REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF COMMERCE AND INDUSTRIES

DIVISION OF SEA FISHERIES
INVESTIGATIONAL REPORT No. 51

SOUTH AFRICAN CONTRIBUTION TO THE INTERNATIONAL INDIAN OCEAN EXPEDITION:

(3) Cruise 251 of R/S AFRICANA II during June/July 1961 by R. W. RAND.

(4) A Preliminary Report on the Planktonic Copepoda by A. DE DECKER & F. J. MOMBECK.

THE GOVERNMENT PRINTER, PRETORIA

1965

G.P.-S.5640042—1964-65—1,200.

Reprint from "Commerce & Industry". OCTOBER, 1964

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Invest. Rep. Div. Sea Fish. South Africa. 51: 1—67

Issued by the Division of Sea Fisheries, Beach Road, Sea Point, Cape Town, South Africa.

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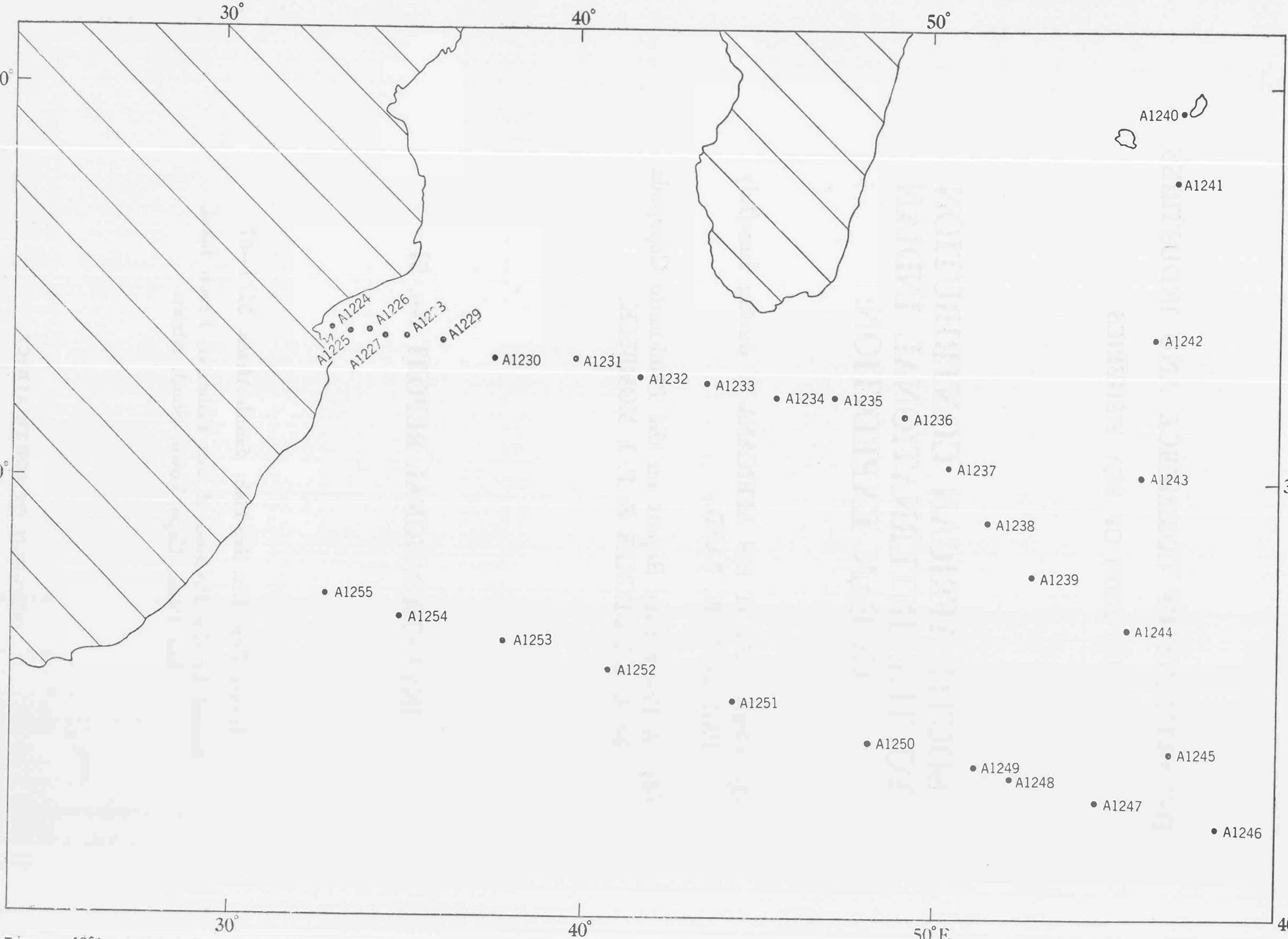

Trigsurvey 1964.

Reprint from "Commerce & Industry", October, 1964

Contents.

These reports are the third and fourth contributions of the Division of Sea Fisheries to the International Indian Ocean Expedition. The first contribution of this series was by BARNARD (1963), the second by ORREN (1963) in Investigational Reports Nos. 44 and 45, respectively.

5640042–2

CRUISE 251 OF R/S AFRICANA II DURING JUNE/JULY 1961

by

R. W. RAND.

1. Abstract.

During June and July 1961, in response to the commitments of the International Indian Ocean Expedition, the reseach vessel AFRICANA II of the Division of Sea Fisheries, explored four lines of oceanographic stations in an area south of Madagascar. Thirty-two stations yielded biological samples and physical and chemical data from a hitherto little-known region.

2. Introduction.

An international investigation of an ocean is no new idea; during 1957 and 1958 for instance, co-operation between nations led to the accumulation of much scientific information about the Atlantic Ocean. The success of the recent "International Geophysical Year" showed that such co-operation could indeed be fruitful. Soon afterwards attention was focussed on the comparatively unexplored Indian Ocean (HUMPHREY 1961). The Special Committee on Oceanic Research (SCOR) falling under the jurisdiction of the International Council of Scientific Unions, was quick to realise the many advantages of programming on an international scale; plans would take into consideration the resources of countries bordering on the Indian Ocean as well as those of interested nations in other parts of the world.

Participation by South Africa in such a venture was planned to include a reconnaissance deepsea cruise by the research vessel AFRICANA II of the Division of Sea Fisheries in 1961, and a subsequent but more comprehensive inshore series of cruises by the survey ship NATAL of the South African Navy during 1962/63. Other smaller vessels would also be involved. The present cruise by AFRICANA II was the first contribution of our country towards realising the aims of the "International Indian Ocean Expedition" as the project has come to be called.

A high degree of national responsibility is necessary in an expedition of this sort and national resources and autonomy are always carefully considered. The necessary liaison between the different organisations gained impetus through the controlling interest displayed by the South African Committee for Oceanographic Research (see DAVIES 1960). The administration of the Expedition has been possible largely through the energy and outlook of the Science Co-operation Division of the Council of Scientfic and Industrial Research which among other things, has co-ordinated research both from within the country and outside.

3. The Area Investigated.

During 1960 it was planned that AFRICANA II explore a somewhat rectangular area of the ocean extending to about 1,500 miles east of Durban. To this end, a pattern of three lines was selected, the first running from Lourenco Marques eastward for 900 miles, the second to continue south-east for an additional 800 miles then to join a third line terminating at Durban. This scheme was closely followed on the actual voyage. Only the second line was interrupted when the vessel was unexpectedly forced to proceed to Mauritius.

AFRICANA II left Cape Town on 7 June, reaching Durban on 11 June in fair weather. Live fish were caught at Bird Island and again at Umgazi Bay for delivery to the Durban Oceanarium. The vessel then continued to Lourenco Marques for fuel and water.

The first line of oceanographic stations was started outside Delagoa Bay in the early morning of 14th June. Between this date and 26 June, sixteen stations (an average of one each day, except near the coast) were investigated on the first and part of the second line of stations south of Madagascar, i.e. from 32°E to about 50°E longitude. The ship then deviated to land a sick seaman at Mauritius, reaching this island on 30th June. After a day at the island, the ship resumed its cruise working one station (A1240) off the island and thereafter a third line of four short stations before reaching the specified route.

When the second of the originally planned lines of stations was reached, the oceanographic programme reverted to its original form. Routine sampling continued as planned but distances between stations were slightly altered according to the exigencies of the voyage.

The fourth line was commenced on 7 July and terminated 170 miles SSE of Durban eight days later, owing to inclement weather, the last few stations had to be abandoned. The vessel departed from Durban on 17 July, docking in Cape Town on 20 July. Altogether 6,790 miles were covered in the 46 days that the ship was absent from Cape Town.

TABLE I.—Schedule of Distances.

Line.	Period (days).	Station.	Distance (miles).
A..................	9	12	883
B..................	4	4	300
C..................	7	7	1,080
D..................	8	9	1,450
TOTAL........	28	32	3,713

4. Personnel.

All navigational work aboard AFRICANA II was under the direction of Captain K. T. McNish, who was ably assisted by the deck-officers, Messrs. J. D. Richardson, D. Merrington and H. G. Hoy. The Engine Room staff was under the control of the Chief Engineer, Mr. J. E. L. Cureden, and the engineer-officers Messrs. R. Danks and P. J. Bessel. The electrician, Mr. J. F. Wheeler, undertook the maintenance of all electrical equipment on the ship. In addition to their normal watch-keeping duties, many extra responsibilities such as handling gear or taking special observations, were entrusted to these officers. Their wholehearted co-operation and enthusiasm contributed much to the success of the cruise.

With respect to the research activities, project responsibility on rather broad lines was allocated to specific personnel. The latter were solely responsible for the manipulation of gear and the timing of operations. The following scientific personnel from three different institutions were involved in collecting data during the cruise, namely:—

DIVISION OF SEA FISHERIES (CAPE TOWN).

Biological Oceanography......... R. W. Rand (Officer-in-Charge).
A. De Decker (Biologist).

Physical/Chemical Oceanography.. M. J. Orren (Hydrologist).
A. C. Paterson (Hydrologist)

Experimental Fishing............ W. Taylor (Fishing Master).

OCEANOGRAPHY RESEARCH INSTITUTE (DURBAN).

Phytoplankton Productivity Measurements and Shark Observations................ B. A. Roets (Technician).

WEATHER BUREAU (PRETORIA).

Meteorology.... S. Postma (Radio Sonde Expert)

While collecting samples the two biologists both supervised the plankton nets, but only one or the other was responsible for log and record sheets. A stricter rotation of individual duties was practised by the hydrologists when handling flights of reversing bottles, titrating samples and recording data. The latter officers used the forward winch exclusively for handling their sampling bottles; biological collecting was confined to the midships winch or the heavier winch aft, except in rough weather when the vertical plankton nets were towed from the forward winch, the ship being hove to.

Samples for phytoplankton productivity measurements were obtained by means of the hydrological winch and a Nansen-Petterssen sampling bottle. The samples were incubated and further processed in a small laboratory which had special tanks installed for this purpose.

Radiosonde balloons were launched by the meteorologist from the deck and detailed meteorological information was transmitted daily to the Weather Bureau in Pretoria.

A ship-borne wave recorder from the National Institute of Oceanography (England) was installed shortly before the voyage. This instrument with two recording heads fixed to each side of the ship's hull, measured the water pressure and vertical displacement during wave effects. Data are integrated electronically and recorded graphically. The instrument was operated regularly by the ship's officers.

Handlines were used at every station; members of the crew assisted admirably in surface fishing and were responsible for all the large fish brought on board. These fish were examined and measured in great detail on the deck, a special wooden table being erected there for that purpose.

5. The Ship.

The research ship AFRICANA II was completed in Glasgow in January 1950 as a steam-trawler type of vessel meeting all the requirements for British foreign-going vessels. Her dimensions are 206 feet overall length, 33 feet beam, mean draft 14′06, 882 tons gross (displacement 1,300 tons) and she has an economical cruising speed of 10·5 knots (12·75 knots on trials). Her seaworthiness and stability were appreciated on numerous occasions during the cruise especially when hove-to at a station. A reciprocating steam engine drives a single fixed-blade screw capable of developing 1,300 H.P. at 120 r.p.m. The bunker capacity is 378 tons fuel oil, giving the ship a range of about 9,500 miles or 38 days at an economical speed of ten knots. In practice the endurance is estimated at 6,000 miles or 25 days. There is a complement of 28 with accommodation for six scientists. [MARCHAND *et al.* (1951) describes the equipment which has hardly been altered during the last eleven years.]

Navigational instruments include Marconi " Seavista " and " Seagraph " echo sounders, and an ELAC echo sounder capable of recording depths to 12,000 metres, Kelvin Hughes type 14/9 Radar, Sperry gyrocompass, Marconi " Transarctic " radio transmitter and receiver, and other conventional equipment. The ship generates 61 kilowatt.

The main deck has been fitted for deep sea trawling on the starboard side only. The heavy Robertson & Fleetwood trawl winch has two drums carrying 1,000 fms. of $2\frac{1}{4}$ inch galvanised flexible steel trawl warp. The two small Reader winches on the port side have 30 inch reels holding 6,000 metres of 4 mm. wire. Both winches are coupled to steam engines and have metre-measuring sheaves and clocks on special davits which allow bottles or nets to be hauled up to the level of the bulwark. A large torpedo-type davit allows over-the-stern operations and is fed by wire of one inch circumference, from a steam-driven Clarke-Chapman winch. This arrangement was usefull for al light net tows such as the N 100 nets but not for the heavy N 200 net which was handled from the side of the ship.

The large (26 feet by 18 feet) scientific laboratory is situated in the bridge superstructure. The original Peroba wooden flooring has been replaced by an epoxy resin but the furnishings of the laboratory are otherwise the same as when the ship was commissioned [see MARCHAND *et al.* (*op cit.*) for further details]. There is space below decks for storing specimens on racks or in deep refrigeration. A net store is situated in the forecastle. The scientific workshop on the port side of the engine room has now been converted into a laboratory for radioactive tracer research.

6. Scientific Work on the Cruise.

There was no dearth of oceanographic problems which merited investigation during the planning of the cruise. The identification of water masses, sampling on the ocean floor, or the detailed collection of plankton were some of the more obvious fields that would repay study. It was nevertheless realised at an early stage that within the limitations of the ship and sampling equipment, a most fruitful study could best be made of the general hydrological structure of the water masses and their biological associations rather than to attempt more circumscribed objectives. Much of the data would have a fundamental application and could eventually be of value to the commercial fisheries. The experience gained could well determine the feasibility of more detailed investigations for future cruises in the area. Accordingly it was proposed to follow the programme summarised in paragraphs 6.1 to 6.4.

6.1. Physical and Chemical Oceanography.

Serial samples of temperature and salinity would be taken at standard depths of 0, 10, 20, 30, 50, 75, 100, 150 and 200 metres by means of the Nansen–Petterssen water bottle samples and from 300, 400, 500, 600, 800, 1,000, 1,200, 1,500, 2,000, 2,500, 3,000 and 4,000 metres by means of the Munro-Ekman reversing-bottle samples. To provide for the possible repetition of some flights due to faulty sampling, a total of six hours was allowed for each station.

Serial samples for oxygen analysis would be collected at all the above depths. Similarly samples for inorganic phosphates would be taken normally at 0, 10, 20, 30, 50, and 100 metres but at greater depths (500, 1,000, 1,500, 2,000, 3,000 and 4,000 metres) on selected stations only.

TABLE 2.—Approximate hauling times for flights of reversing bottles.

Depth in metres.	Time in minutes.
300– 600	33
400– 800	28
500–1,000	28
800–1,500	53
1,000–2,000	54
1,200–2,500	68
2,000–4,000	126
3,000–4,000	123

During the cruise every effort was made to follow these standard depths when sampling from the ship's side.

In practice, the operation of the two types of insulated water bottle varied widely with depth and condition of the sea. The shallow surface samples were taken by means of the Nansen-Petterssen bottle from standard depths down to 150 metres and less frequently to 200, 300 or even 400 metres. A small (250 c.c.) sample for phytoplankton analysis was drawn off from the first seven sampling depths, for inorganic phosphorus analysis. Samples for temperature, salinity, density and oxygen were taken from all these depths (ORREN 1963).

The reversing (Munro–Ekman) bottles operated at greater depths. Owing to the strain on the wire, these bottles were usually lowered in single flights in roughly the ratio of 5: 4: 2 with increasing depth, or one flight for the depths 300–1,000 metres, a second one between 1,200 and 2,500 metres, and a third flight for the 3,000 and 4,000 metre depths (see Table 2 for times of hauling of some of these flights). No bottles were lost during the cruise and fouling of the wires from the hydrological and biological winches occurred only once but with no damage to the equipment.

6.2. Biological Oceanography.

It was planned to take qualitative phytoplankton samples by means of the N 50 V net raised vertically from 100 metres and to supplement these by quantitative samples for diatoms taken with the Nansen-Petterssen bottle at the shallow hydrographic depths of 0, 10, 20, 30, 50, 75 and 100 metres only. At each station zooplankton would be collected with the N 70 V net by controlled closing, from the following water columns: 50–0, 100–50, 250–100, 500–250, 750–500, 1,000–750 and 1,500–1,000 metres. Extra hauls would be made according to the position of the deep scattering layer should it be found. Macro-plankton would be caught by means of the towed N 100 H (0–5 metres), the N 100 B (300–0 metres) and the N 200 B (300–0 metres or deeper) nets, the last-named net to be used as a young fish trawl at certain stations only.

During the cruise studies of primary productivity were carried out at 16 stations. The method of measuring light and handling the samples was that originally proposed by Steemann–Nielsen (see GODDYN 1961). Light measurements at three depths were taken with an Evans electro-selenium cell suspended from the hydrological wire.

Standard plankton nets, with closing mechanism in the case of the N 70 nets (see Discovery Report 1929) were used at all stations. The silk N 50 vertical net and the nylon N 70 vertical net were both operated from the biological winch amidships (except in rough weather). No special sequence of handling these nets was adopted but it was usually convenient to work the more fragile N 50 net at the beginning of the station. Seventeen hauls were made with this net and supplemented the phytoplankton samples taken by means of the Nansen–Petterssen bottle. The N 70 net was operated at all stations but the depths to which this net was lowered varied considerably (Table 3). Nearly 200 samples were obtained by means of the N 70 V hauls. Plankton from the N 70 nets and continuous plankton pump were allowed to settle for about 6 hours in graduated cylinders. The samples were then transferred to 4 inch by 1 inch glass tubes.

TABLE 3.—Operation of the N 70 V nets.

Depth (metres).	Number of stations.
50– 0	31
50– 100	30 (100–0: 19)**
250– 100	29 (250–0: 1)*
500– 250	27 (500–0: 4)*
750– 500	23 (750–0: 3)*
1,000– 750	20
1,500–1,000	16
3,500–1,500	2

* Rehauls due to failure of the closing gear.

** Hauls made during darkness, for comparison with daylight hauls made at the same station.

The operation of the vertical nets took much of the time at each full station. The biological samples were immediately transferred from the net buckets into glass jars in the case of the N 50 hauls, or poured from the net buckets into graduated (crows-feet) receivers in the case of the N 70 samples to give the settled volumes after 6 hours. All samples were fixed with 5 per cent neutral formalin.

TABLE 4.—Approximate time of hauling N70 nets.

Depth (metres).	Time in minutes.
50– 0	3
100– 50	5
250– 100	10
500– 250	20
750– 500	30
1,000– 750	40
1,500–1,000	60
3,500–1,500	150

In addition to the two small plankton nets described above, two N 100 nets were also used, one towed horizontally for 10 minutes with a flowmeter (N 100 H) and the other similar one net towed obliquely (N 100 B). Because of their robust construction, these nets were used successfully under almost all the prevailing weather conditions (except at stations A1229, A1248 and A1249). The N 100 H was towed at the surface for ten minutes, sometimes at the commencement of a station but more often after the other work was completed. The N 100 B net was towed simultaneously, at the first station from a depth of 300 metres but later (owing to a weakness in the wire) from 250 metres. The towing time was about 20 minutes, the net being lowered and simply hauled to the surface after reaching the required depth. On only one occasion was a N 100 bucket lost; the nets were otherwise undamaged. Plankton obtained by these nets was strained into a muslin bag and preserved in 5 per cent neutral formalin in glass jars.

In the course of the cruise (from Station 19 onwards) a small net was rigged on deck to collect plankton continuously. A waterpipe was specially fitted with a plankton silk sock and small bucket; sea water was pumped through this pipe when the ship was underway, the bucket being removed while the ship was on station (see DE DECKER 1962).

A small plankton net, here called the NJAP (or N 7 V) net, about 7 cm. in diameter and having about 40 meshes to the inch, was attached to the heavy metal weight at the end of the hydrological wire holding each flight of deep bottles. This net was based upon the design of TAKANO (1954) and captured bathypelagic plankton down to 4,000 metres. It was used at 24 stations, about three hauls being made at each station.

6.3. Exploratory Fishing.

Young fish would be sampled by a blanket net (duration one hour per station) suspended from the side of the ship, tuna by means of long lines (duration two to three hours) at certain stations only, and other organisms by surface trolling and hand lining, beam trawling and dredging.

