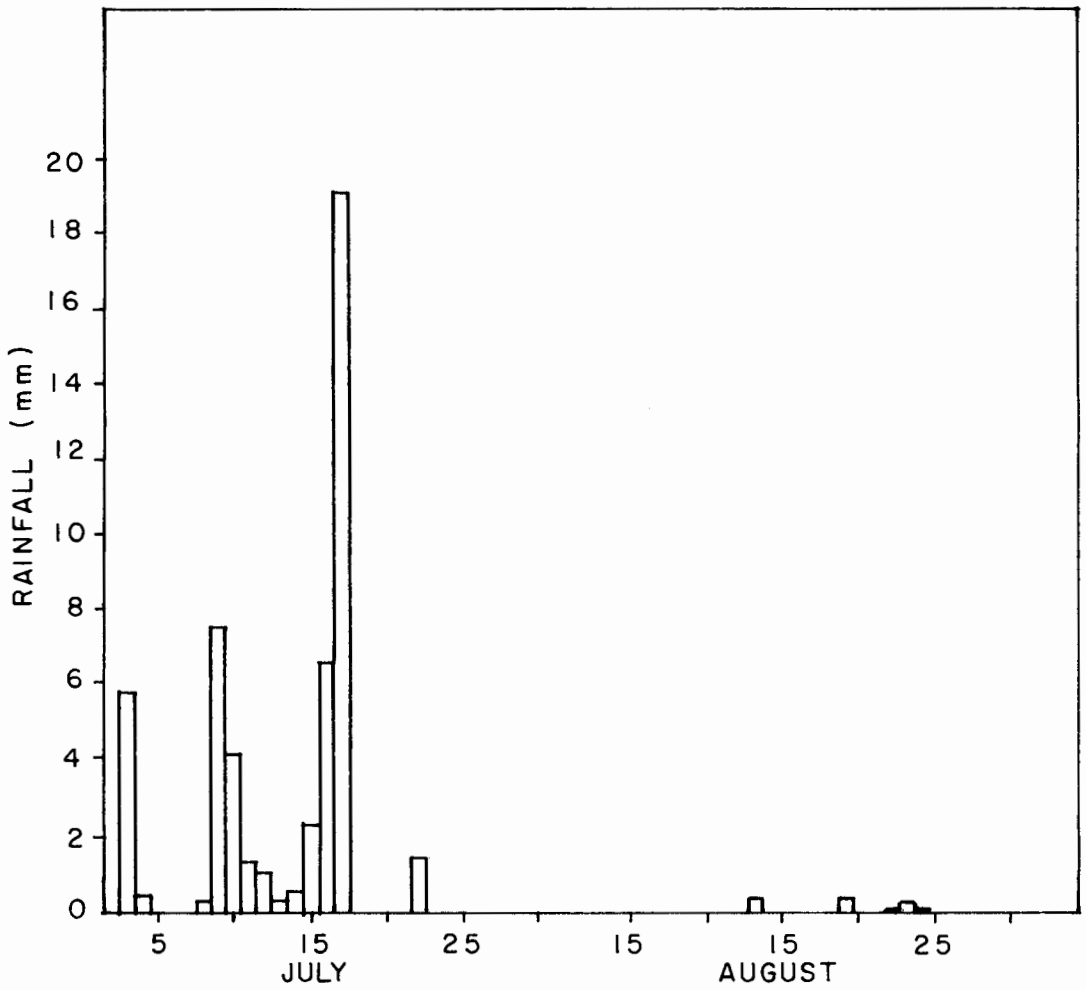

Fig. 4. Daily rainfall at Nanaimo Airport (Cassidy) July 2-September 3, 1974.