During the voyage the large N 200 oblique young-fish trawl (see Discovery Report cited above) was frequently towed behind the ship, at first from the after davit but later over the starboard side by means of the 2¼ inch warp. Because of good catches in this net, hauls were also specially made in the dark in conjunction with a single vertical N 70 net fished from 100 to 0 metres. Specimens were collected in buckets or trays, taken to the laboratory for rough sorting, labelled and preserved in large glass jars. The net proved particularly successful in catching small bathypelagic fish (*Macrouridae*, *Myctophidae*, *Argyropelecus*, *Bathymicrops* and *Idiacanthus*), bathypelagic shrimps and large copepods. Altogether 23 hauls were made from 21 stations, the cod end being changed after the first few stations, to take the full range of macro-plankton.

A blanket net previously mentioned by DAVIES (1957), was rigged and operated one night at station A 1228 but as results were disappointing the net was not used again.

A reversible beam trawl (15 feet wide) was used at station A 1229 but was lost when the bridle wire parted against a bottom obstruction at about 2,000 metres. This type of trawl was not operated again.

A dredge (three feet in width) was towed at three stations in relatively shallow water. Although the frame was badly buckled, good hauls of coral were obtained. [The molluscs have recently been listed by BARNARD (1963).]

Handlines were set at all stations either casually (baited with pilchard) over the ship's side or deliberately trolled with lures. Apart from a single female Blue shark (*Glyphis*) caught at station A 1237, several smaller fish were obtained. These have been identified by Professor J. L. B. SMITH as follows: Halfbeak, *Euleptorhamphus longirostris* (A 1226); flying fish, *Cypselurus furcatus*, *C. nigripennis* (A 1227), and *Exocoetus volitans* (A 1228/9); Sharksuckers, *Remora remora* (A 1227, A 1237); dolphin, *Coryphaena hippurus* (A 1227); and porcupine fish, *Cyclichthys orbicularis* (A 1230, A 1234). A lancet fish, *Alepisaurus ferox* was caught at A 1247. A single " basket " of the conventional tuna long lines was allowed to drift from the stern of the ship at each station but no fish were caught by this means.

6.4. **General.**

It was proposed that geological samples be collected by cores and continuous observations be made on birds, mammals and surface fish.

A special gravity corer of the Phleger type with 24 inch plastic liner was supplied by the Geology Department of the University of Cape Town. The instrument was dropped from the biological winch on nine occasions. A reasonably-sized core was obtained only once. The corer was badly dented on rock, and the wire was severely kinked from overwinds.

Regular underway observations recorded the distribution and density of seabirds (RAND 1962), whales and other surface animals. Some of the latter such as *Physalia* sp., *Porpita* sp. and *Glaucus* sp. could be scooped from the surface by means of long hand nets, as well as " Blaasops " (*C. orbicularis*), squid and insects (*Halobates*).

7. Acknowledgements.

Much of the preparatory work of planning this cruise was done by Mr. B. DE JAGER (Director of Sea Fisheries) and Mr. R. BUYS (formerly Chief Professional Officer of this Division). The success of the cruise was largely due to their work.

I am also indebted to the officers and men of the AFRICANA II for their co-operation at sea.

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A PRELIMINARY REPORT ON THE PLANKTONIC COPEPODA

by

A. DE DECKER and F. J. MOMBECK.

1. Abstract.

Some 274 Copepod species were collected in the South Western Indian Ocean during 1961. Sixty-five of these species appear to be new to the Indian Ocean. They have been grouped into local communities and appear to indicate certain oceanographic phenomena. The bathypelagic Copepods are compared with those reported by SEWELL and A. SCOTT from the Northern Indian Ocean and the Indonesian Archipelago, respectively.

2. Introduction.

The area covered by the 1961 cruise of AFRICANA II is situated in one of the least known parts of the Indian Ocean as far as zooplankton, and especially the copepod fauna are concerned.

The examination of the AFRICANA II material yielded 274 Copepod species, among which 65 appear to be new to the Indian Ocean. It seems unlikely that further and more thorough processing of the samples will greatly add to the number of species stated above. Nevertheless, such a variety found during a relatively short cruise shows that the diversity in this part of the ocean is quite comparable with that of other oceanic areas where more intensive sampling was carried out in the past over greater areas and for longer periods. SEWELL's major papers (1929, 1932, 1947) on the Northern Indian Ocean make mention of a total of some 350 species found between Burma and East Africa. In samples taken by the Siboga Expedition in the Eastern Malay Archipelago, A. SCOTT (1909) identified 278 holoplanktonic species. Over 1,000 plankton samples collected by Prince ALBERT I of Monaco during his long cruises through the Atlantic north of the Equator included 348 Copepod species, as identified by SARS (1925) and ROSE (1929). C. B. WILSON (1942, 1950) found 281 species in the CARNEGIE collections and 473 species in those made by the ALBATROSS, both vessels having worked numerous stations scattered all over the Pacific as well as in some parts of the Western Atlantic north and south of the Equator. In the case of the ALBATROSS, this was carried on for over twenty-two years.

The variety of the Copepod fauna in our samples, together with a few observations on the spatial distribution of certain of its components, justifies this short preliminary report. The area concerned is of special biogeographical interest as it lies on the border of the Indian Ocean where influences of the South Atlantic and the West Wind Drift may, at times, interfere with the dominant features provided by the Mozambique-Agulhas system and the South Equatorial Current.

3. Methods.

The procedures followed at sea for catching and preserving the plankton are described in the general narrative of this cruise (R. W. RAND, pp. 4–9).

The information contained in this report was derived from—

(*a*) a routine general cataloguing of the entire contents of the N 70 V-samples; and

(*b*) a detailed identification of all the Copepods found in the N 200-net used as a mid-water trawl.

Out of the 199 N 70 V-samples, 14 day-light hauls (viz. the 100–50 m. hauls at alternate stations) and 18 hauls taken in the dark in 100–0 m. are as yet unprocessed. The remaining 167 samples were examined under a binocular dissecting microscope and their general contents catalogued on special record sheets. Each species or higher taxonomic group was given a symbol to indicate its estimated abundance in the sample, as follows:—

r = 1 to 5 indiv.	1 = 50 to 100 indiv.
f = 6 to 20 indiv.	2 = 100 to 200 indiv.
+ = 20 to 50 indiv.	3 = 200 to 400 indiv.

The plankton of the N 200-samples was fully sorted into groups and all Copepods were identified and counted. It may be of interest to note that the N 200 catches yielded a total of 115 Copepod species, of which 43 were new additions to our list; the remaining 72 were also found in the N 70-nets. One of the authors of this report (F. J. M.) who has carried out all the taxonomic work on Copepods from the N 200-nets, will discuss his findings in greater detail in a separate paper.

The occurrence of each species in the N 70 V-samples has been plotted on a separate diagram, which shows the horizontal and vertical distribution of the species as well as their approximate abundance in each haul. Eighty-four of these diagrams form an appendix to this report. The distribution of the other species is detailed in the species list. In this list the serial number of the station is followed by a capital letter which indicates the depth range where the net was operated. Thus the stations A 1224 to A 1255 are given the serial numbers 1 to 32, and the depth ranges 50–0 m. to 1,500–1,000 m. are represented by the letters A to G, H being applied to some nets used in depths of more than 1,500 m.

As far as possible, the Copepods were identified according to species, free use being made of dissection and examination under high power. Where necessary, permanent mounts were made and specimens kept for future reference. This procedure, however, could only be followed with Copepod forms whose specific identification would not involve too great a delay in the routine cataloguing of the general zooplankton. Consequently, no consistent effort was made to identify all specimens belonging to such genera as *Oithona*, *Oncaea*, *Corycaeus*, *Paracalanus*, etc., which either through their large number and variety or through the technical difficulties associated with their taxonomy, could not be positively identified at this stage. They will receive closer attention in an exhaustive account of the Copepod fauna of the whole area.

4. List of Species and Occurrence.

Symbols used in the following species list and annexed diagrams of distribution are shown in Table I below:—

TABLE I.

Symbol used in		Definition.
List.	Diagrams.	
x		Found in N 200 nets only.
xx		Found in both N 70 V nets and N 200 nets.
N		New to Indian Ocean.
*	†	Net has sampled all the way up to the surface, because closing mechanism failed to operate.
	•	Specimen of same genus present, but not identified to species.
	?	Species present, but no data on abundance.
	—	Sample not yet examined.

Species.	*Occurrence.*
Acartia amboinensis Carl	2A, 5A, 8A.
A. danae Giesbrecht	See diagram.
A. negligens Dana	See diagram.
Acrocalanus gibber Giesbrecht	See diagram.
A. gracilis Giesbrecht	See diagram.
A. longicornis Giesbrecht	See diagram.
A. monachus Giesbrecht	See diagram
Aegisthus mucronatus Giesbrecht	See diagram.
Aetidlopsis divaricata Esterly	14G N.
A. rostrata Sars ?	6B N.
Aetideus armatus (Boeck)	See diagram xx.
Amallothrix emarginata (Farran)	13E, 28F.
Amallothrix sp. was also recorded in 4E, 16G, 26G, 30G and 30F.	
Arietellus aculeatus (T. Scott)	xN.
A. giesbrechti Sars	14F xx.
A. pavoninus Sars	xN.
A. plumifera Sars	x.
A. setosus Giesbrecht	15C xx.
A. simplex Sars	x.
Augaptilus glacialis Sars	30F N.
A. longicaudatus Claus	30F.
A. spinifrons Sars	15C N.
Augaptilus specimens occurred in ten other closing-nets, all between 100 and 1,000 m.	
Bathypontia elegans Sars	xN.
B. minor Sars	30F N.
Calanoides carinatus (Kröyer)	See diagram xx.
Calanopia elliptica (Dana)	2A, 7G, 8A, 11A.
C. minor A. Scott	2A, 11A.
Unidentified specimens of *Calanopia* were recorded at 1A, 3A, 4B, 5A, 23A.	
Calanus tenuicornis Dana	See diagram.
C. tonsus Brady	See diagram. N.
Calocalanus contractus Farran	6A, 28A ?, 30A, 32A.
C. gracilis Tanaka	32A N.
C. pavo (Dana)	See diagram.
C. plumulosus (Claus)	See diagram.
C. styliremis Giesbrecht	See diagram.
C. tenuis Farran	32A N.
Calocalanus spp. were present in almost all catches from all depths (see diagram).	
Candacia aethiopica (Dana)	See diagram xx.
C. bipinnata (Giesbrecht)	3A, 6B, 17A xx.
C. bispinosa (Claus)	See diagram.
C. catula (Giesbrecht)	See diagram.
C. curta (Dana)	8A xx.
C. longimana (Claus)	See diagram xx.
C. pachydactyla (Dana)	5A, 6A.
C. simplex (Giesbrecht)	See diagram. xx.
C. truncata (Dana)	See diagram.
C. varicans (Giesbrecht)	11A.
Canthocalanus pauper (Giesbrecht)	See diagram. xx.
Centraugaptilus horridus (Farran)	x.
Centr. rattrayi (T. Scott)	x.
Centropages calaninus (Dana)	See diagram.
C. elongatus Giesbrecht	See diagram.
C. furcatus (Dana)	See diagram.
C. gracilis (Dana)	See diagram.
C. orsinii Giesbrecht	2A.
Cephalophanes sp.	13F N.
The species could not be identified with the literature at our disposal.	
Chiridiella macrodactyla Sars	26F N.

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Species.	Occurrence.
Chiridius poppei Giesbrecht	27C.

Chiridius sp. was recorded in six other catches but has not yet been identified to species (see diagram).

Species.	Occurrence.
Chirundina streetsii Giesbrecht	24E, 26E, 30E xx.
Clausocalanus arcuicornis (Dana)	See diagram.
C. furcatus (Brady)	See diagram.
C. paululus Farran	See diagram N.
C. pergens Farran	10A, 12A, 14A N.
Clytemnestra rostrata (Brady)	30F, 32A.
C. scutellata Dana	6E, 8B, 10A, 11A, 26G.
Conaea gracilis (Dana)	See diagram.
Copilia mediterranea Claus	12B, 13A, 32A, xx.
Copilia mirabilis Dana	See diagram. xx.
C. quadrata Dana	See diagram. xx.
C. vitrea Haeckel	14B, 14E*, 32A. xx.
Corina granulosa Giesbrecht	11G. N.
Cornucalanus chelifer (I. C. Thompson)	24F, 24G? xx.
Corycaeus agilis Dana	6A, 8A, 30A, 32A.
C. asiaticus F. Dahl	8A.
C. catus F. Dahl	26A.
C. clausii F. Dahl	12A, 14A, 20A.
C. crassiusculus Dana	6A, 8A, 10A, 20A, 30A, 32A.
C. flaccus Giesbrecht	6A, 8A, 12A, 14A, 20, 32A.
C. giesbrechti F. Dahl	12A.
C. latus Dana	30A. N.
C. limbatus Brady	8A, 14A.
C. longistylus Dana	12A, 32A.
C. pacificus F. Dahl	6A, 8A, 12A.
C. speciosus Dana	6A, 8A, 10A, 12A, 14A, 32A.
C. typicus Kröyer	6A.
Corycella carinata Giesbrecht	10A, 12A, 14A, 18A.
C. concinna Dana	6A, 8A, 10A, 12A, 14A, 32A.
C. curta Farran	10A, 12A, 28A, 30A, 32A.
C. rostrata Claus	10A, 12A, 14A, 20A, 21A, 26A, 28A, 30A, 32A,

The genera *Corycaeus* and *Corycella* were represented in the majority of the hauls and in all depths (see diagram). The data given here apply to a number of surface samples only.

Species.	Occurrence.
Ctenocalanus vanus Giesbrecht	See diagram. N.
Disseta palumboi Giesbrecht	30F.
Euaetidius acutus (Farran)	See diagram N.
E. giesbrechti Cleve	See diagram.
Euaugaptilus affinis Sars	x N.
E. angustus (Sars)	x.
E. bullifer (Giesbrecht)	12G. xx.
E. filigerus (Claus)	x.
E. gibbus (Wolfenden)	28F N.
E. laticeps (Sars)	x.

Species.	Occurrence.
E. magnus (Wolfenden)	27F xx.
E. nodifrons (Sars)	28F xx.
E. oblongus (Sars)	27F xx.
E. palumboi (Giesbrecht)	See diagram.
Eucalanus attenuatus (Dana)	See diagram. xx.
E. crassus Giesbrecht	See diagram. xx.
E. elongatus (Dana)	See diagram. xx.
E. longiceps Matthews	12B, 24G, 32B?
E. mucronatus Giesbrecht	4B, 5A, 7A, 8B, 32A.
E. subcrassus Giesbrecht	6A, 8A, 8B, 10A, 11A, 32A.
E. subtenuis Giesbrecht	1A, 3A, 8B, 32B.
Euchaeta acuta Giesbrecht	28A. xx.
E. concinna Dana	6G. xx.
E. longicornis Giesbrecht	6A.
E. marina (Prestandrea)	1A, 2A, 4A, 6A, 8A, 12A, 32A. xx.
E. media Giesbrecht	x.
E. spinosa Giesbrecht	x.
E. wolfendeni A. Scott	4A, 6A, 8A.
Euchirella amoena Giesbrecht	6A, 8A, 15A. xx.
E. bitumida With	x N.
E. curticauda Giesbrecht	16G, 25C xx.
E. maxima Wolfenden	x.
E. messinensis (Claus)	x.
E. rostrata (Claus)	31A.
E. formosa Vervoort	x N.
E. venusta Giesbrecht	x.
Euterpina acutifrons Dana	See diagrams.
Gaetanus curvicornis Sars	16G.
G. kruppi Giesbrecht	7E. xx.
G. latifrons Sars	30F. xx.
G. miles Giesbrecht	See diagram. xx.
G. minor Farran	See diagram.
G. pileatus Farran	7E, 14E, 24E, 28E. xx.
G. recticornis Wolfenden	x N.
Gaidius tenuispinus Sars	27F, 30F.
Haloptilus acutifrons Giesbrecht	28C, 30G.
H. angusticeps Sars	24F. N.
H. longicornis (Claus)	See diagram. xx.
H. mucronatus (Claus)	6G.
H. ornatus (Giesbrecht)	7E, 8B, 14D xx.
H. oxycephalus (Giesbrecht)	13A, 28C, 32B xx.
H. spiniceps (Giesbrecht)	28C xx N.
H. tenuis Farran	x N.
H. validus Sars	x.
Heterorhabdus abyssalis (Giesbrecht)	23A (Cast), 30F xx.
H. austrinus Giesbrecht	28F.
H. clausi (Giesbrecht)	7E, 14B.
H. compactus Sars	16G N.
H. norvegicus (Boeck)	29F, 4E N.
H. papilliger (Claus)	22A, 22B, 29C xx.
H. spinifrons (Claus)	See diagrams. xx.
Heterostylites longicornis (Giesbrecht)	23D, 27D, 30D xx.
Labidocera acutifrons (Dana)	x.

Species.	*Occurrence.*
L. acutum Giesbrecht	1A, 2A, 3A, 11A.
L. minutum Giesbrecht	4A, 11A.
Lophothrix frontalis Giesbrecht	14E, 26D xx.
L. latipes (T. Scott)	14D, 14E*. 24F, 28C, N.
L. varicans Wolfenden(?)	23F N.
Lubbockia aculeata Giesbrecht	7D, 14E, 15D.
L. squillimana Claus	See diagram. N.
Lucicutia clausi (Giesbrecht)	See diagram.
L. curta Farran	See diagram N.
L. flavicornis (Claus)	See diagram. xx.
L. magna Wolfenden	28A.
L. maxima Wolfenden	27F xx.
L. ovalis Wolfenden	8A, 24E, 26A, 28B, 32B.
L. simulans Sars	26F N.
Macrosetella gracilis (Dana)	See diagrams.
Mecynocera clausi I. C. Thompson	See diagrams.
Megacalanus princeps Wolfenden	13F., 23F. xx.
Mesorhabdus angustus Sars	x.
Mesundeuchaeta asymmetrica Wolfenden.	x.
Metridia bicornuta Davis	16G, 24F, 26F, 27F, 28F xx.
M. boecki Giesbrecht	27F.
M. brevicauda Giesbrecht	See diagram.
M. longa (Lubbock)	13G, 16G, 24G.
M. lucens Boeck	See diagram.
M. venusta Giesbrecht	See diagram.
Microcalanus pygmaeus Sars	10G, 12G. N.
Microsetella norvegica (Boeck)	See diagram.
M. rosea (Dana)	See diagram.
Miracia minor T. Scott	24B, 32A. N.
Monacilla tenera Sars	30G.
M. typica Sars	See diagram. N.
Mormonilla minor Giesbrecht	See diagram. N.
M. phasma Giesbrecht	See diagram N.
Nannocalanus minor (Claus)	See diagram. xx.
Neocalanus gracilis (Dana)	See diagram. xx.
N. robustior (Giesbrecht)	6A, 12A, 22C, 28B. xx.
Oculosetella gracilis (Dana)	4A, 27D, 30B.
Oithona atlantica Farran	24A, 28A.
O. attenuata Farran	30A, 32A.
O. fallax Farran	6A, 10A, 12A, 30A, 32A.
O. nana Giesbrecht	12A.
O. plumifera Baird	6A, 8A, 10A, 12A, 14A, 16A, 18A, 20A, 22A, 24A, 30A, 32A. xx.
O. rigida Giesbrecht	6A.
O. setigera (Dana)	10A, 12A, 14A, 20A, 30A, 32A.
O. similis Claus	10A, 16A, 22A, 24A, 28A, 30A, 32A.
O. simplex Farran	3B.
O. tenuis Rosendorn	6A, 10A, 12A, 14A, 30A, 32A.
Oncaea clevei Früchtl	6A, 8A, 10A, 12A, 32A.
O. conifera Giesbrecht	10A, 24A, 32A,

Species.	*Occurrence.*
O. curta Sars	20A. N.
O. dentipes Giesbrecht	20A. N.
O. media Giesbrecht	6A, 8A, 10A, 12A, 14A, 20A, 28A, 30A, 32A.
O. mediterranea Claus	14A.
O. obscura Farran	28A. N.
O. similis Sars	10A, 14A. N.
O. venusta Philippi	6A, 8A, 10A, 12A, 26A, 32A, xx.
Onchocalanus sp.	27F.
Pachyptilus eurygnathus Sars	x.
Paracalanus aculeatus Giesbrecht	2A, 2B, 6A, 8A, 10A, 30A, 32A.
P. nanus Sars	6A, 6D, 10A, 12A, 16A, 26A, 26D, 28A, 30A, 32A.
P. nudus Sewell	6A, 10A, 30A, 32A.
P. parvus (Claus)	10A, 12A, 16A. 22A, 32A, xx.
P. pygmaeus (Claus)	8A, 10A, 24A, 26A, 28A, N.
Paraeuchaeta barbata (Brady)	13G, 26G, 30G. x.
P. biloba Farran	x N.
P. dubia Esterly	x N.
P. diegensis (Esterly)	x N.
P. exigua (Wolfenden)	x N.
P. gracilis Sars	x N.
P. hanseni With	x.
P. malayensis Sewell	x.
P. norvegica (Boeck)	30F. N.
P. sarsi Farran	x.
P. scotti (Farran)	x.
P. tonsa (Giesbrecht)	x.
Phaenna spinifera Claus	3A, 4E, 5C, 7A, 12C, 14E*, 14G, 14H, 22C, 25C.
Phyllopus aequalis Sars	23F. N.
P. helgae Farran	5E, 14E, 24E, 28F, 30E. xx.
Pleuromamma abdominalis (Lubbock)	3A, 8B, 14A, 16A. xx.
P. borealis Dahl	x N.
P. gracilis (Claus)	x.
P. piseki Farran	3A xx.
P. xiphias (Giesbrecht)	See diagram. xx.
Pontella diagonalis C. B. Wilson	10C. xx N.
Pontellina plumata (Dana)	See diagram.
Pontellopsis regalis (Dana)	4A, 10G.
Pontoeciella abyssicola (T. Scott)	6F, 14D. N.
Ratania atlantica Farran	14F. N.
R. flava Giesbrecht	32B N.
Rhincalanus cornutus Dana	See diagram. xx.
R. nasutus Giesbrecht	See diagram. xx.
Sapphirina angusta Dana	12C xx.
S. auronitens Claus	8A, 11A, 32A,
S. bicuspidata Giesbrecht	8A.
S. gastrica Giesbrecht	6A.
S. maculosa Giesbrecht	4E*. N.
S. metallina Dana	4E, 6B, 14B, 14C, 14E, 15C, 20A, 32B.
S. nigromaculata Claus	8A, 12A.

Species.	*Occurrence.*
S. opalina Dana	3A, 4B, 11A. xx.
S. ovatolanceolata Dana	10A, 14B, 30A, 32A. xx.
S. stellata Giesbrecht	x.
Scaphocalanus magnus (T. Scott)	x.
S. medius Sars	13F, 24 F.
Scolecithricella dentata (Giesbrecht)	See diagram. N.
S. dubia (Giesbrecht)	22C. N.
S. media Wolfenden	x N.
S. vittata (Giesbrecht)	27c, 28C, 29C N.
Scolecithrix bradyi Giesbrecht	See diagram. N.
S. danae (Lubbock)	See diagram.
Scottocalanus longispinus A. Scott	28F xx N.
S. persecans (Giesbrecht)	28F xx.
S. securifrons (T. Scott)	22F, 28E xx.

Species.	*Occurrence.*
Spinocalanus magnus Wolfenden	16G.
S. spinosus Farran	16G. N.
Temora discaudata Giesbrecht	See diagram.
T. stylifera Dana	See diagram.
T. turbinata Dana	See diagram.
Temoropia mayumbaensis T. Scott	See diagram. N.
Undeuchaeta intermedia A. Scott	22E, 30E xx.
U. major Giesbrecht	26F. xx.
U. plumosa (Lubbock)	See diagram. xx.
Undinula caroli (Giesbrecht)	See diagram.
U. darwinii (Lubbock)	See diagram. xx.
U. vulgaris (Dana)	See diagram. xx.
Xanthocalanus sp	4C, 14C, 16E, 16G, 19C, 22C, 30F xx.

Fig. 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Average
A	44	46	53	37	34	51	38	58	10	40	47	51	15	35	14	16	37
B		19	–	34	–	27	–	43	–	0	–	24	–	25	–	15	23
C		18	6	30	23	24	19	7	25	9	11	31	13	25	24	12	18
D		21	13	15	9	10	18	10	6	11	10	10	11	26	20	15	14
E				33	23	20	44		7	14	10	17	24	31	24	12	22
F						14	14			6	9	9	22	28	15	18	15
G						22	29			24	12	27	27	29	15	35	24
H													22	24		9	19

	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Average
A	52	16	37	8	26	13	18	15	13	15	9	12	22	18	7	21	19
B	36	–	15	–	24	–	14	–	13	–	13	–	8	–	–		18
C	22	14	25	18	21	23	22	24	9	12	22	12	10	21			18
D	9	9	16	14	8	6	14		12	8	26	11	9	17	13		12
E		11	17	10	28	8	23		21	12	21	9		13			16
F		13	45	15	49	35	37		25	19	12	6		13			24
G			28	17		12	19		26	14	21	13					19

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5. Discussion.

Diversity distribution.

The total number of Copepod species found in each separate haul (=diversity) is recorded in Fig. 1. Although our taxonomic work is not complete, the present data already show two maxima: one in the surface layers along the northern line, the other in the deep hauls between 750 and 1,500 m. throughout the area. The occurrence of maxima in those levels has been observed on many occasions in all oceans, as SEWELL (1948) has already emphasized.

In the greater part of the southern area, however, the surface water was marked by a paucity of species as well as by low plankton volumes. In fact, comparatively few adult copepods were found near the surface at most of the southern stations and the populations were composed of a very high percentage of early copepodid stages of small Calanoids and *Oithona.*

Distribution of certain species within the area.

In more than 100 of our distribution diagrams of individual species some sort of pattern is apparent. When we compare these patterns, it is possible to classify them into four groups, which could well correspond to four separate communities. By utilizing one diagram on which was plotted the occurrence of all the species which appear to fall into the same group (or supposed community), we obtained the results shown in Figs. 2 to 5, where each dot represents the occurrence of one species of the group in a certain haul.

Table II shows that both groups C and D, occurring in deeper levels, contain a number of species known to occur in the Atlantic and Pacific, but not previously found in the Indian Ocean. The number of these species appears to increase with depth. Furthermore, from Table II, the per cent occurrence of each of the four groups is uniformly high in that area to which we have tentatively assigned it. This strengthens our supposition that the four groups correspond with real plankton communities.

The vertical distribution of the four groups closely agrees with that of the water masses as deduced from the hydrological data of the cruise (ORREN 1963):—

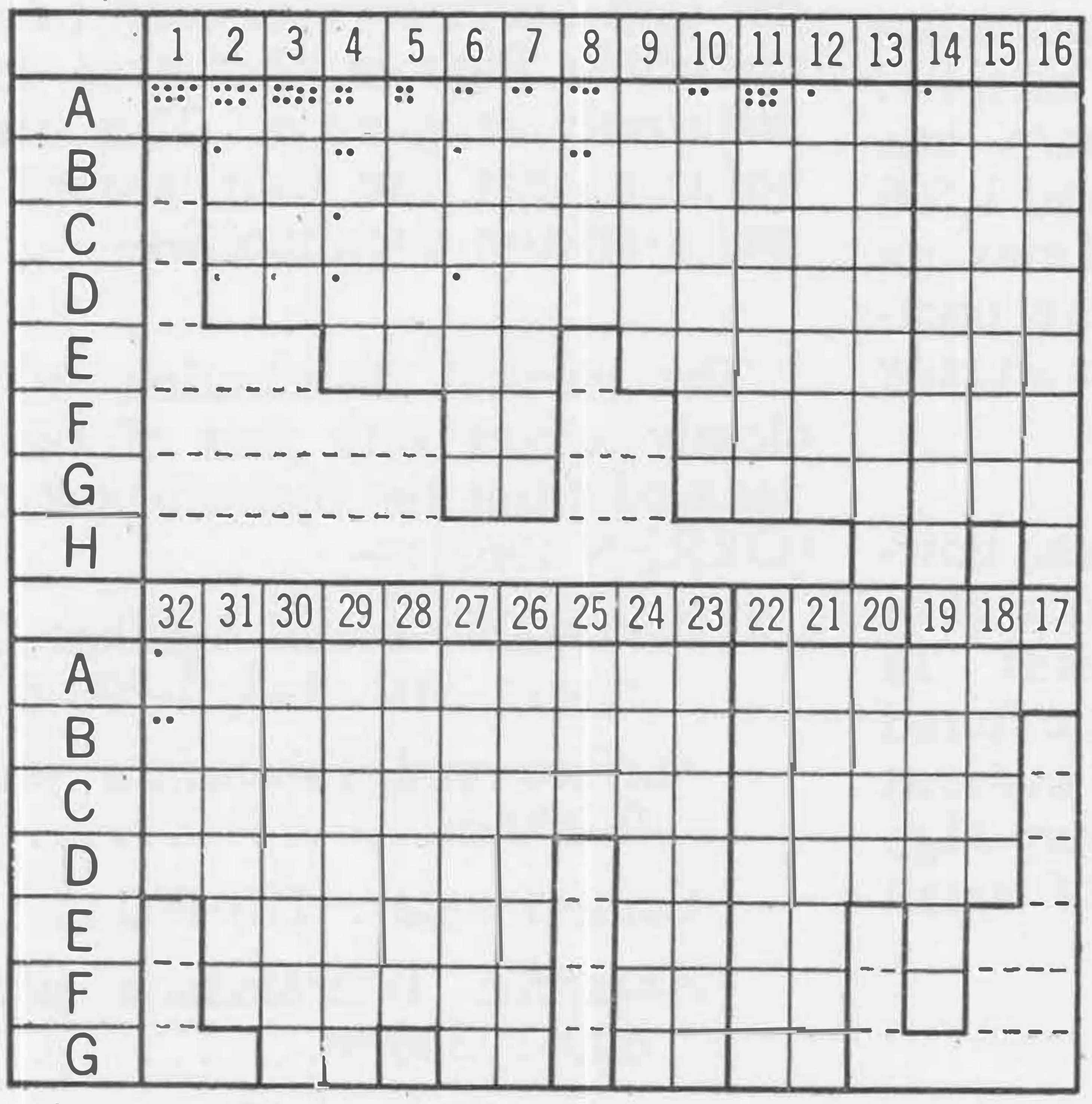
- Mocambique and Agulhas Currents: Stat. 1–5, 0–500 m... Group A.
- Surface and subsurface water: 0–200 m.................. Group B.
- Central water: 200–600 m..... Group C.
- Antarctic Intermediate water: 600–1, 300 m............... Group D.
- Deep water: 1,400–3,000 m: As the nets seldom reached further down than the upper limit of the "Deep water", it cannot be expected that a separate community (which might well occur here) would be distinguishable in our catches.

Again, the surface water at the southern line of stations did not yield any species falling within any of the four groups. This water mass seems to be inhabited by a few ubiquitous species only. The hydrological data here point towards a general sinking of the surface water (ORREN 1963), but we can find no connection between this phenomenon and the dearth of surface plankton.

TABLE II.

Group.	No. of species.	General distribution.			No. of occurrences in our catches.			Percentage occurrence in group area.
		Atlantic.	Indian.	Pacific.	In/Outside group area.		Total.	
A......................	12	10	12	12	52	10	62	84
B......................	21	15	21	21	166	37	203	82
C......................	14	14	10	14	107	41	148	72
D......................	81	75	50	75	491	83	574	85

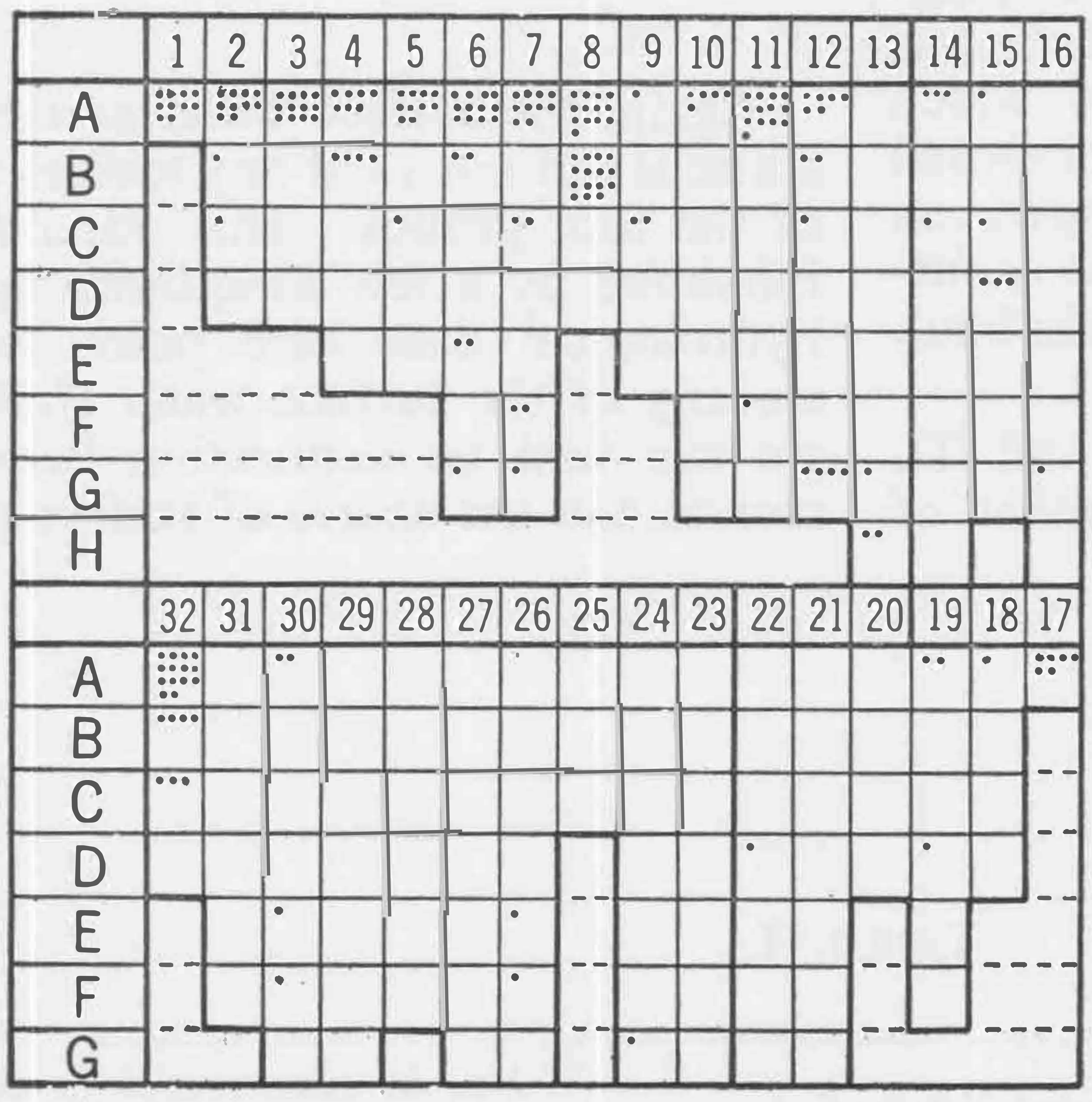
Fig. 2



GROEP A

Canthocalanus pauper
Eucalanus crassus
E. subtenuis
Euterpina acutifrons
Labidocera acutum
L. minutum
Pontellina plumata
Sapphirina opalina
Temora discaudata
T. stylifera
T. turbinata
Undinula caroli

Fig. 3



GROUP B

Acrocalanus gibber
A. gracilis
A. longicornis
A. monachus
Calanopia elliptica
Candacia simplex
C. truncata
Centropages calaninus
C. elongatus
C. furcatus
C. gracilis
Clytemnestra rostrata
C. scutellata
Copilia mirabilis
Eucalanus attenuatus
E. longiceps
E. mucronatus
E. subcrassus
Scolecithrix danae
Undinula darwinii
U. vulgaris

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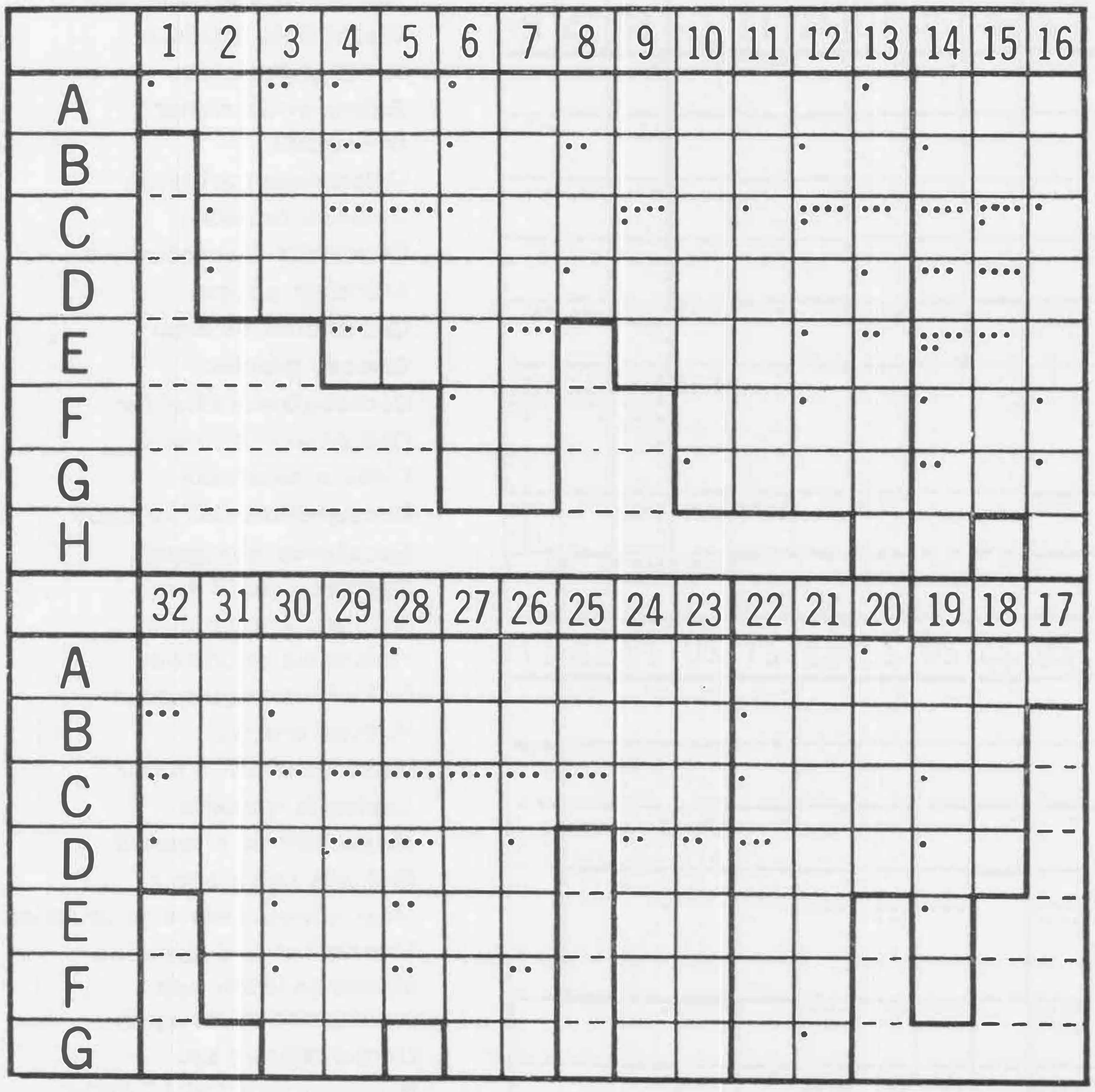
Fig. 4



GROUP C

Aetidius armatus
Candacia longimana
Euaetidius giesbrechti
Haloptilus longicornis
H. ornatus
H. oxycephalus
H. spiniceps
Heterorhabdus papilliger
H. spinifrons
Phaenna spinifera
Sapphirina metallina
Scolecithricella vittata
Scolecithrix bradyi
Undeuchaeta plumosa