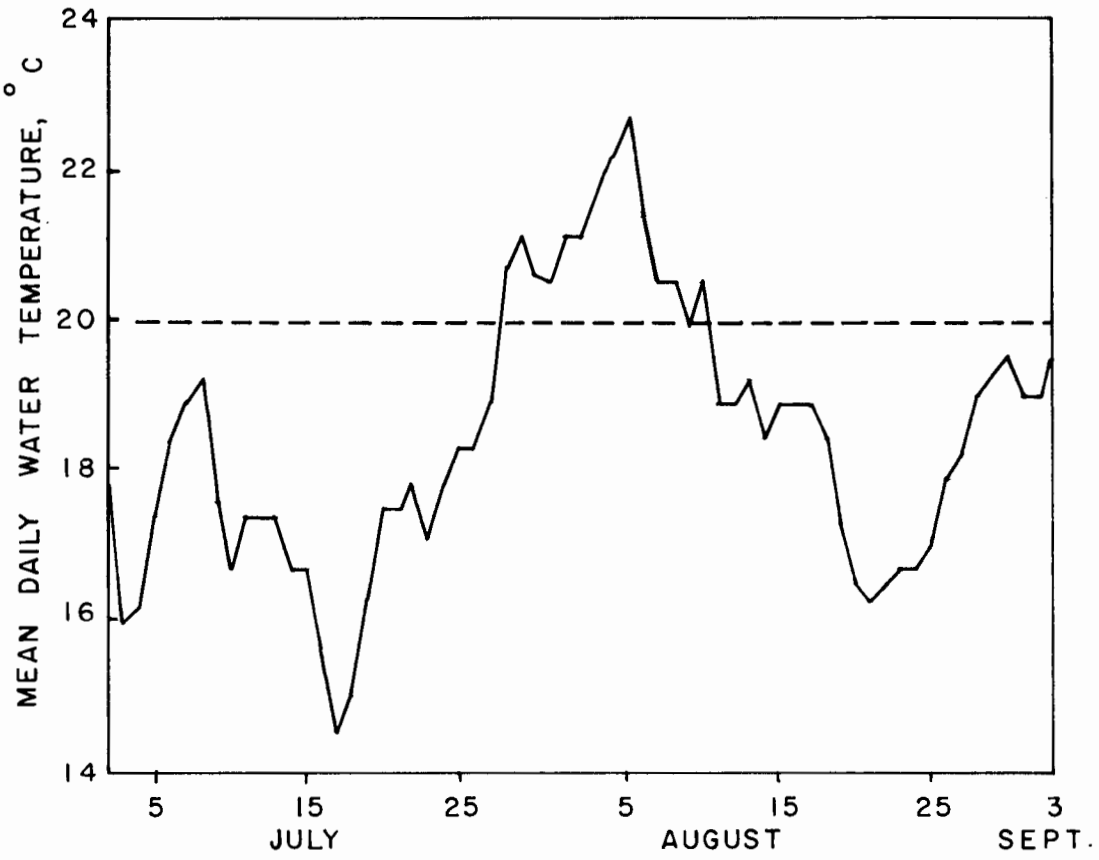

Fig. 5. Mean daily water temperatures at a depth of 1 m at Station 4, Ladysmith Harbour, July 2-September 3, 1974.

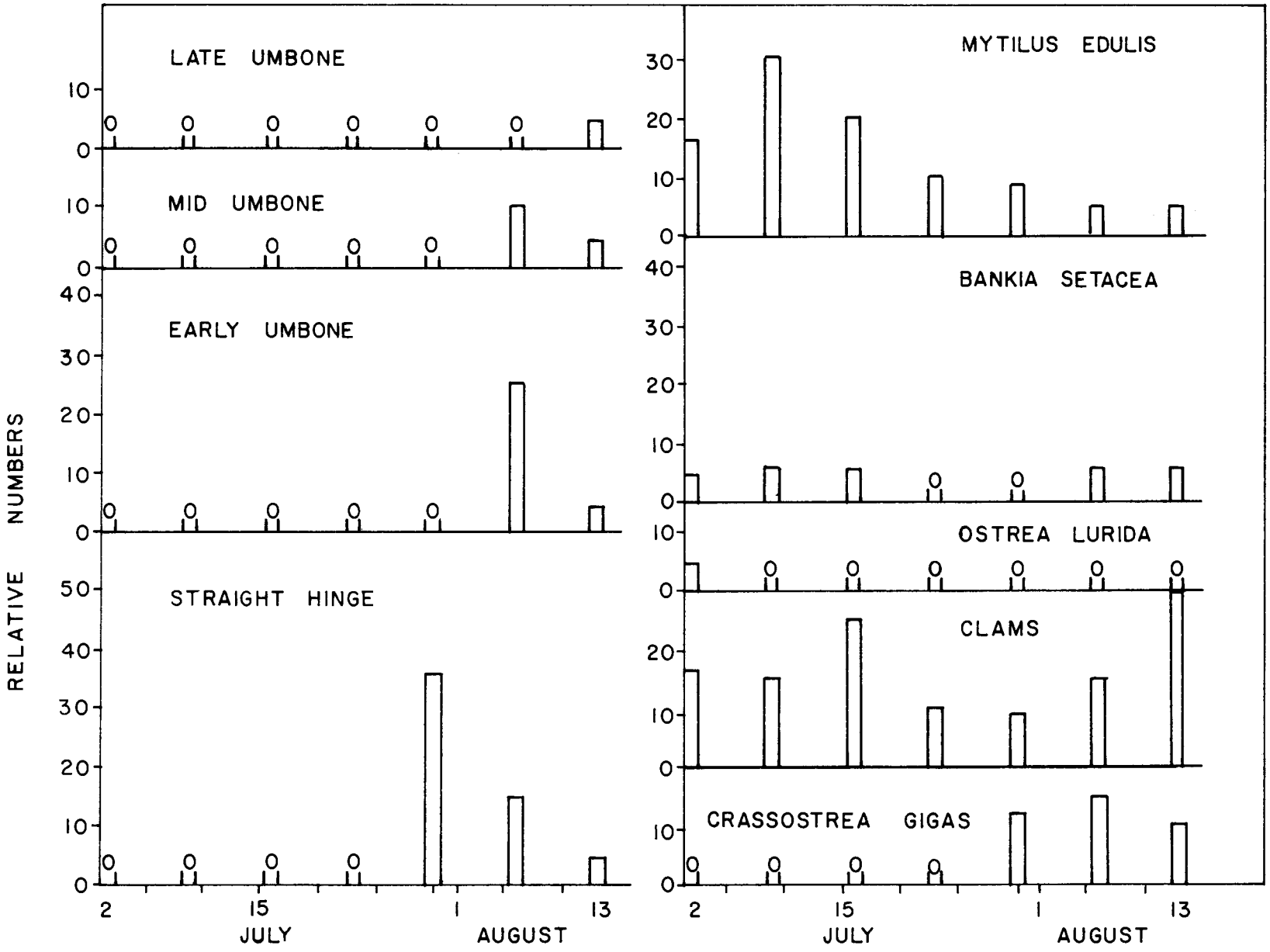

Fig. 6. Relative number of the four developmental stages of C. gigas larvae and other bivalve larvae in surface plankton tows, Station 4, Ladysmith Harbour, 1974.