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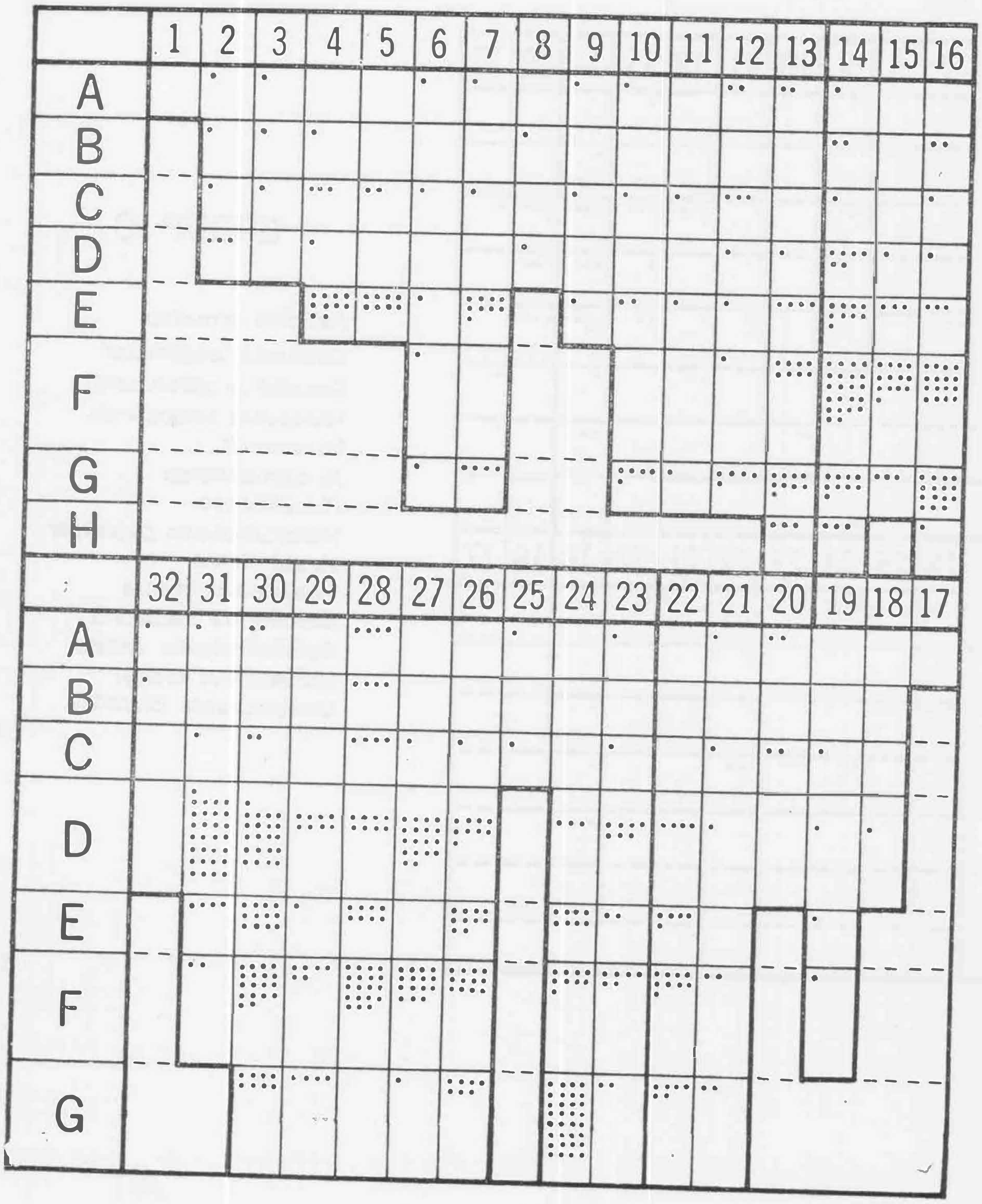
Fig. 5



GROUP D

Amallothrix emarginata
Augaptilus glacialis
A. longicaudatus
Bathypontia minor
B. elegans
Calanoides carinatus
Calanus tonsus
Chiridiella macrodactyla
Chiridius poppei
Chirundina streetsi
Conaea gracilis
Cornucalanus chelifer
Ctenocalanus vanus
Disseta palumboi
Euaugaptilus (all 10 spp.)
Eucalanus elongatus
Gaetanus (all 7 spp.)
Gaidius tenuispinus
Haloptilus acutifrons
Haloptilus angusticeps
H. mucronatus
Lophothrix (all 3 spp.)
Lucicutia maxima
Megacalanus princeps
Metridia (all 6 spp.)
Mesundeuchaeta asymmetrica
Microcalanus pygmaeus
Monacilla (both spp.)
Mormonilla (both spp.)
Onchocalanus sp.
Paraeuchaeta (all 12 spp.)
Phyllopus (both spp.)
Pontoeciella abyssicola
Ratania atlantica
Rhincalanus nasutus
Scaphocalanus (both spp.)
Scottocalanus (all 3 spp.)
Spinocalanus (both spp.)
Temoropia mayumbaensis
Undeuchaeta intermedia
U.major

A certain number of species showed no special distribution pattern as they were found in nearly every haul from all depths, including the surface nets along the southern traverse. Such species were among others, *Acartia danae*, *A. negligens* and *Mecynocera clausi*. It seems probable that after completion of the taxonomic work certain species of *Oithona*, *Paracalanus*, *Clausocalanus*, *Calocalanus* and perhaps a few others will show the same ubiquitous trend. They could be placed into a fifth group, which we will here call the " ubiquists ".

Macrosetella gracilis could be classified as a " ubiquist ", if only the northern profile (stations 1–12) were considered. Elsewhere, it is found only in the deepest nets (1,500–1,000 m.) and near the 250 m.-level, except at station 32 where it is again found at all depths down to 500 m. (no deeper hauls could be made at that station). Hydrologically, station 32 has the same type of water as the northern stations. *M. gracilis* provides an apt transition towards a sixth group of distribution patterns which is not uncommon in our material and which could be defined as " *dichotopic* ", i.e. occurring in two or more rather widely separated areas, and being conspicuously absent between them.

The following are some examples of dichotopic distribution:—

Acrocalanus gracilis and *A. monachus* are found regularly in the upper 50 (seldom 100)m. from station 1 to 11, at stations 17 and 32. However, they also appear below 500 m. and down to 1,500 m. at stations 6, 7, 11 and 12.

Centropages gracilis is rather scattered in the upper 250 m. at stations 1, 5 and 11, but occurs twice below 1,000 m. at stations 11 and 12.

Euaetidius acutus is found in the upper 100 m. in the Mocambique Current but also below 1,000 m. at stations 6 and 10. The waters between them accommodate *E. giesbrechti*.

Aetideus armatus occurs in the Central water in the north, but only in the Atlantic Intermediate water in the south.

Ctenocalanus vanus is found at six stations above the 100 m.-level and at four stations below the 750 m.-level along the northern profile, whereas in the south it occurs in one surface catch, five central water catches shallower than 500 m. and eight deep catches in over 1,000 m.

Although it is premature at this stage to theorise about these cases of " dichotopic " occurrence, we feel tempted to put forward the following considerations.

In many cases of " dichotopy " we are dealing with species known to occur in both the Indian and the Atlantic Oceans. It is known that Atlantic water flows eastward around the Cape of Good Hope at a certain depth and penetrates the Indian Ocean. This influx carries elements of Atlantic plankton into the deep layers of the Indian Ocean, whereas the autochthonous Indian population of the same species lives near the surface. Hence the appearance of such species at two separate levels in our cross sections.

There are other cases of dichotopy involving species which are rare or entirely absent in the Atlantic, such as *Acrocalanus gracilis* and *A. monachus*. Their occurrence in our deep nets seems to coincide with that of North Indian Deep water originating from surface water sinking in the Arabian Sea. Thus our northern transect would show these species to occur both as a " normal " epiplanktonic population and as a deep " displaced " one.

The distribution of meso- and bathypelagic Copepods throughout the Indian Ocean.

The frequent occurrence in our deep catches of such species as *Calanus tonsus*, *Calanoides carinatus*, *Ctenocalanus vanus*, *Metridia lucens* as well as many others considered to be representatives of the Atlantic and Subantarctic plankton, suggests a considerable influx of southern and western origin into this part of the Indian Ocean. The four species just mentioned are among those that have not been found elsewhere in the Indian Ocean. With the exception of *C. tonsus*, they are at times very common along the western and southwestern coasts of South Africa, where they reach the surface with the upwelling water masses (Benguela Current system). *C. tonsus* can be found in great numbers in the upper layers some 100 miles south of the Cape of Good Hope.

SEWELL (1948) has shown a correlation between a deep current of Antarctic Intermediate water flowing into the Arabian Sea and the occurrence in that area of a number of species which he considers to be of North Atlantic and Arctic origin and transported there by way of the Cape. Following the path of that current northward, he finds a decrease in the number of these species from 56 and 38, respectively, at two stations in the southern and central Arabian Sea, to 32, 19 and 12, respectively, at three stations near the Gulf of Oman and the Gulf of Aden.

By applying SEWELL's standards (SEWELL 1948, pp. 498–506, list of species) we find that the Atlantic contribution to our SW-Indian bathypelagic fauna has reached 134 species so far, which agrees very well with SEWELL's views. This trend in the western part of the Indian Ocean, as shown by SEWELL, is seen to continue in the region east of the Laccadive–Maldive Ridge as well, if we compare the contents of the six mid-water trawls described by SEWELL (1929, 1932) with our list of meso- and bathypelagic species. Proceeding from west to east, we find—

20 of our " Atlantic " species at station 682 (Laccadive Sea, 1,260 m., 54 spp. in total);

11 of our " Atlantic " species at station 670 (W of Ceylon, 360 m., 40 spp. in total);

5 of our " Atlantic " species at station 393 (ESE of Ceylon, 720 m., 45 spp. in total);

2 of our " Atlantic " species at station 463 (E of Ceylon, 720 m., 8 spp. in total);

none of our " Atlantic " species at station 462 (central southern area of Bay of Bengal, 855 m., 9 spp. in total); and

none of our " Atlantic " species at station 461 (W of Andaman Islands, 675 m., 1 sp.).

From the foregoing figures it will be noted that a gradual decrease in the numbers of Atlantic species in a northerly and easterly direction is apparent in the Indian Ocean, and that a minimum is reached in the Bay of Bengal.

A similar regression seems to occur from the opposite direction, along the axis of the deep current penetrating into the Indian Ocean from the West Pacific through the Moluccan Passage, the Banda and Timor Seas.

In eleven deep hauls made by the Siboga Expedition in the Eastern Malay Archipelago, A. SCOTT (1909) found a number of our " Atlantic " species. When the number of species which each Siboga station has in common with the Central and Antarctic Intermediate waters in our area is plotted on a map, a decrease in a southerly and westerly direction becomes apparent. Isolines drawn around the stations with more than 15 species in common, and around those with more than 20 species in common with our southwestern deep fauna, follow much the same trend as the contour lines of the lower oxygen minimum given by WYRTKI (1961, plates 32 and 35); see Fig. 6.

We may conclude that the influxes of deep water into the Indian Ocean from the South Atlantic as well as from the Western Pacific are clearly indicated by the changes observed in the bathypelagic and mesopelagic Copepod fauna.

6. Literature.

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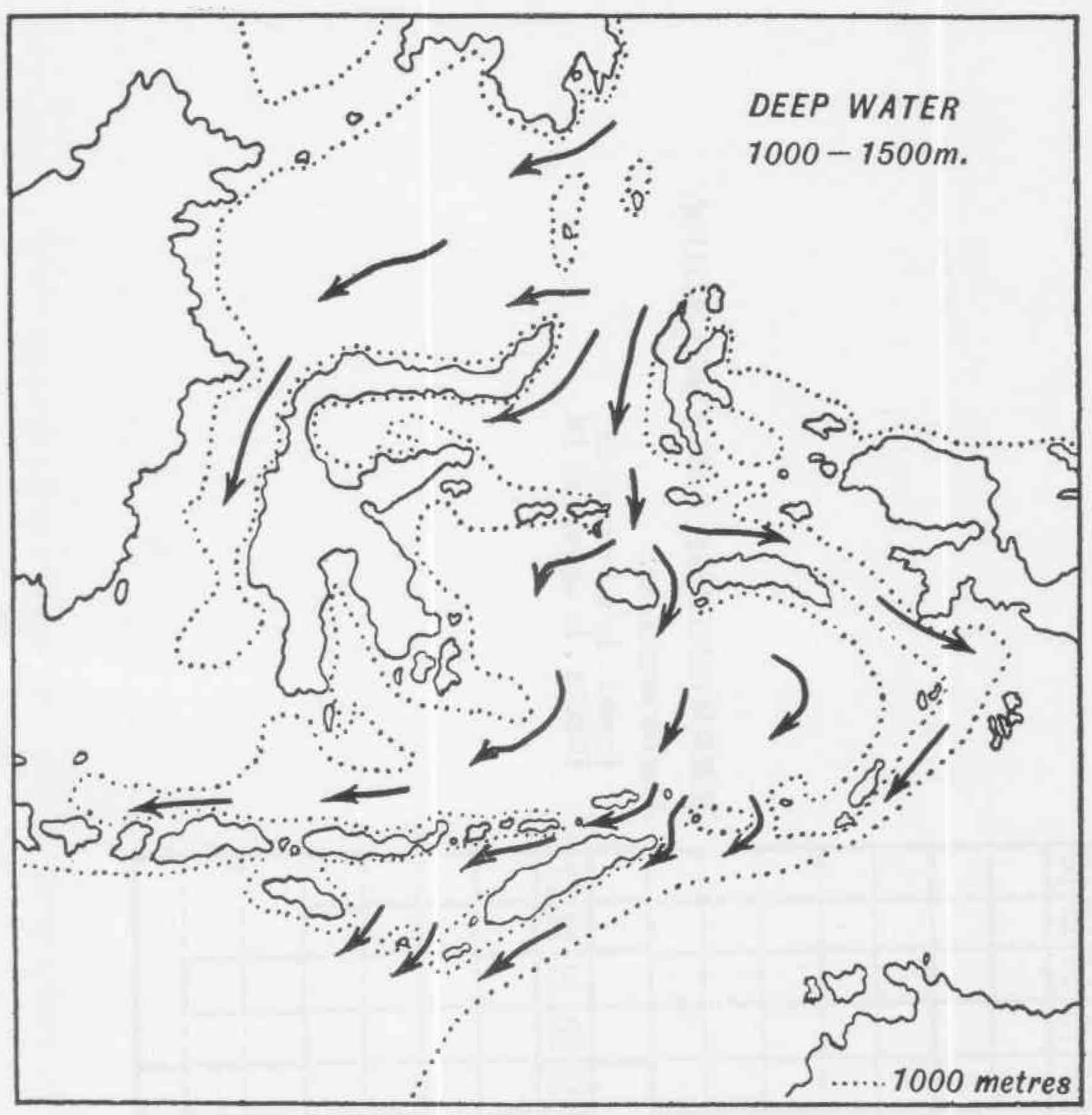
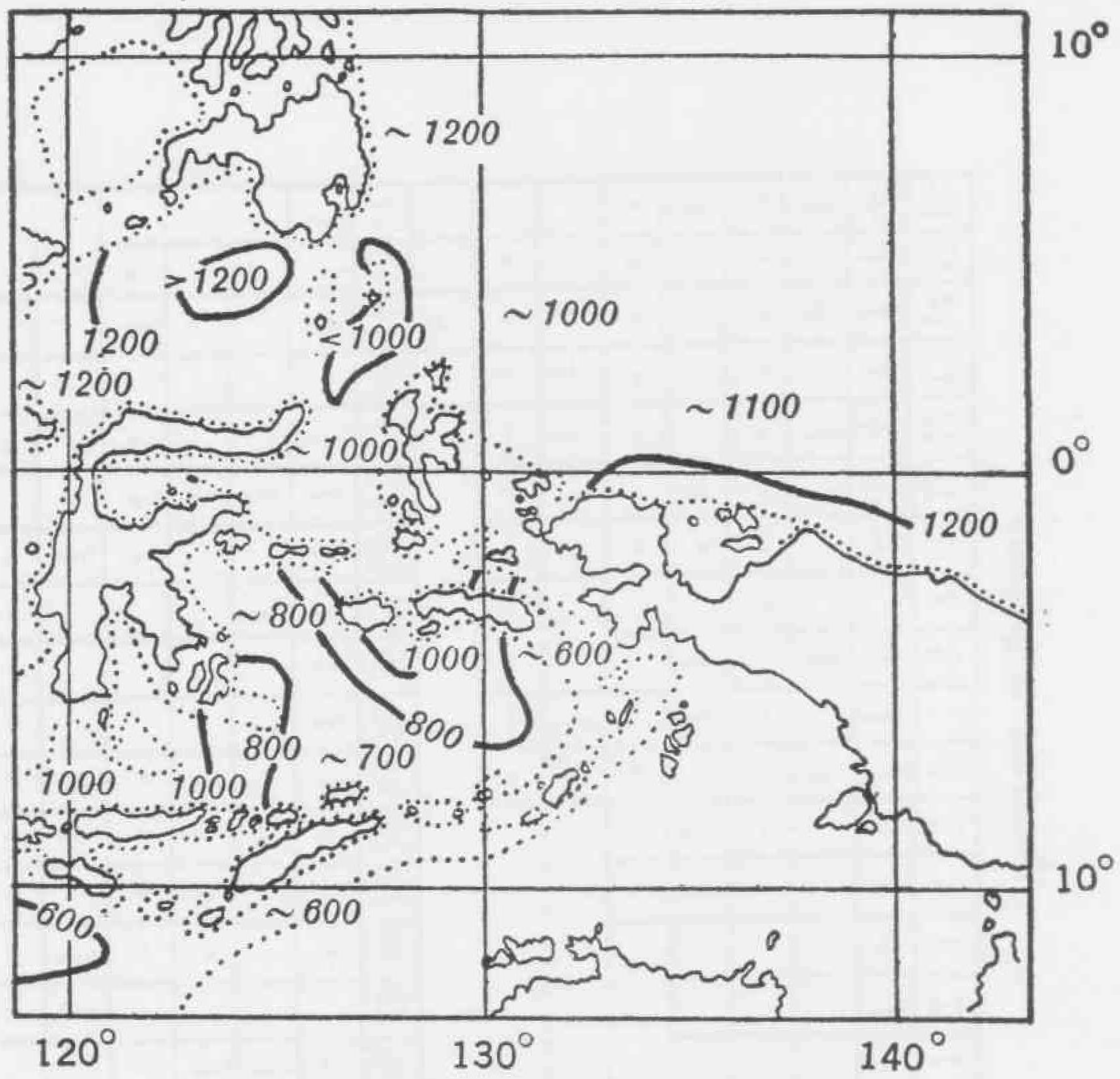
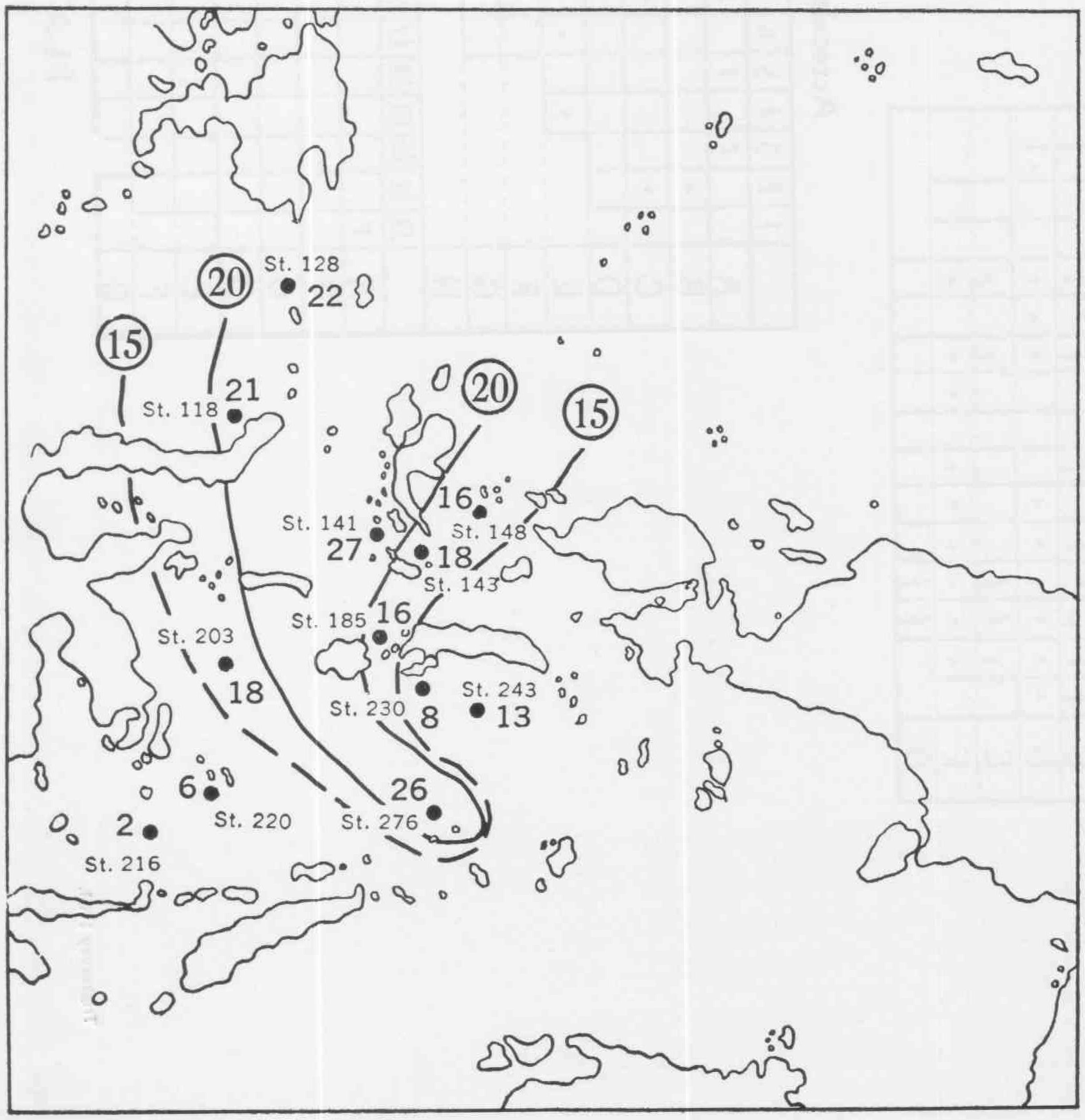


Water movements in 1000 – 1500m.
(from WYRTKI 1961)



Depth (m.) of O_2 minimum
(from WYRTKI 1961)