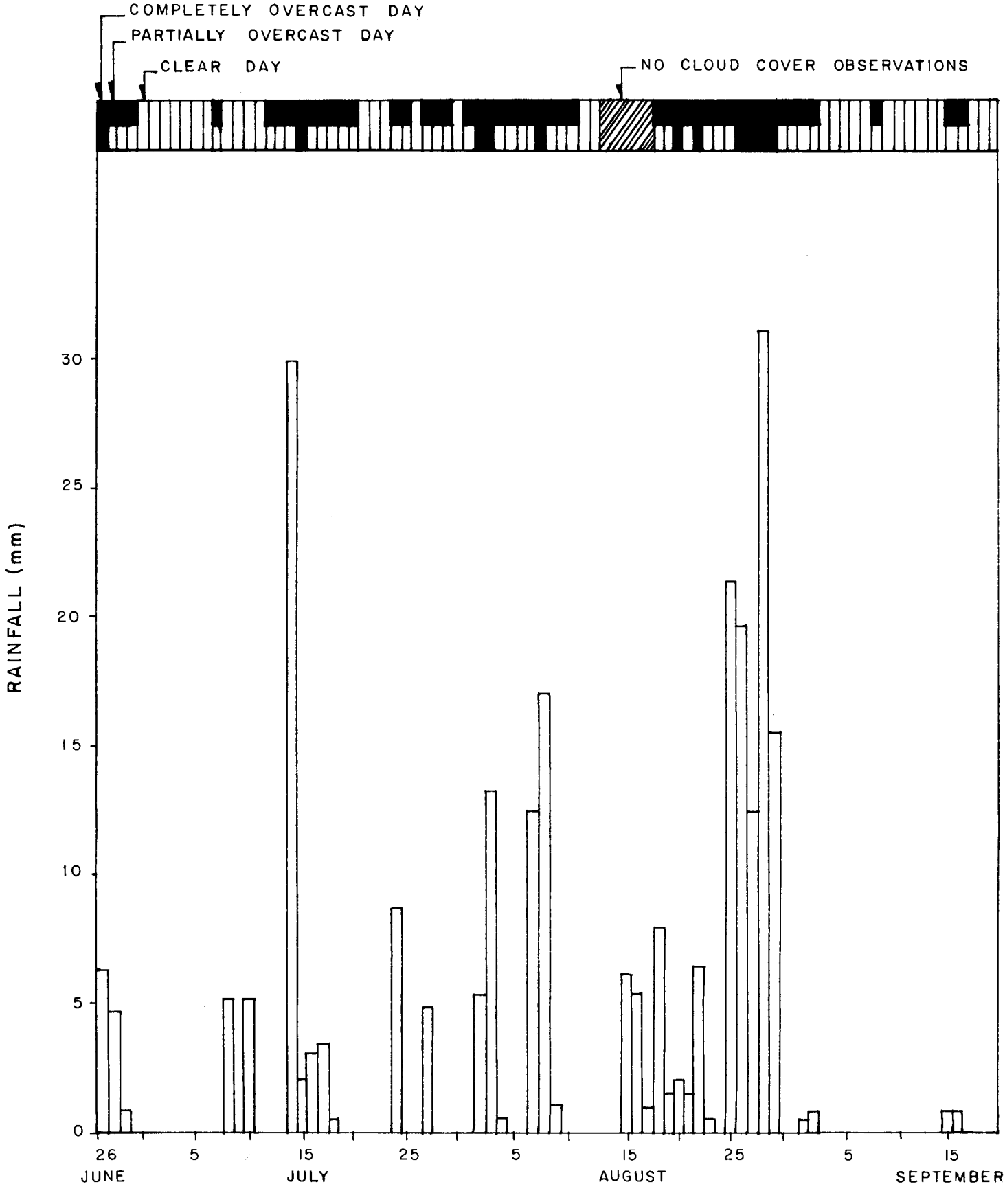

Fig. 7. Cloud cover and daily rainfall at Malibu, Jervis Inlet, June 26-September 16, 1975.

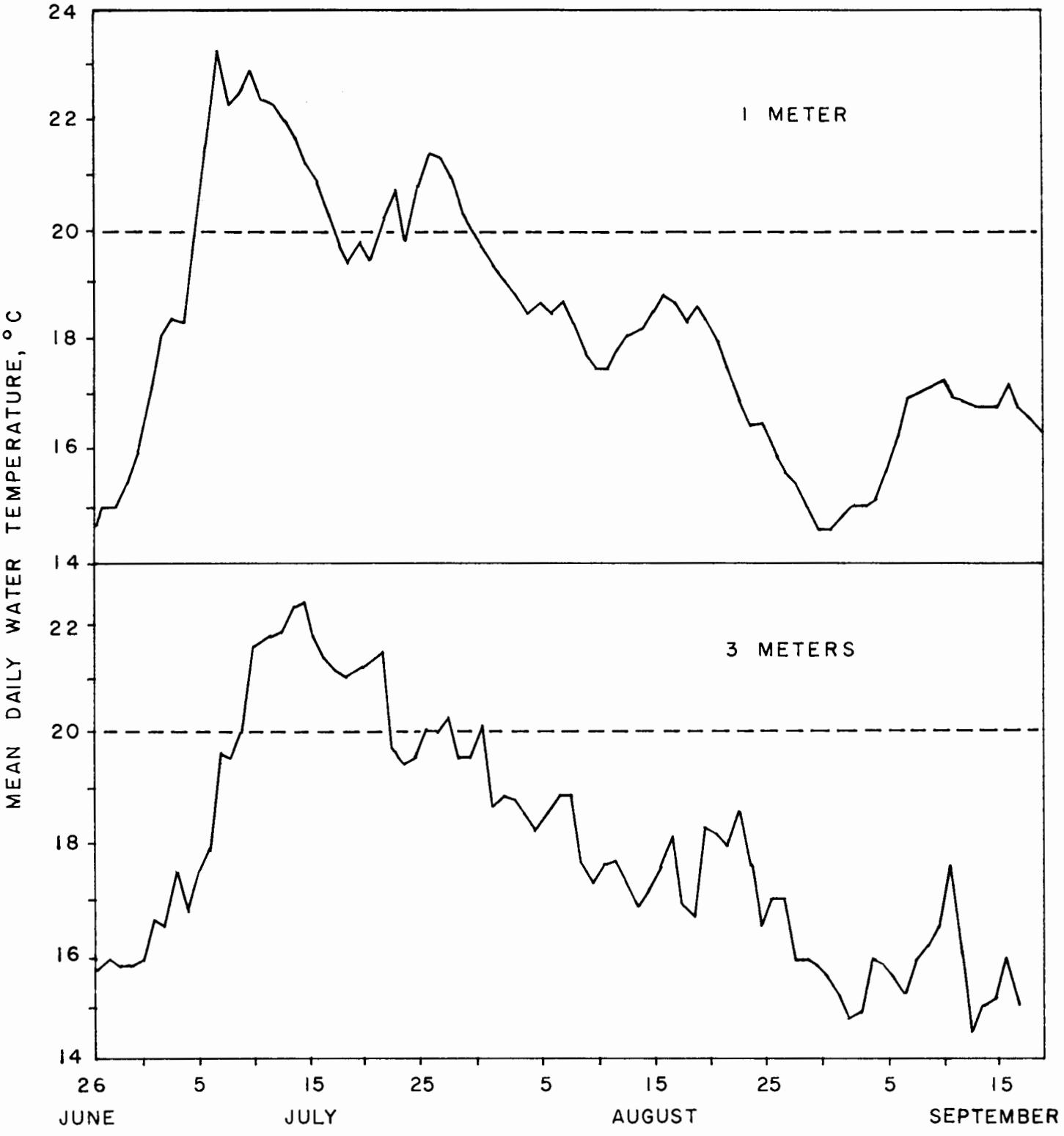

Fig. 8. Mean daily water temperatures at 1 and 3 m, Station 1, Hotham Sound, June 26-September 19, 1975.