Fig. 6

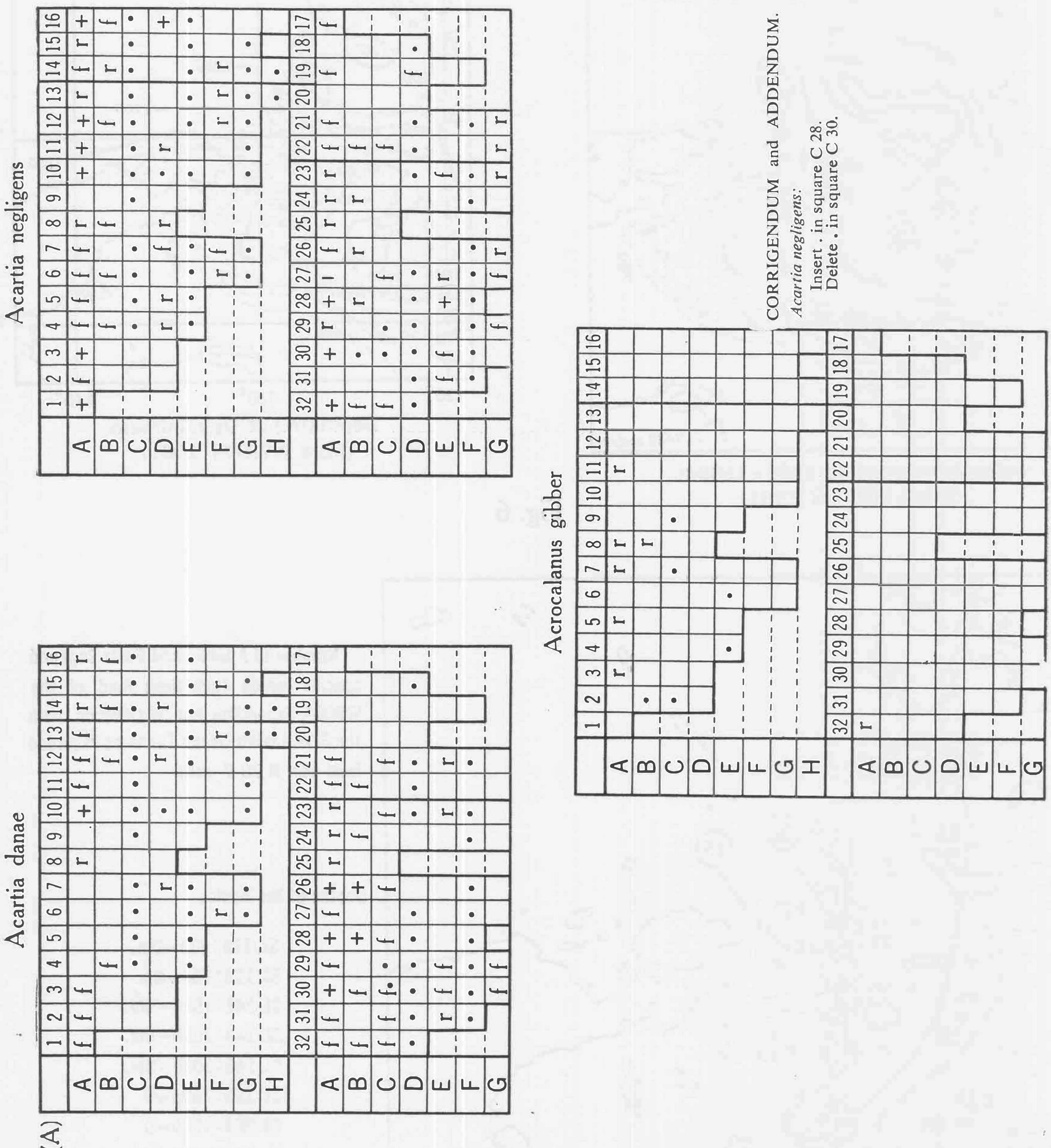


Trigsurvey 1964

Number of Atlantic and Polar Copepod species which each deep haul of the SIBOGA Expedition has in common with the S.W. Indian Ocean fauna as recorded from our N 70 V-nets.

Depths of the hauls:

St. 118 : 900 – 0m.
St. 128 : 700 – 0m.
St. 141 : 1500 – 0m.
St. 143 : 1000 – 0m.
St. 148 : 1000 – 0m.
St. 185 : 1500 – 0
St. 203 : 1500 – 0
St. 216 : 1000 – 400
St. 220 : 200 – 0
St 230 : 2000 – 0
St. 243 : 1000 – 0
St. 276 : 750 – 0



CORRIGENDUM and ADDENDUM.

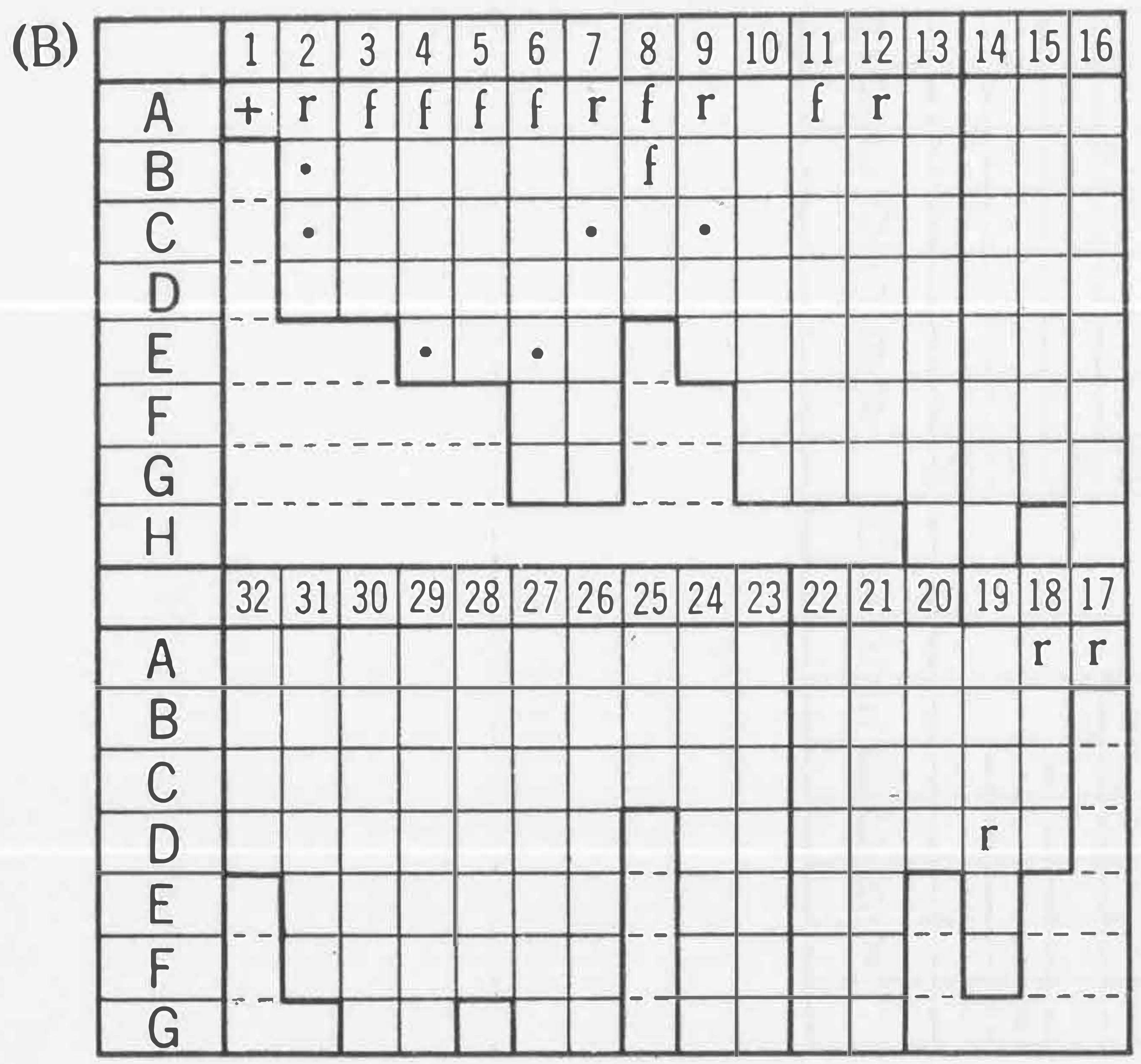
Acartia negligens:

Insert . in square C 28.
Delete . in square C 30.

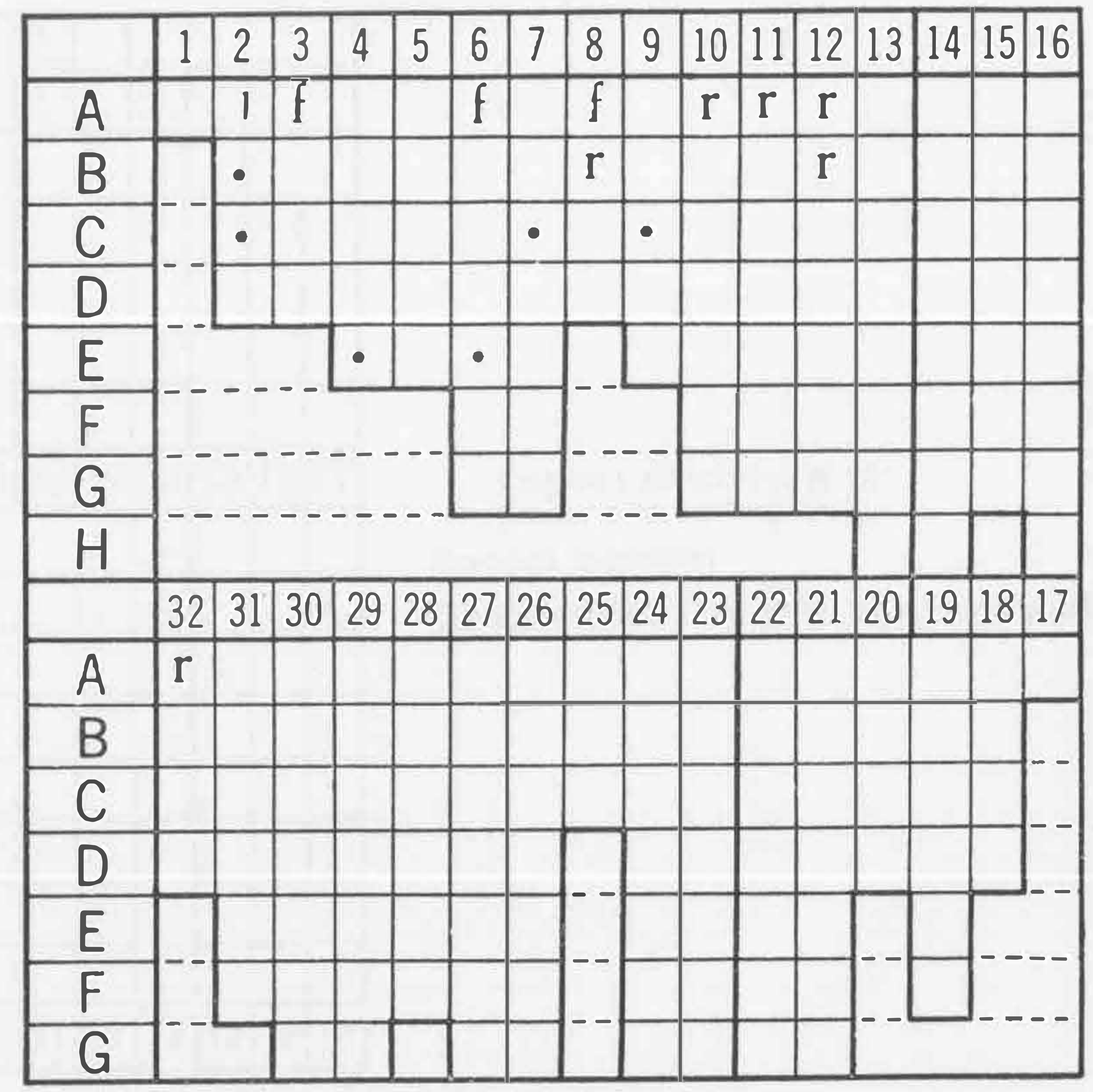
PLATE I

Trigsurvey 1964.

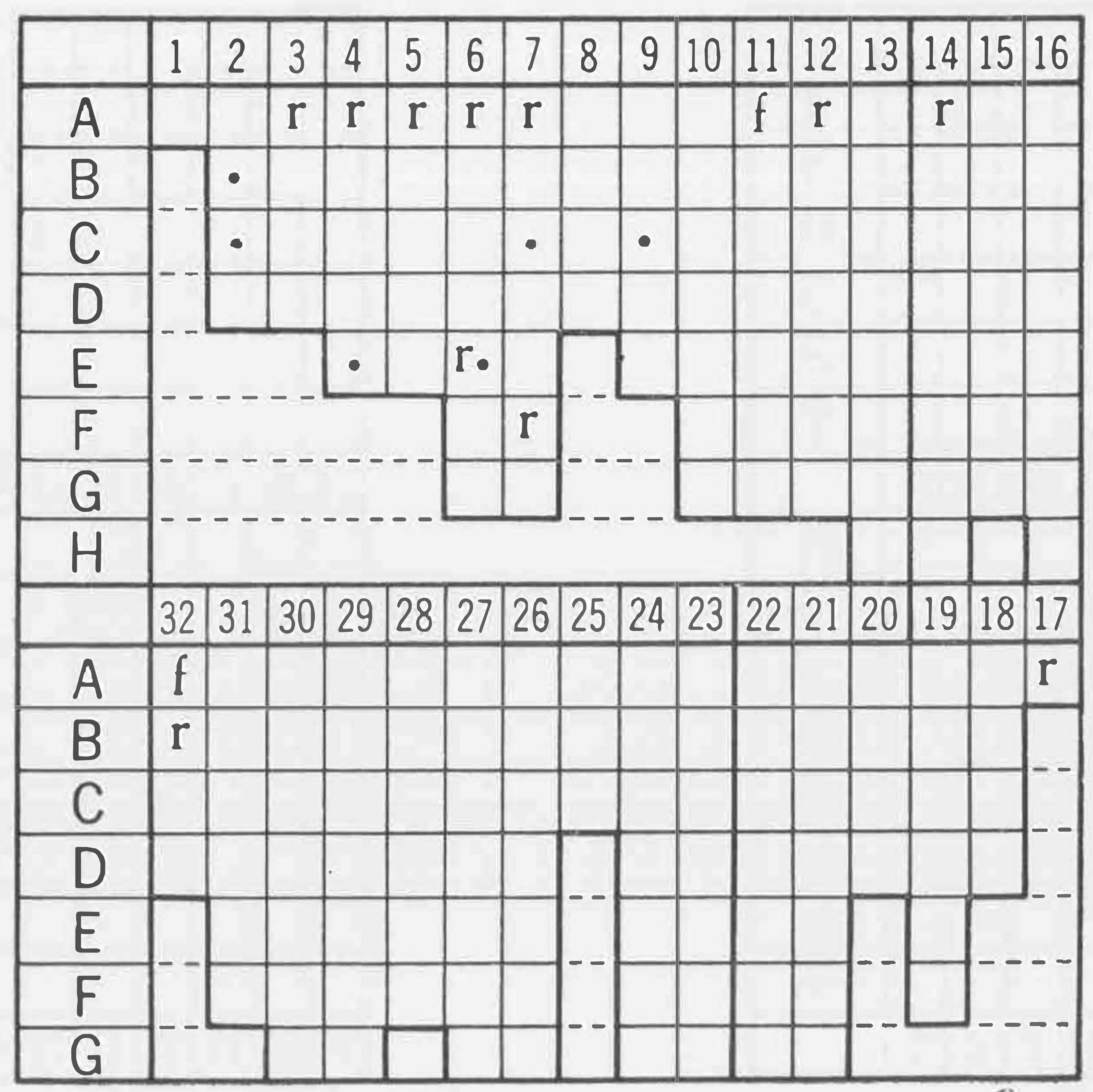
Acrocalanus gracilis



Acrocalanus longicornis



Acrocalanus monachus



ADDENDA.

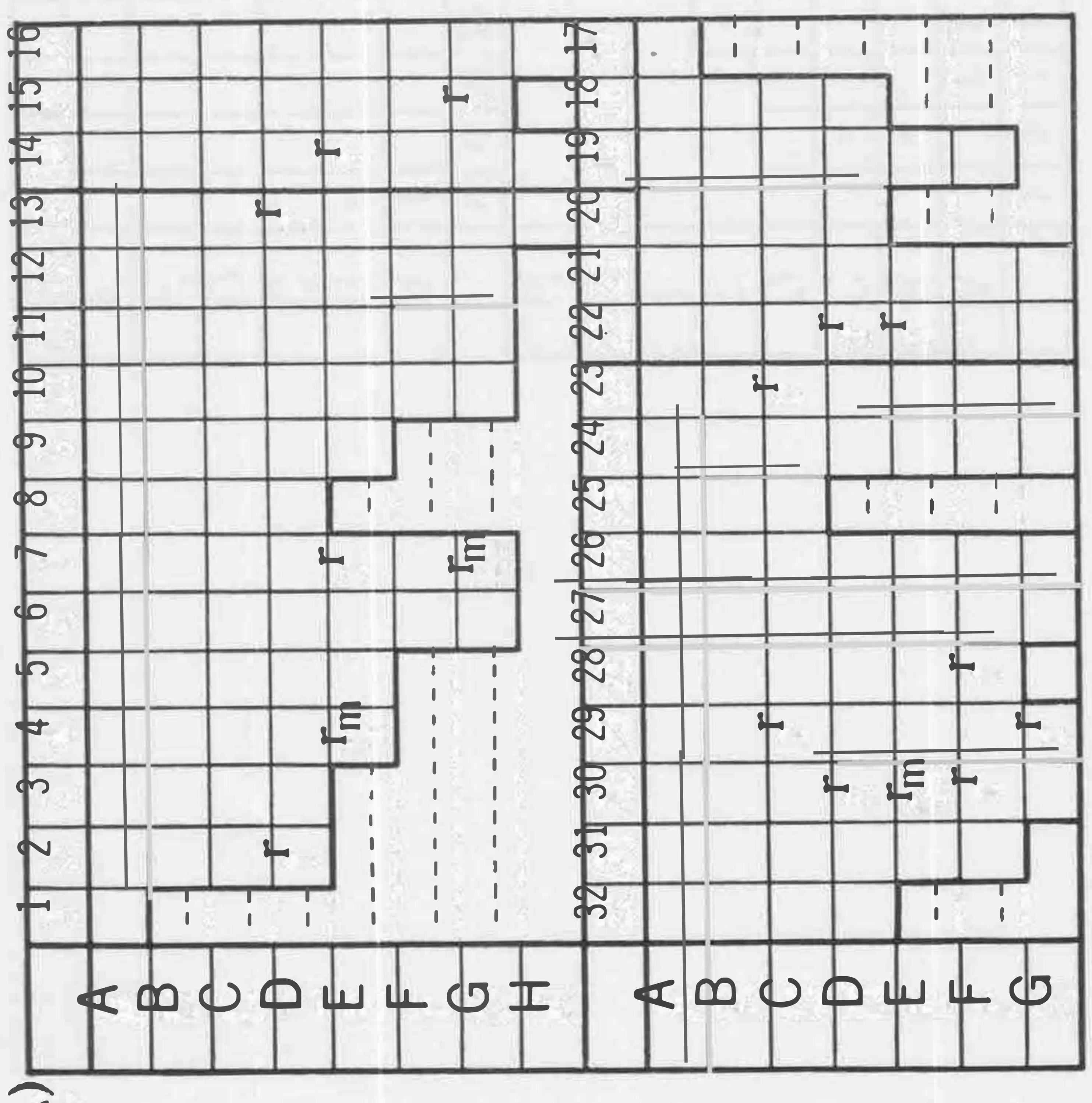
Acrocalanus gracilis:

Insert r in squares: F7, F11 and G12.