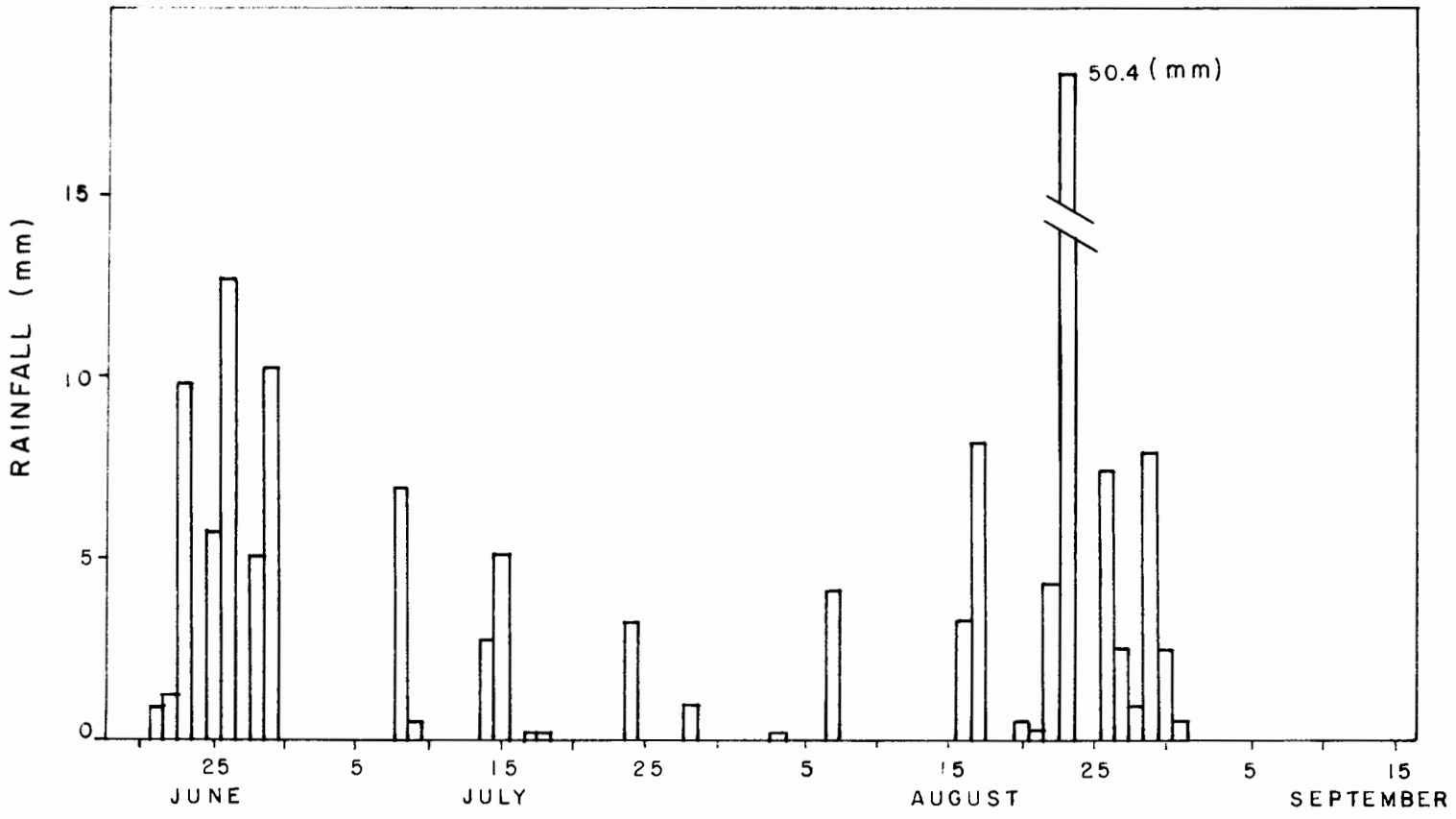

Fig. 9. Daily rainfall at Nanaimo Airport (Cassidy) June 18-September 15, 1975.

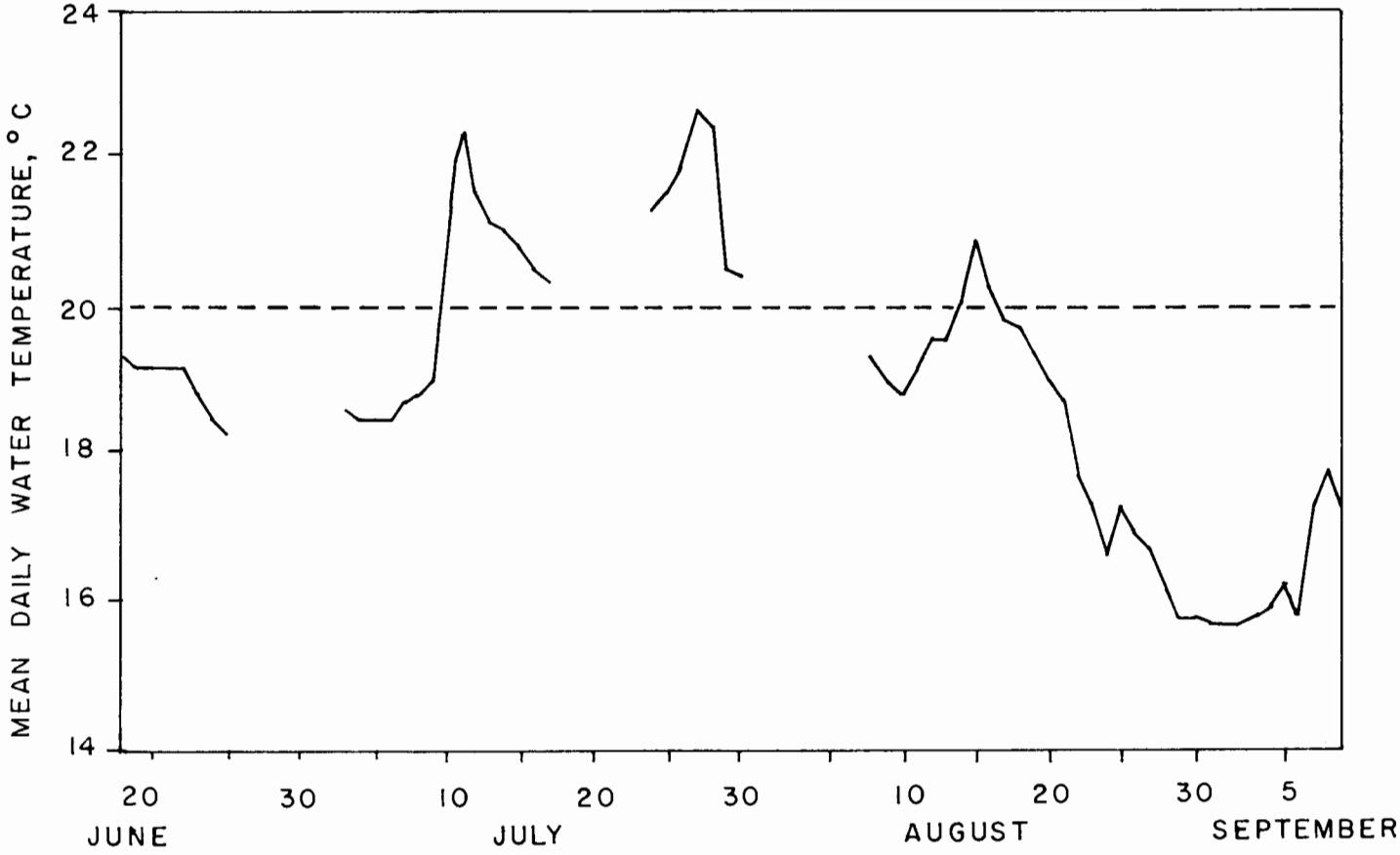

Fig. 10. Mean daily water temperatures at 1 m, Station 2, Ladysmith Harbour, June 18-September 9, 1975.