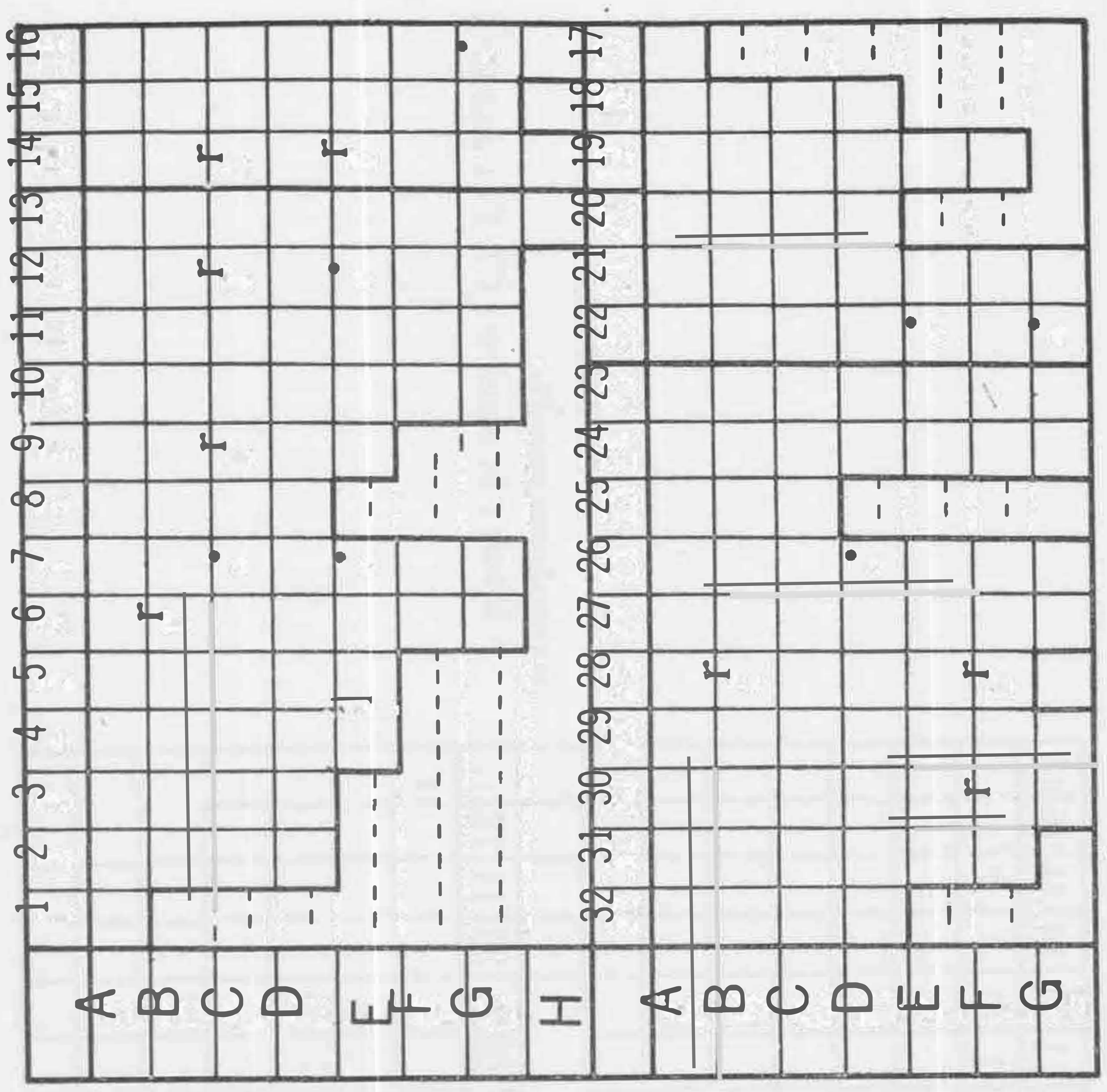
PLATE I

Trigsurvey 1964

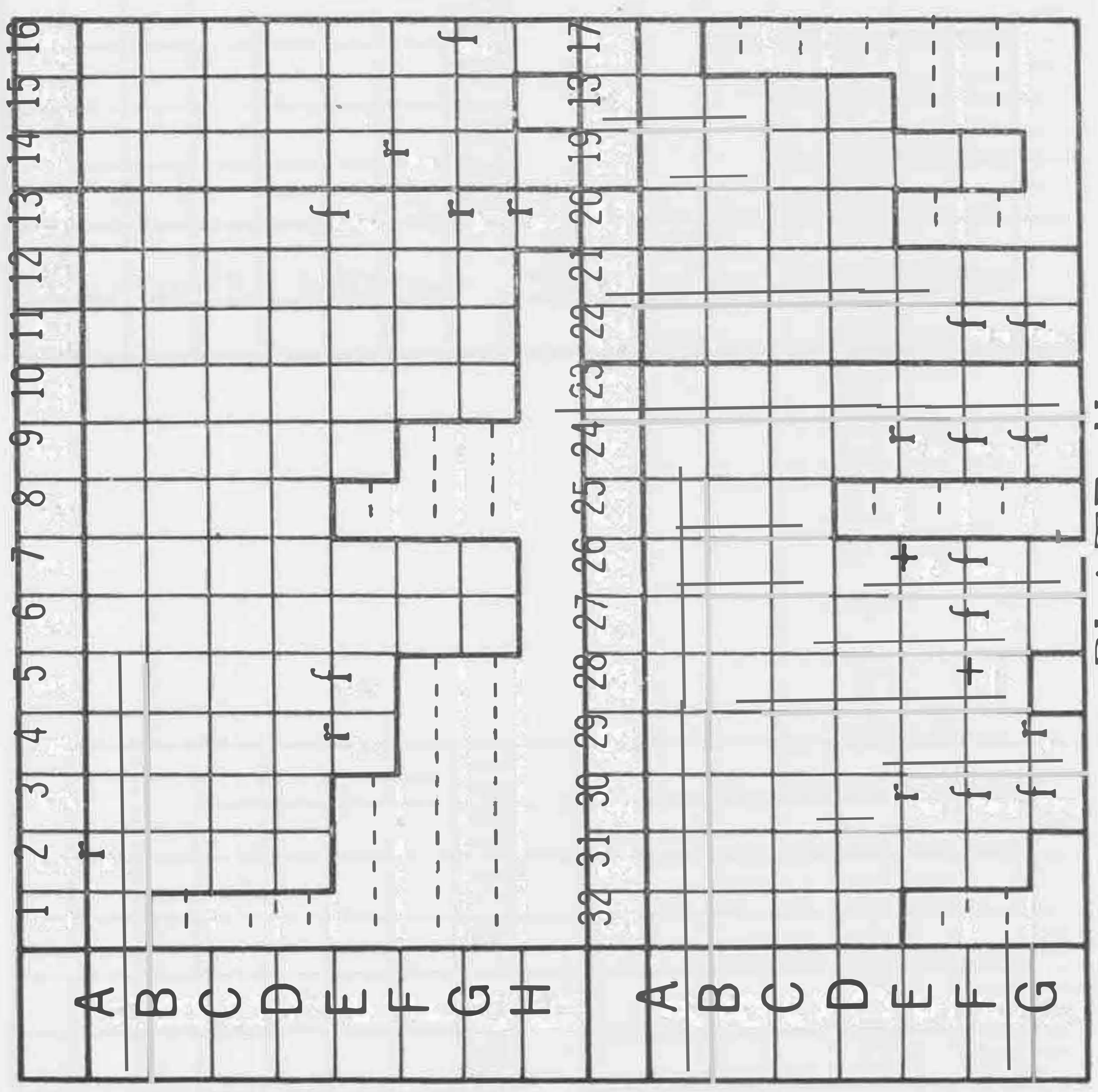
(A) Aegisthus spp. (m=A. mucronatus)



Aetideus armatus



Calanoides carinatus



CORRIGENDUM and ADDENDUM

Aetideus armatus:

Insert r in square A 28.

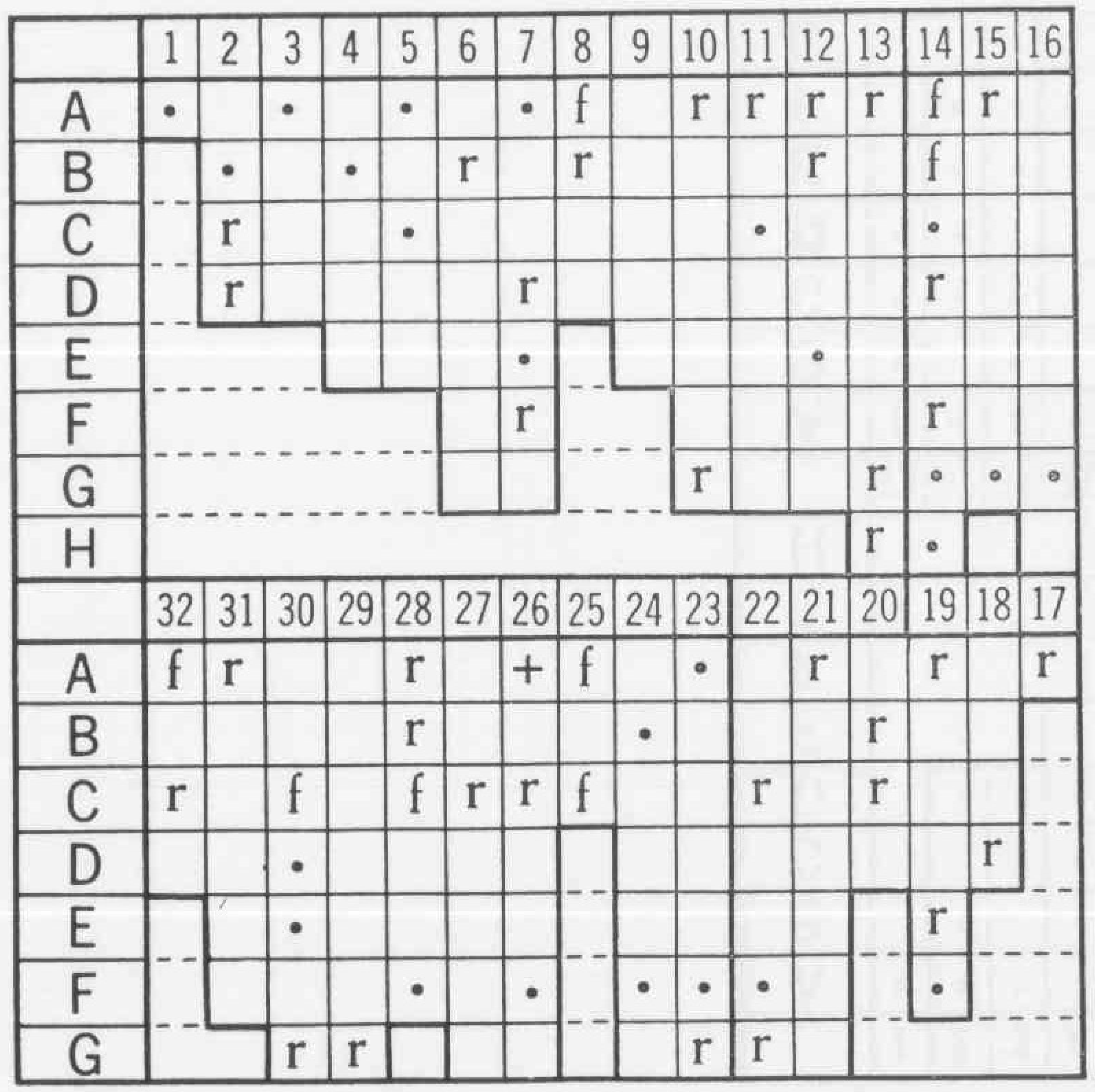
Delete r in square B 28.

PLATE II

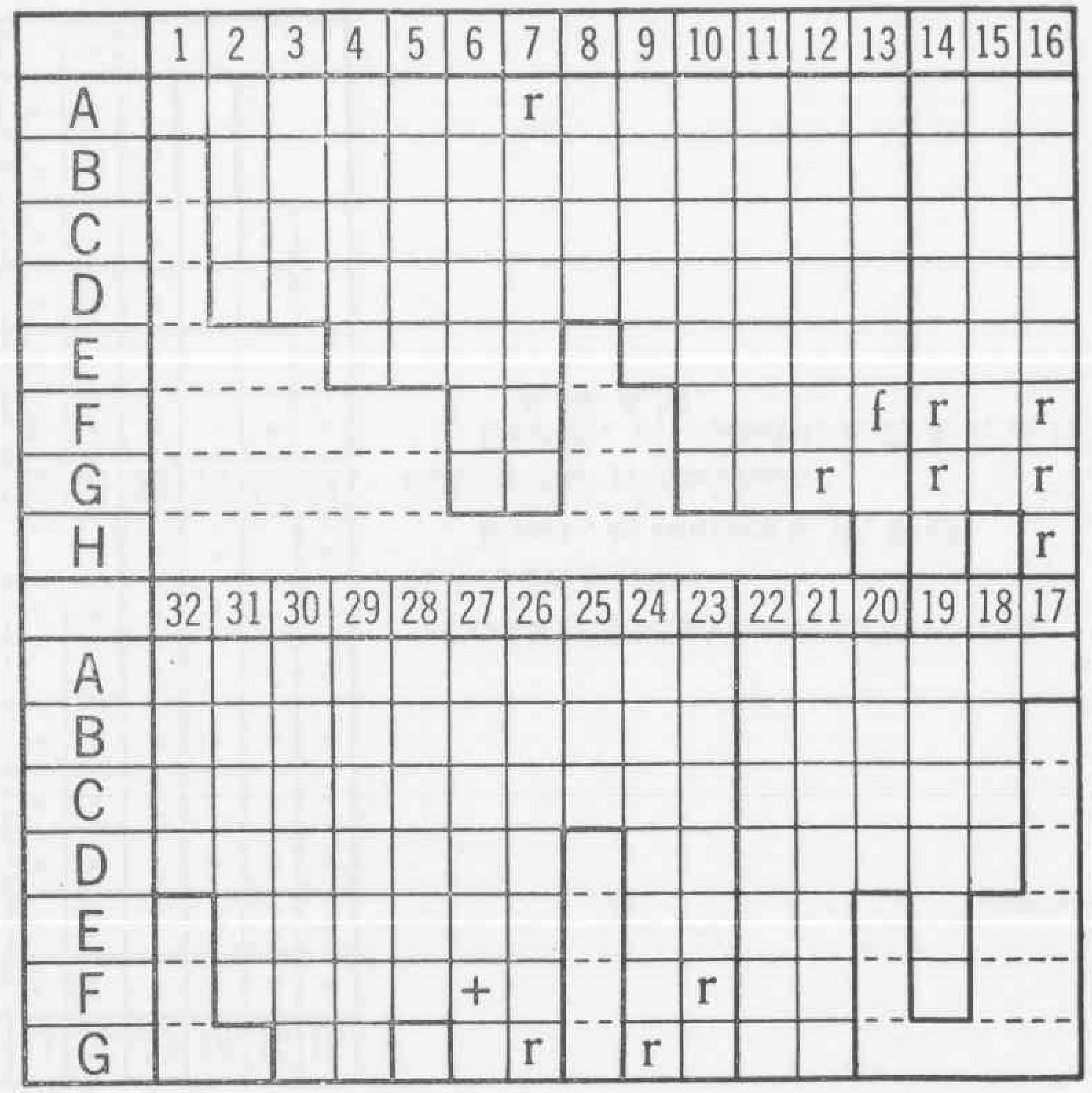
Trigsurvey 1964

Calanus tenuicornis

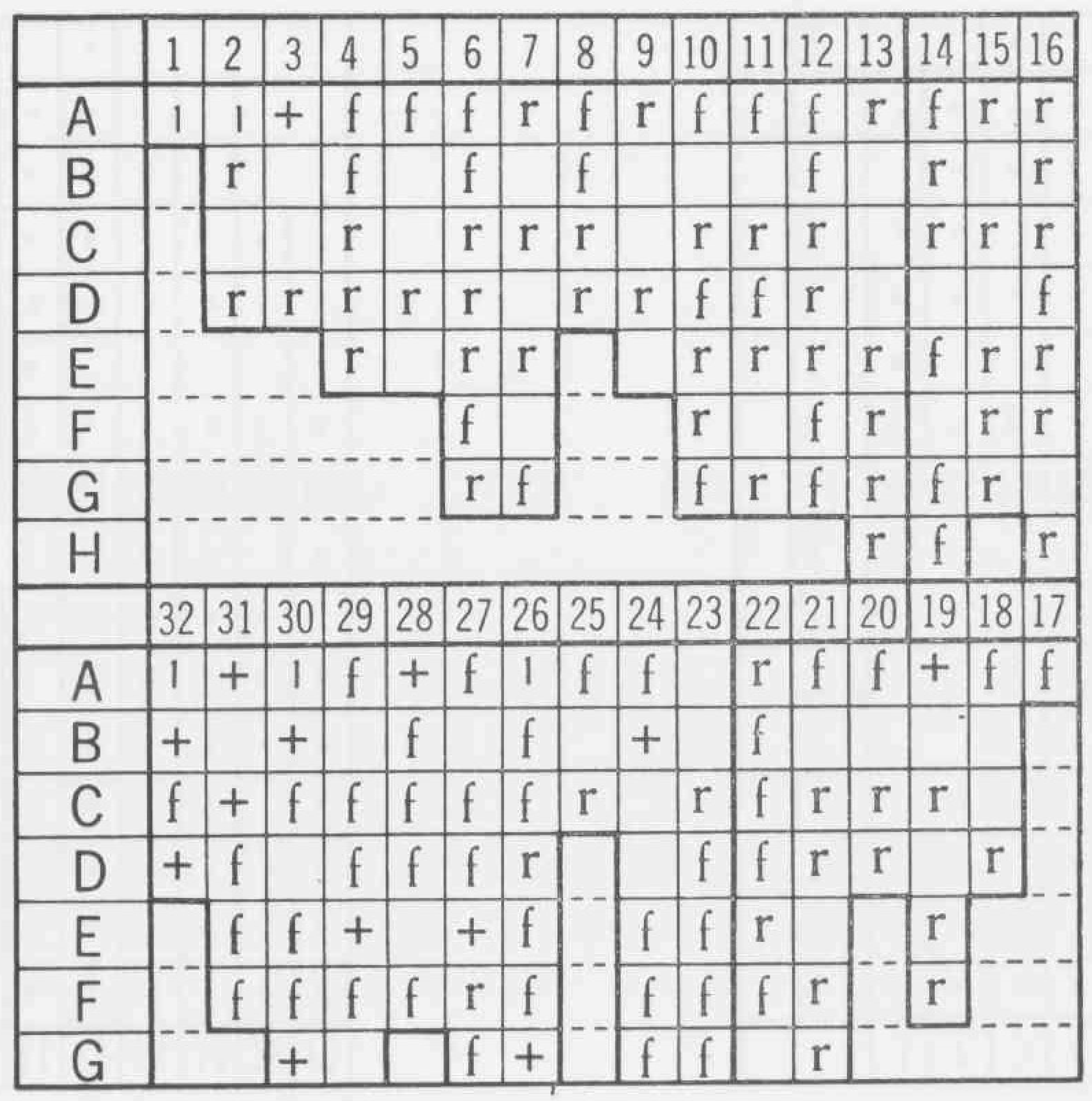
(B)



Calanus tonsus



Calocalanus (all spp.)



ADDENDA.

Calanus tonsus:

Insert . in same squares as in *Calanus tenuicornis*, except where another symbol is already present in *C. tonsus.*

PLATE II

Trigsurvey 1964

Reprint from "Commerce & Industry", October, 1964

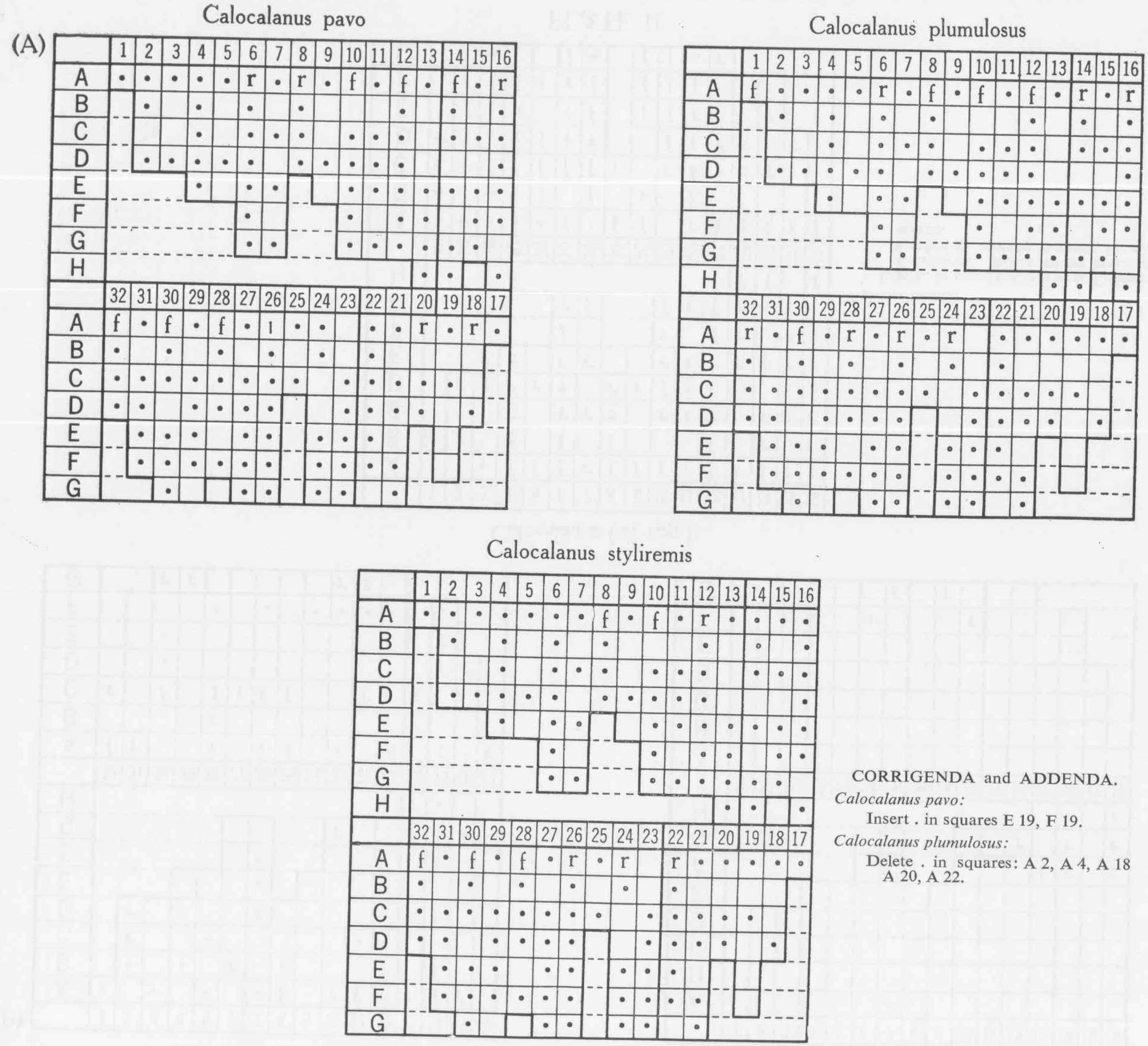


PLATE III

CORRIGENDA and ADDENDA.