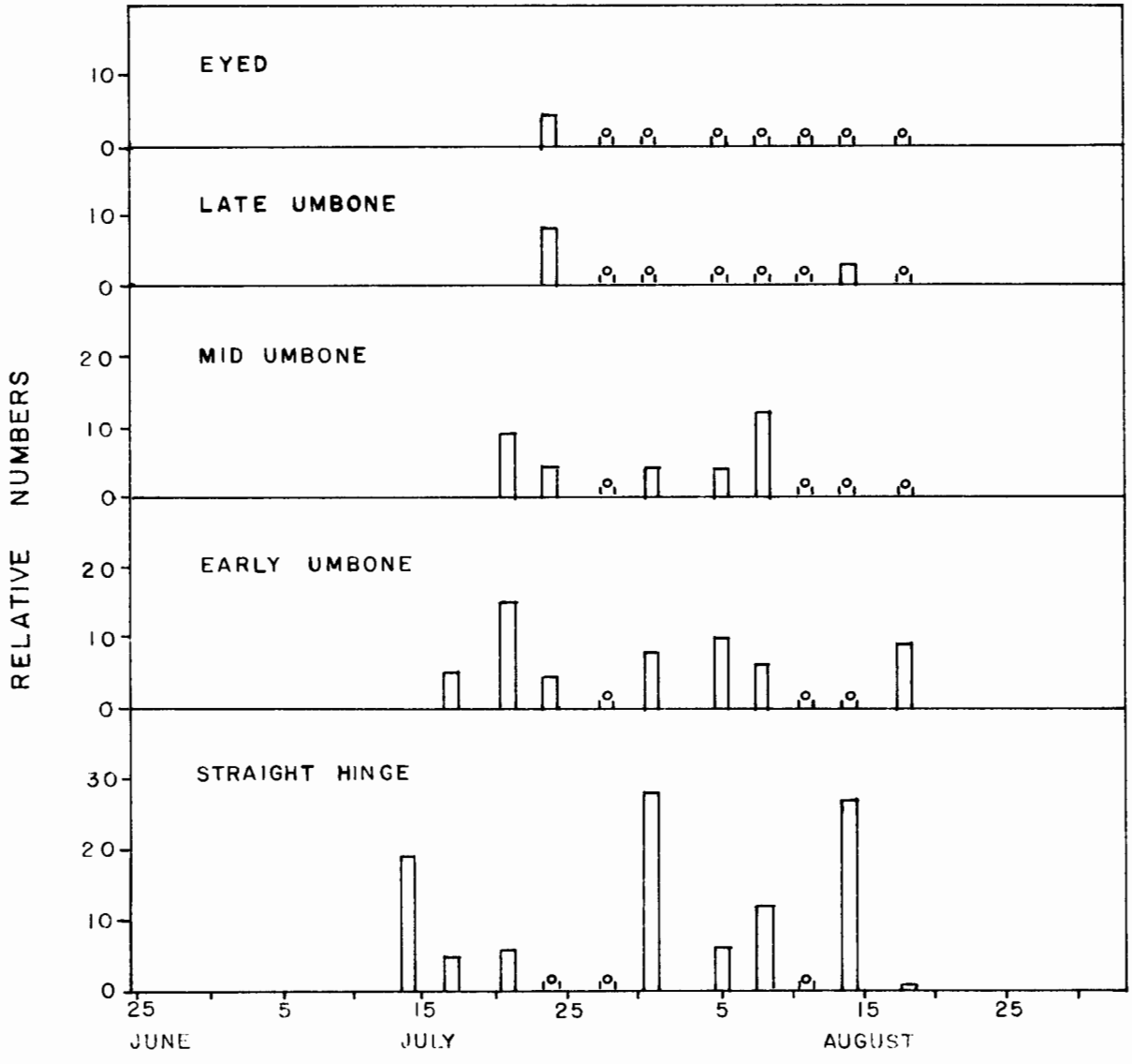

Fig. 11. Relative number of larval stages of C. gigas at Station 2, Ladysmith Harbour, June 25-September 3, 1975.