Calocalanus pavo:

Insert . in squares E 19, F 19.

Calocalanus plumulosus:

Delete . in squares: A 2, A 4, A 18 A 20, A 22.

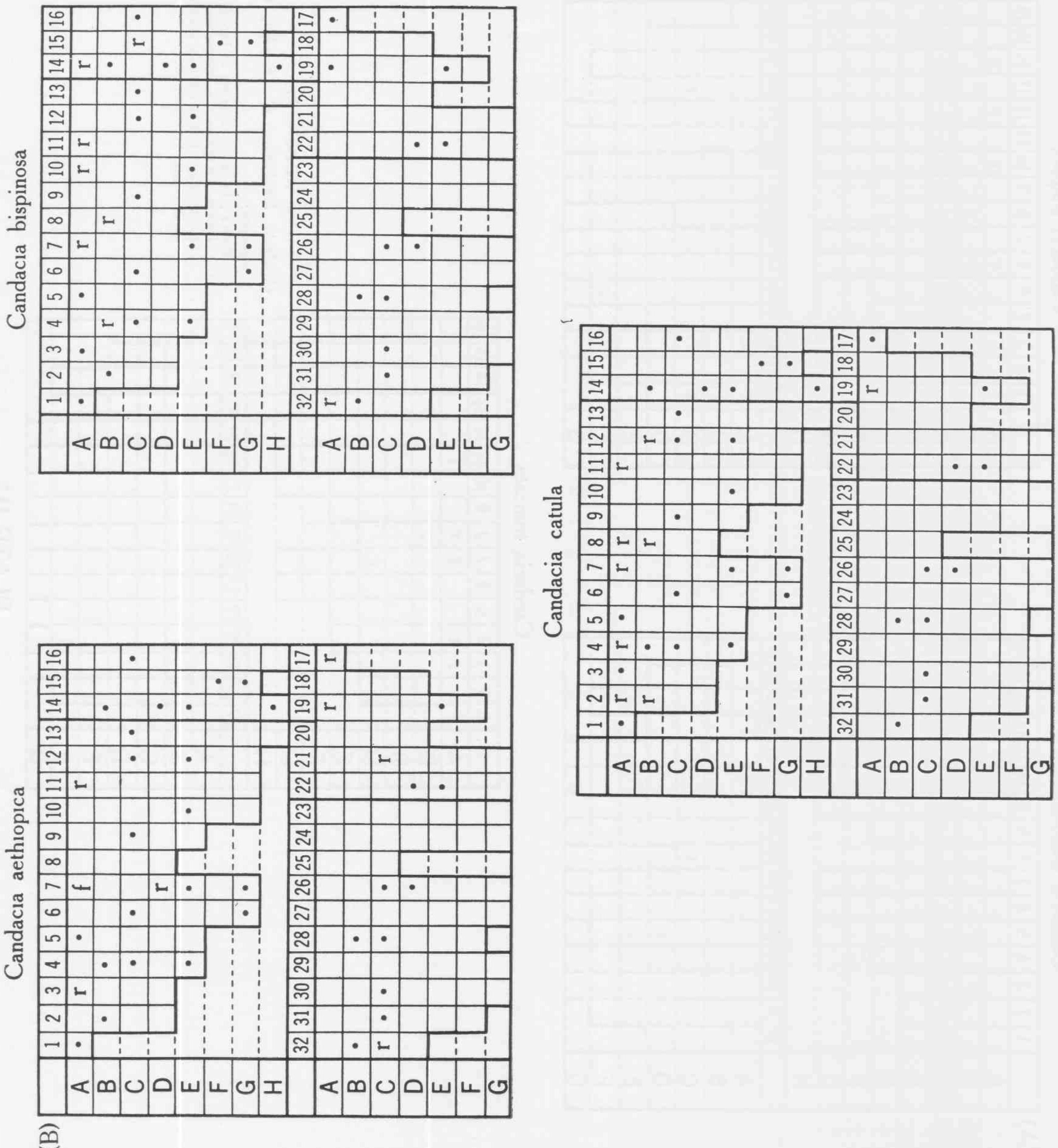


PLATE III

Trigsurvey 1964.

(A)

Candacia longimana

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A																
B																
C																
D															r	
E													r	r		
F																
G																
H																

	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A																
B																
C								r								
D					r											
E					r											
F																
G																

Candacia simplex

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	f		r			r				r		r		r		
B						r		r								
C														r		
D															r	
E																
F																
G																
H																

	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	r		r													
B	f															
C	r												r			
D																
E																
F					r											
G																

Candacia truncata

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	f		r	r			r	r			f					
B								r								
C																
D							r									
E																
F																
G																
H																

	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A																
B																
C																
D																
E																
F																
G																

ADDENDA.

Candacia longimana, C. simplex, C. truncata:

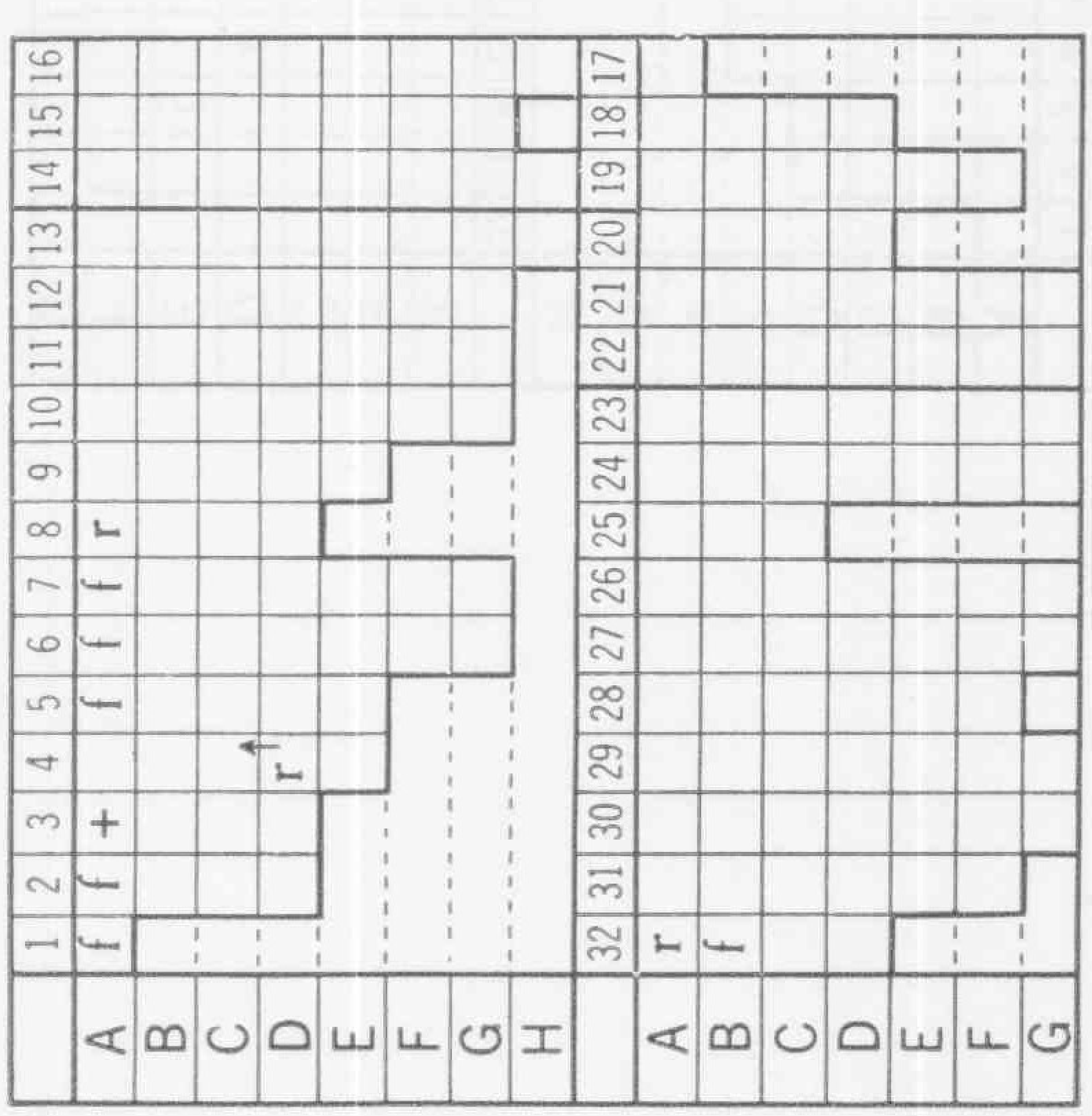
Insert . in same squares as in other *Candaciae* (page 27), except where another symbol is already present in the square concerned.

Trigsurvey 1964.

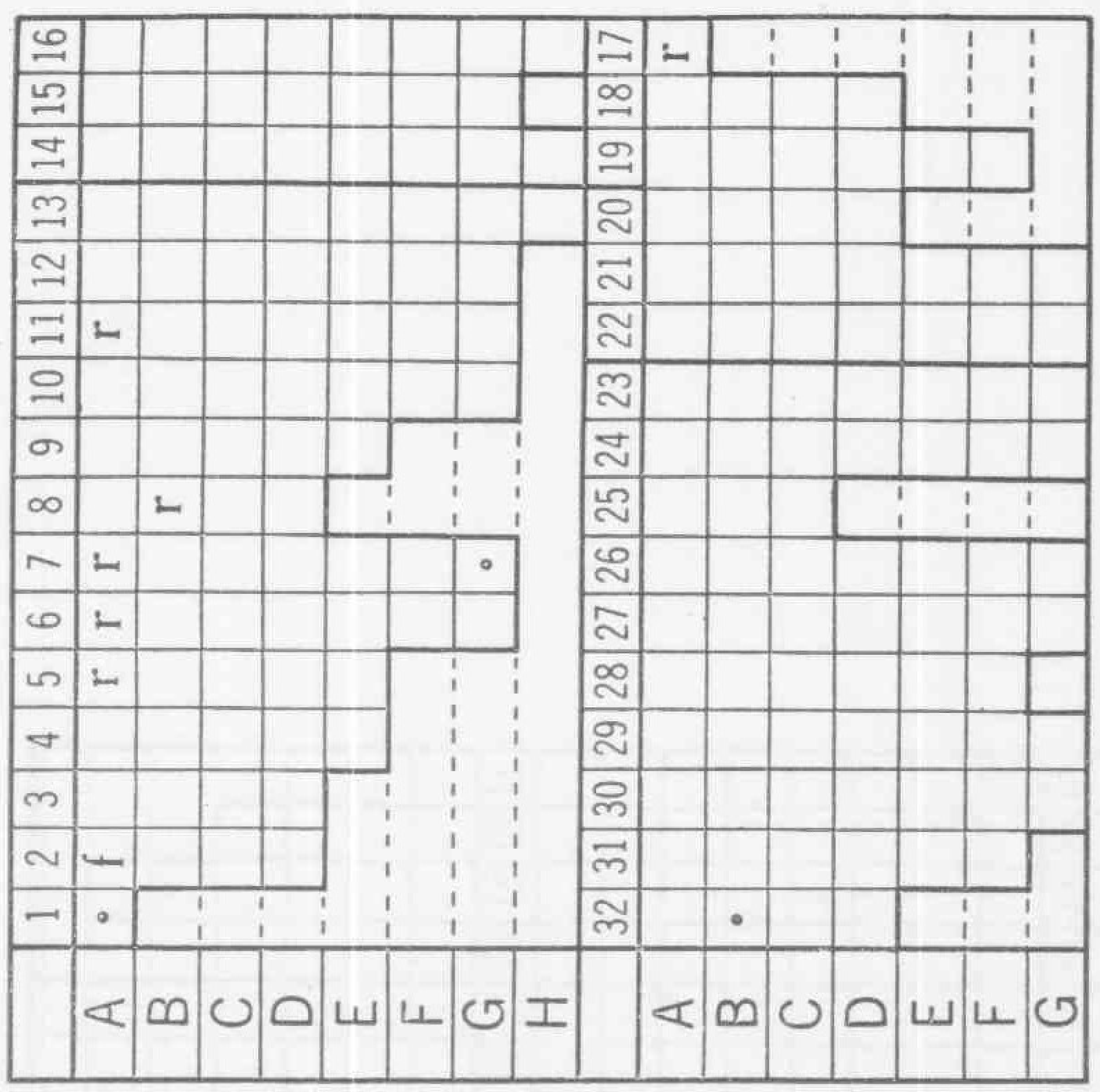
PLATE IV

(B)