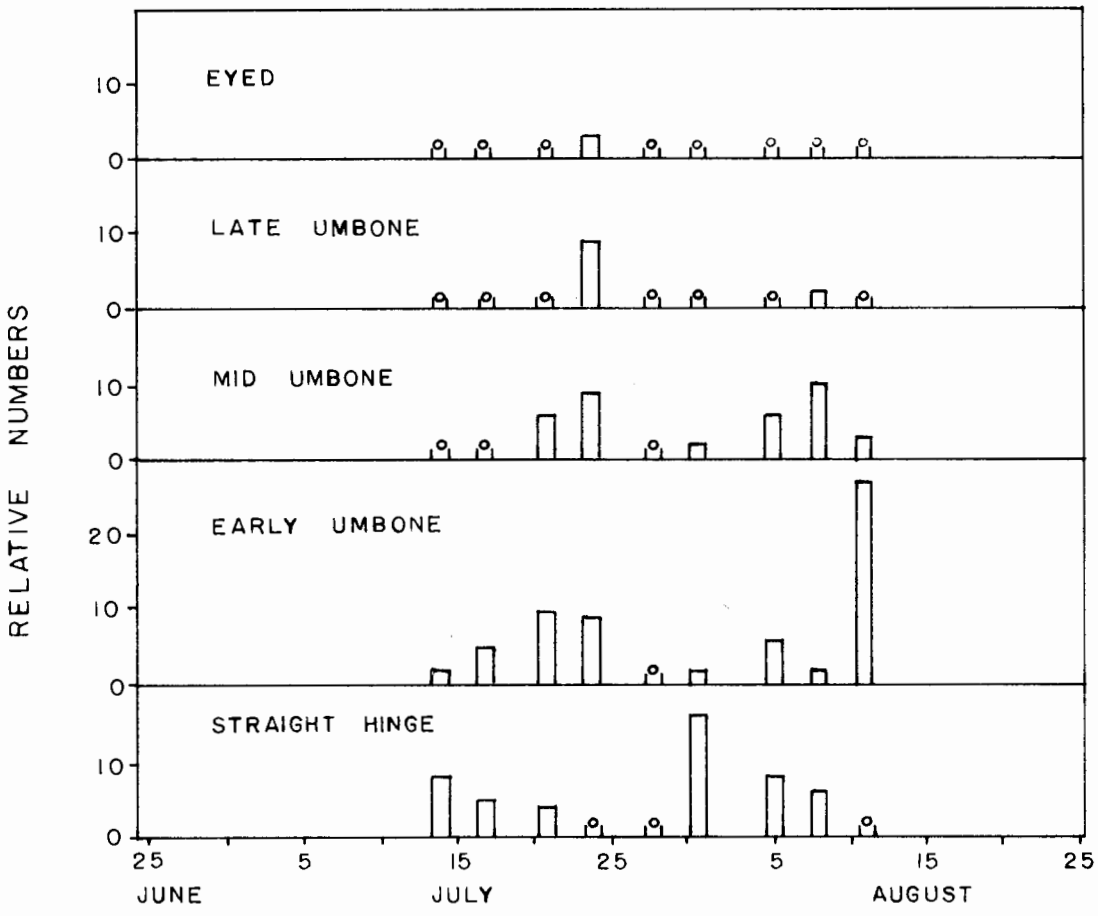

Fig. 12. Relative number of larval stages of C. gigas at Station 6, Ladysmith Harbour, June 25-August 25, 1975.

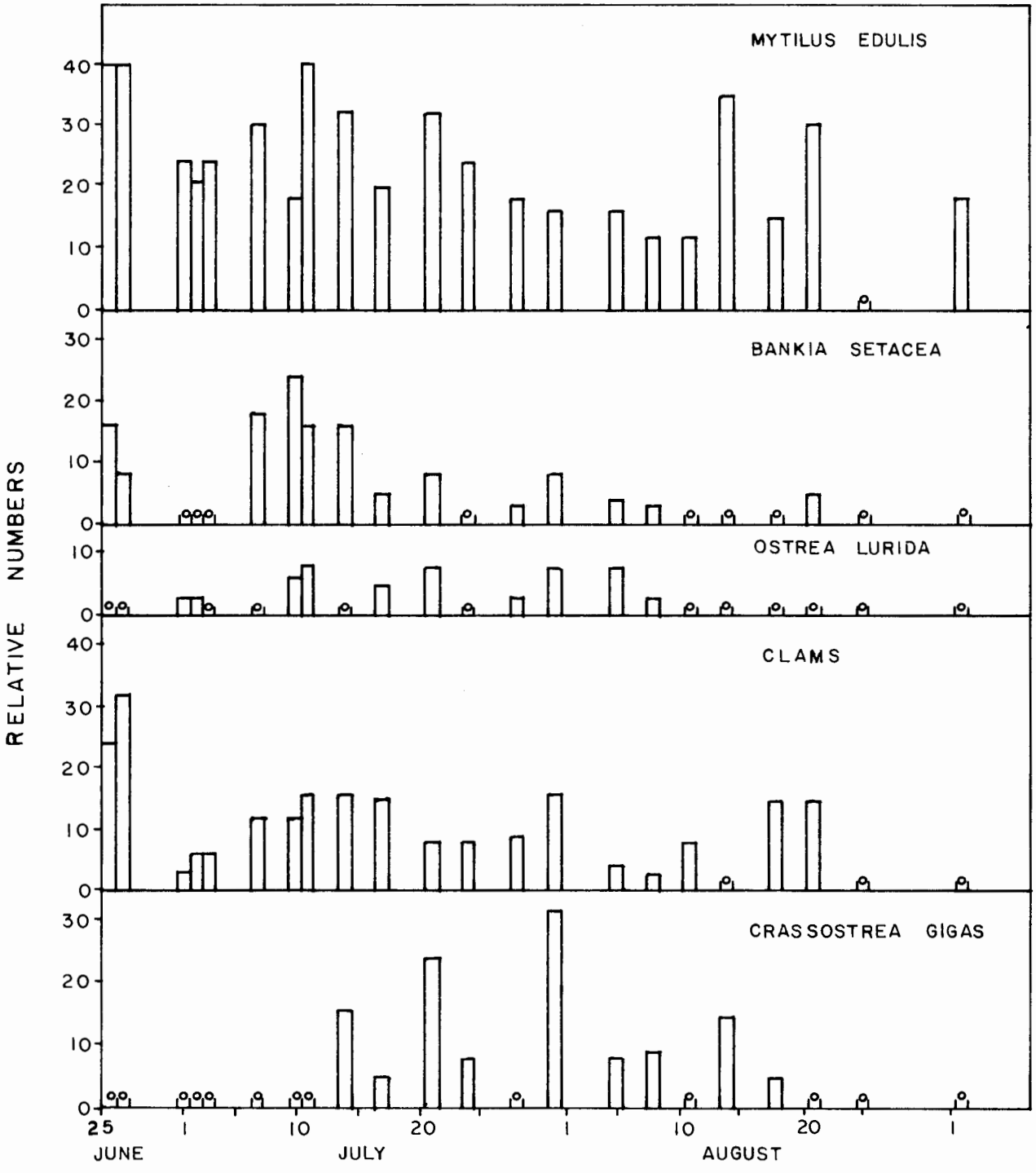

Fig. 13. Relative numbers of M. edulis, B. setacea, O. lurida, clam, and C. gigas larvae in surface plankton tows at Station 2, June 25-September 2, 1975.

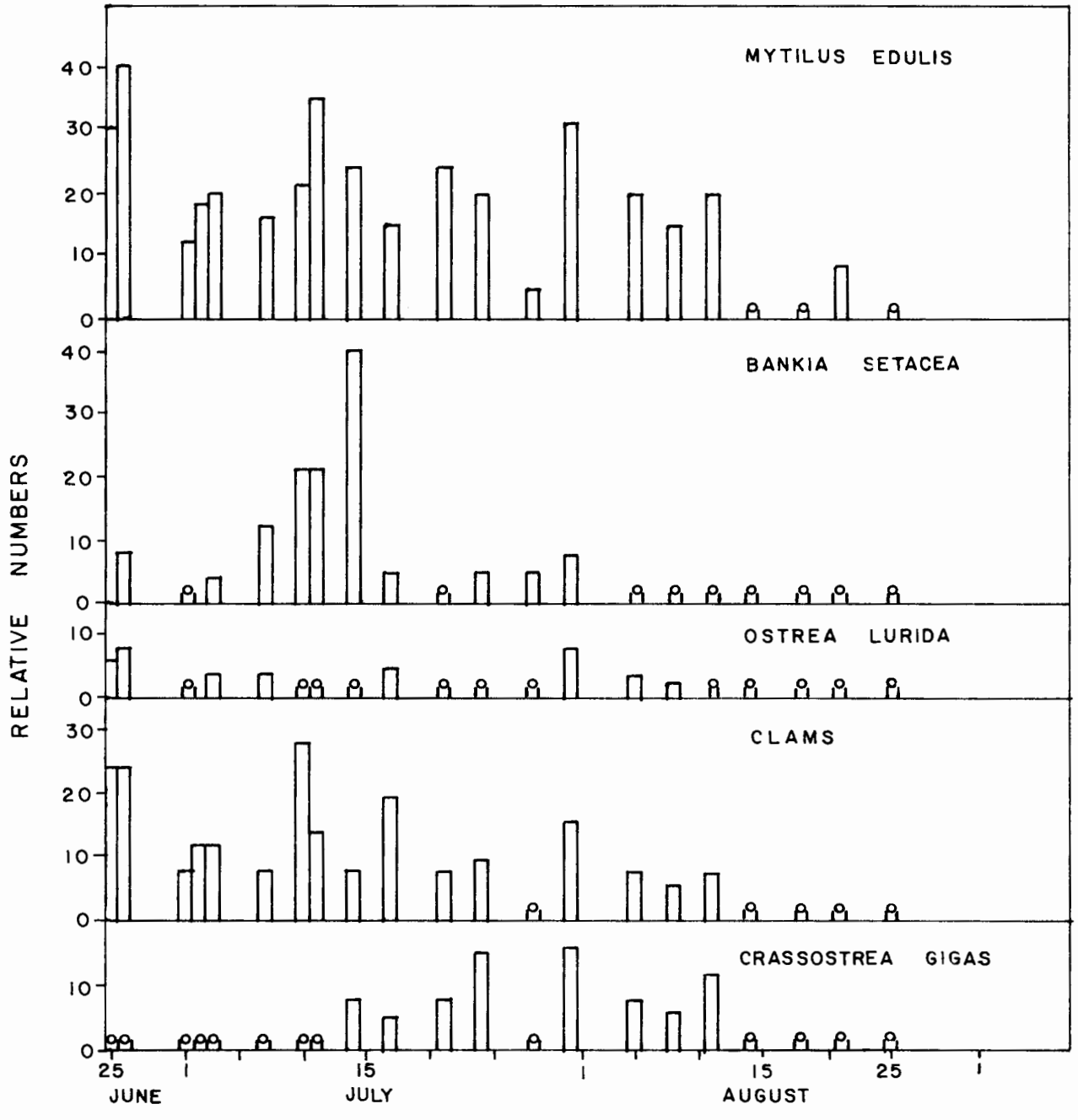

Fig. 14. Relative numbers of M. edulis, B. setacea, O. lurida, clam, and C. gigas larvae in surface plankton tows at Station 6, June 25-September 2, 1975.