Canthocalanus pauper



Centropages calaninus



Centropages elongatus

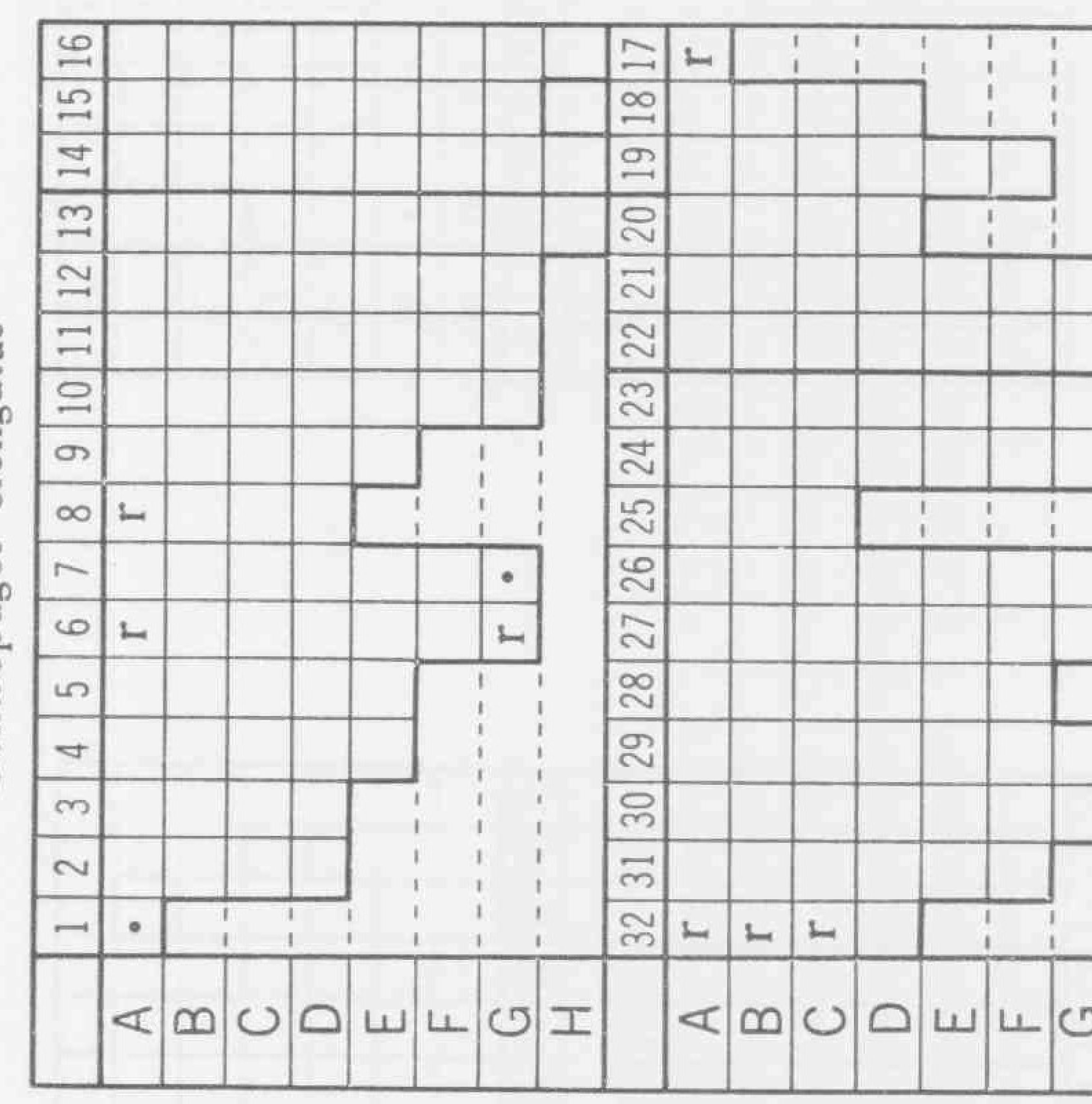


PLATE IV

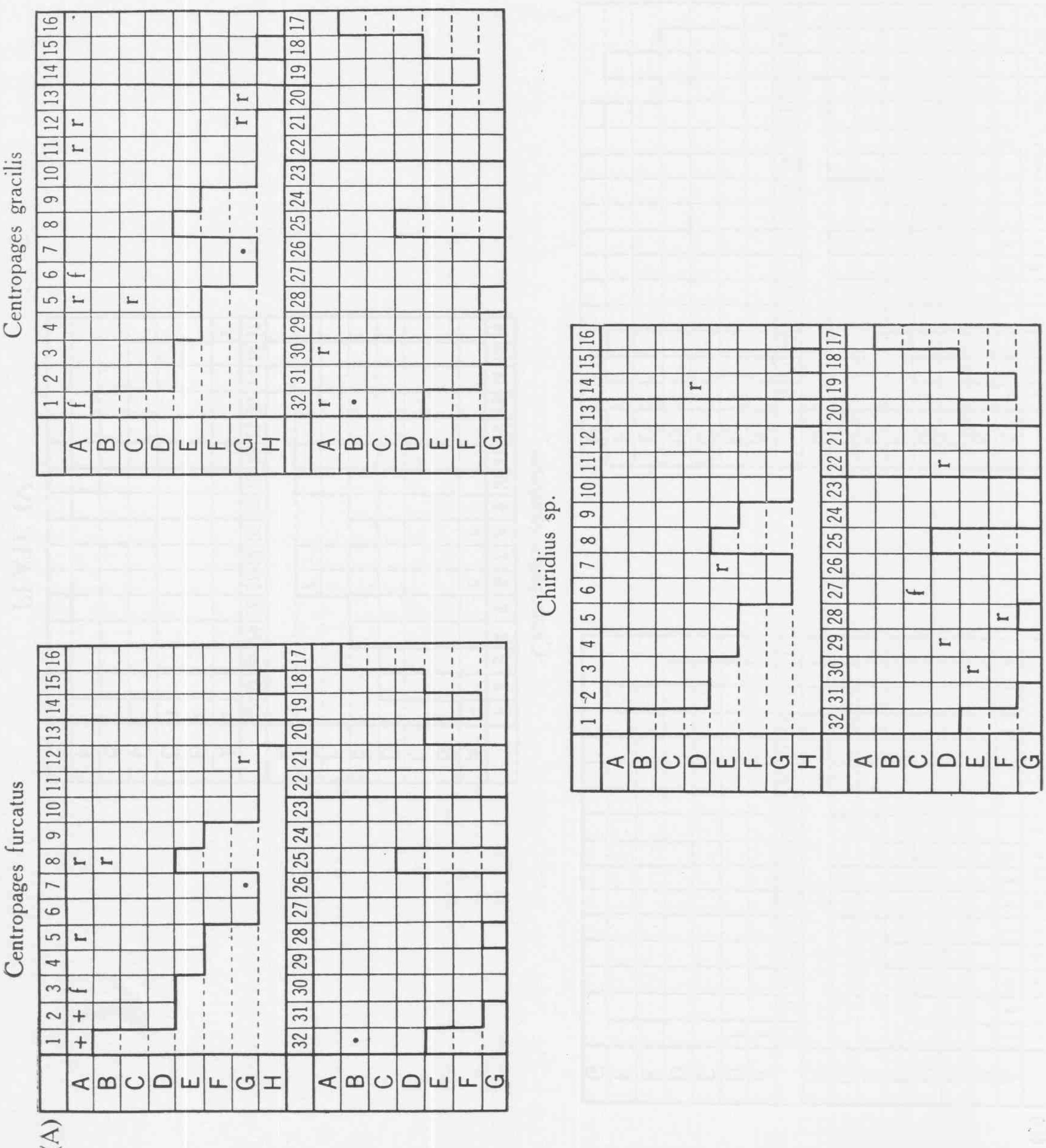
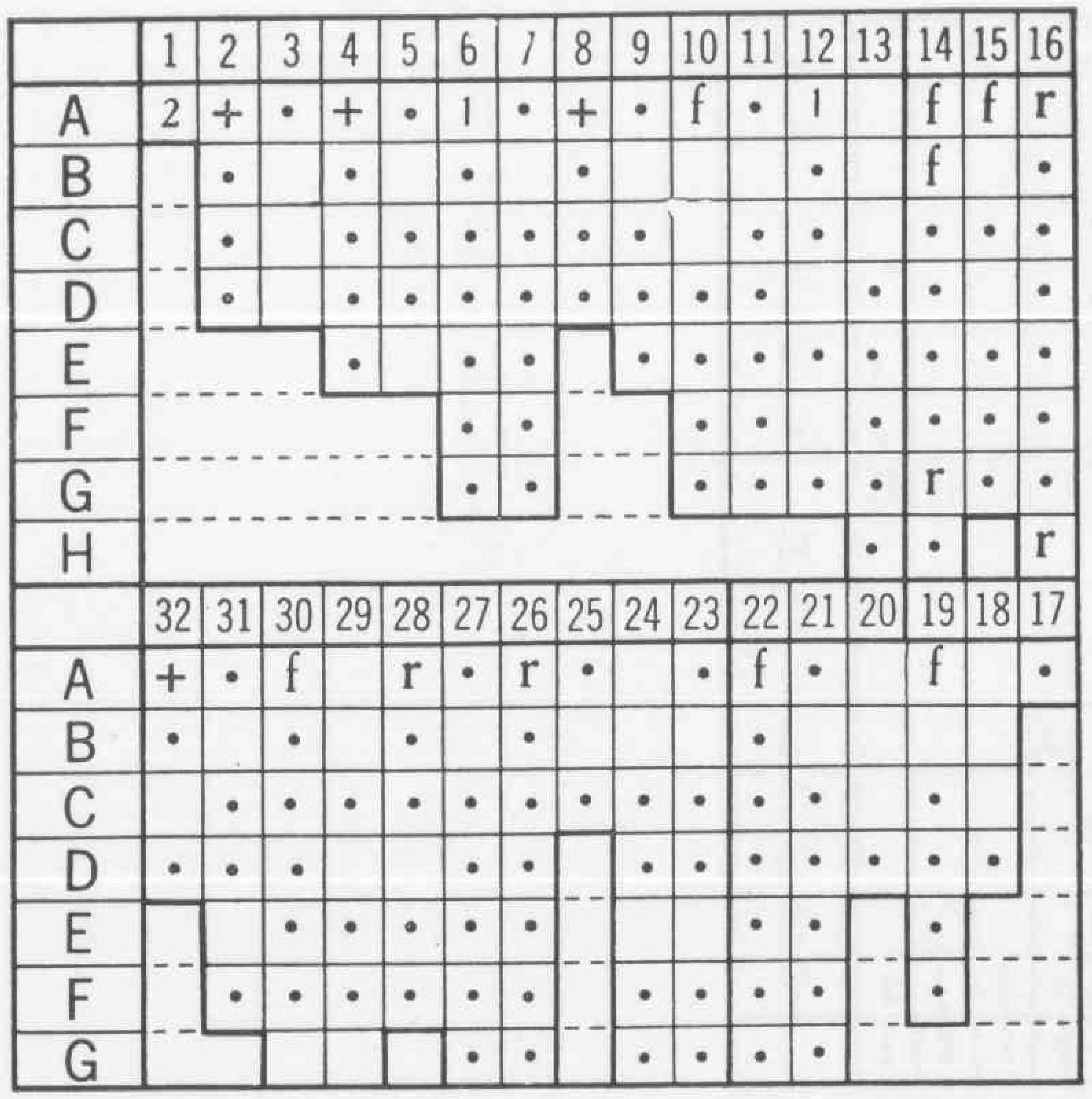


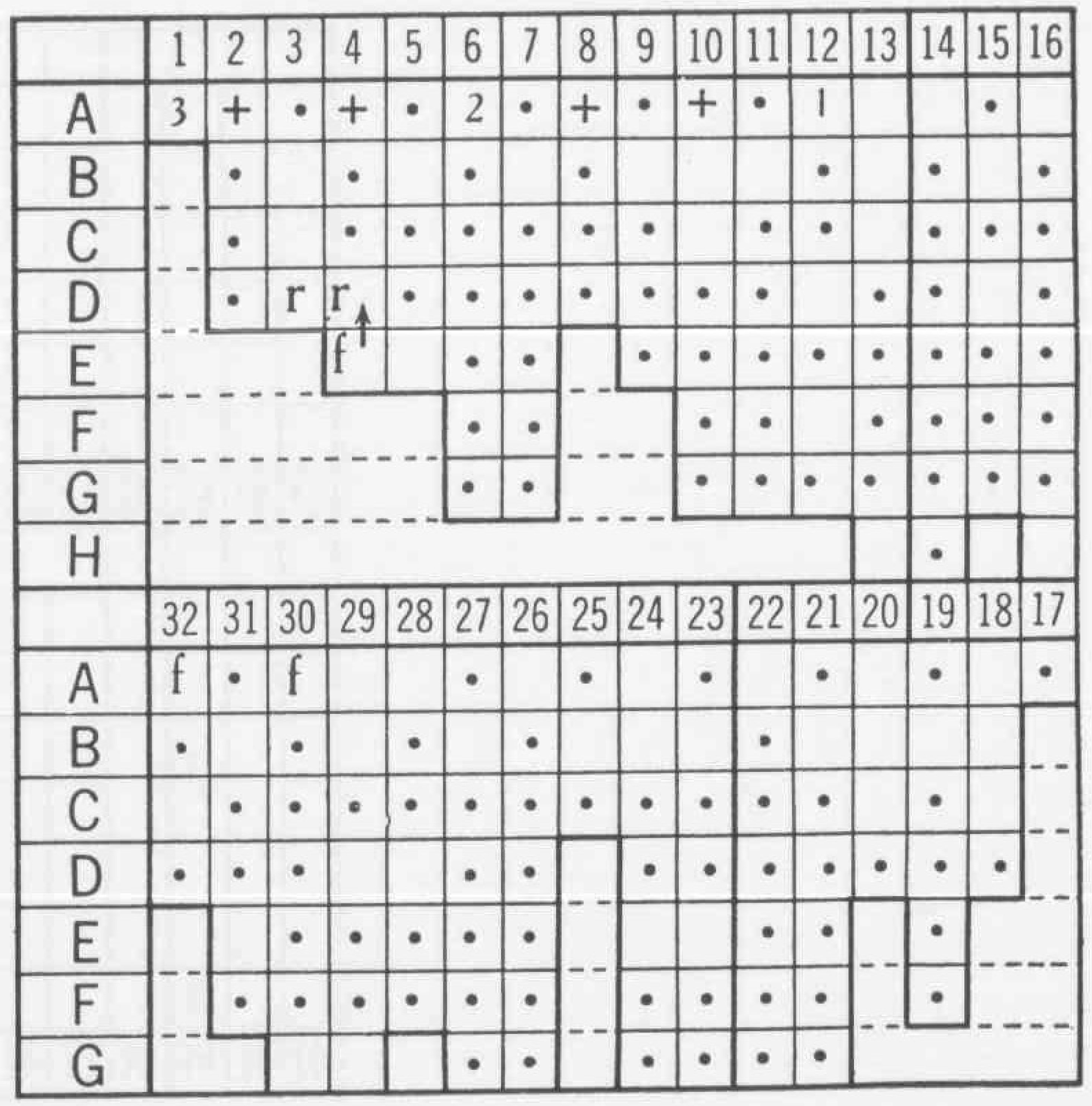
PLATE V

Telesurvey 1964.

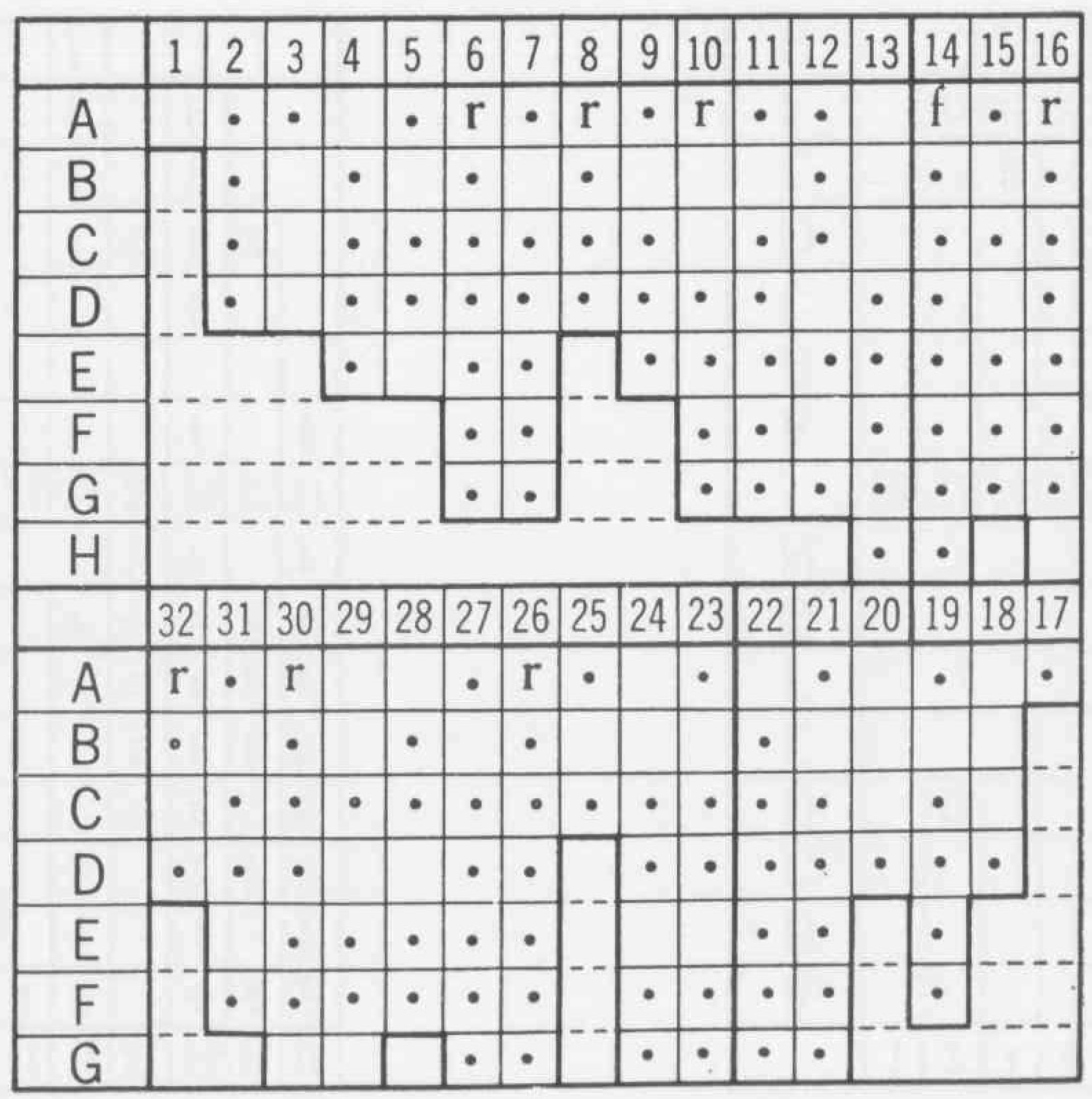
(B)



Clausocalanus arcuicornis



Clausocalanus furcatus



Clausocalanus paululus

ADDENDUM.

Clausocalanus furcatus:
Insert . in square H 13.

PLATE V

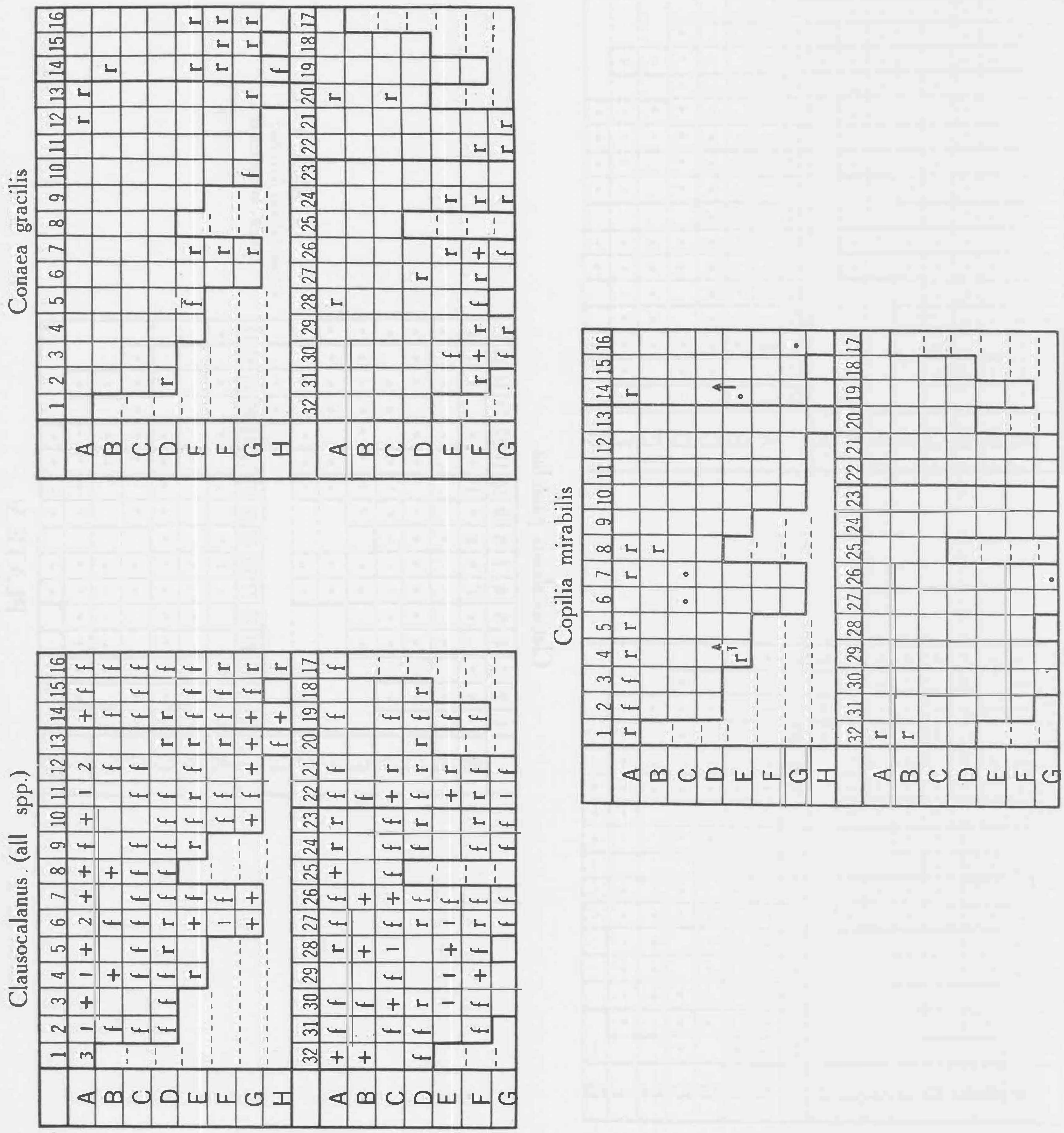


PLATE VI

Trigsurvey 1964.

(B)

Copilia quadrata

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A								r							r	
B														r		
C						•	•								r	
D																
E														•↑		
F																
G																•
H																
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	r															r
B																
C																
D																
E																
F																
G							•									

Ctenocalanus vanus

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A			r													
B		r	r	r				r						r		r
C																
D																
E																
F														r		
G							r			r				r		
H																
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A			r													
B					r											
C					r		r									
D						r						r				
E																
F			f	r			f		r		r	r				
G									r		r					

Corycaeus sensu lato (all spp., excl. Corycella)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	l	l	+	l	+	+	+	+		f	+	+	f	+	r	
B		r		f		f		+				+		f		r
C		r		?	?	?	?		?	?	?	?	?		?	?
D			r	f↑	f	f	+	+	r	r	f	?	r	f↑		r
E				f		r	f		r	r	f	f	r	+	r	r
F						l	r					f	f		r	
G						f	f			f	f	+	r	f		r
H													f	+		f
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	+	f	+				r	f				f	f	+		f
B	+				r								r			
C		+	r	+	l	r		r			r	r	f	?		
D		r	r								f	r	r	f	?	
E		r	f	f	r	f				r		r				
F			r			r						r				
G			f	r			r					f				

ADDENDA.

Ctenocalanus vanus:
Insert r in squares A 12 and A 25.

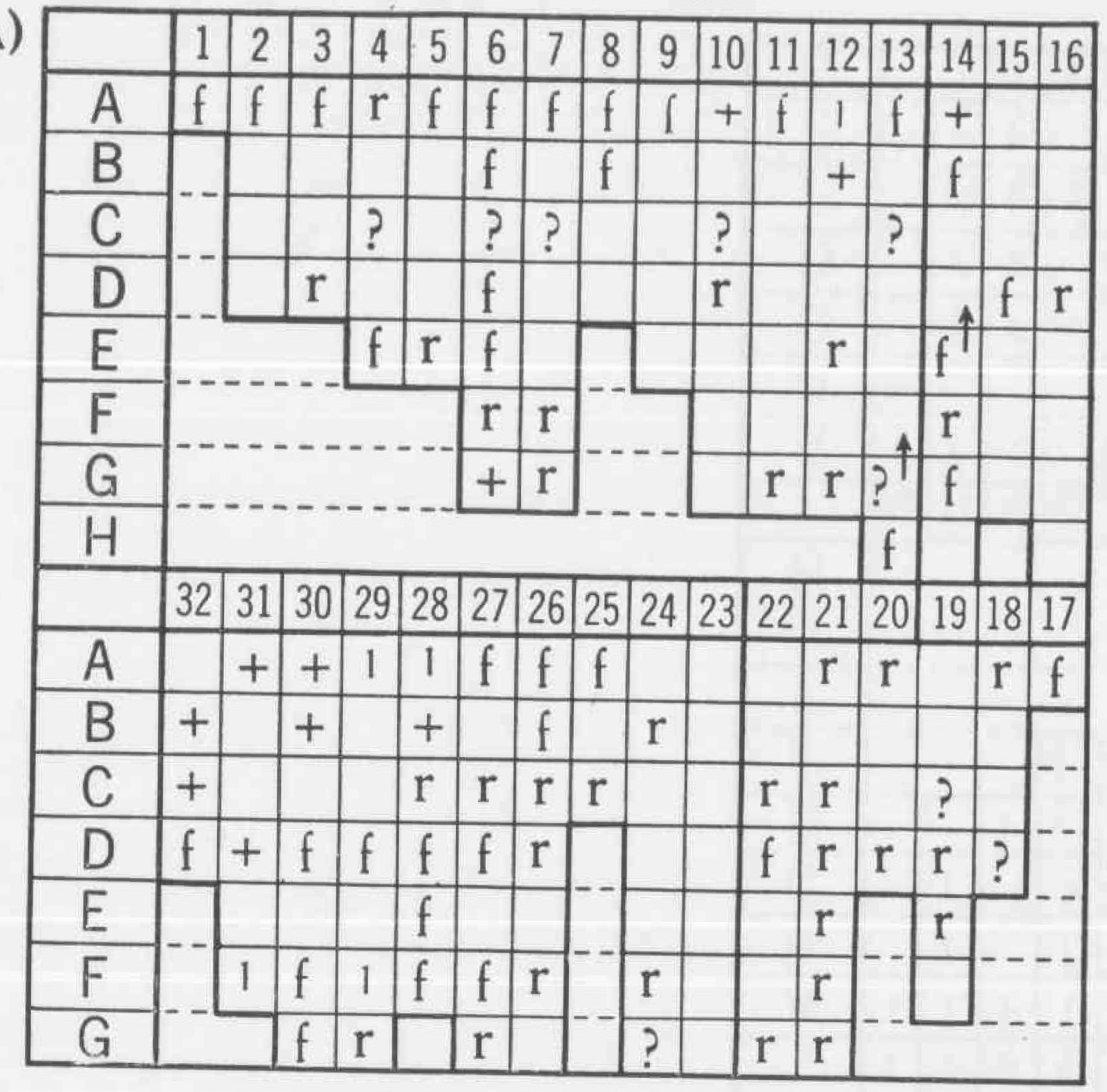
PLATE VI

Trigsurvey 1964.

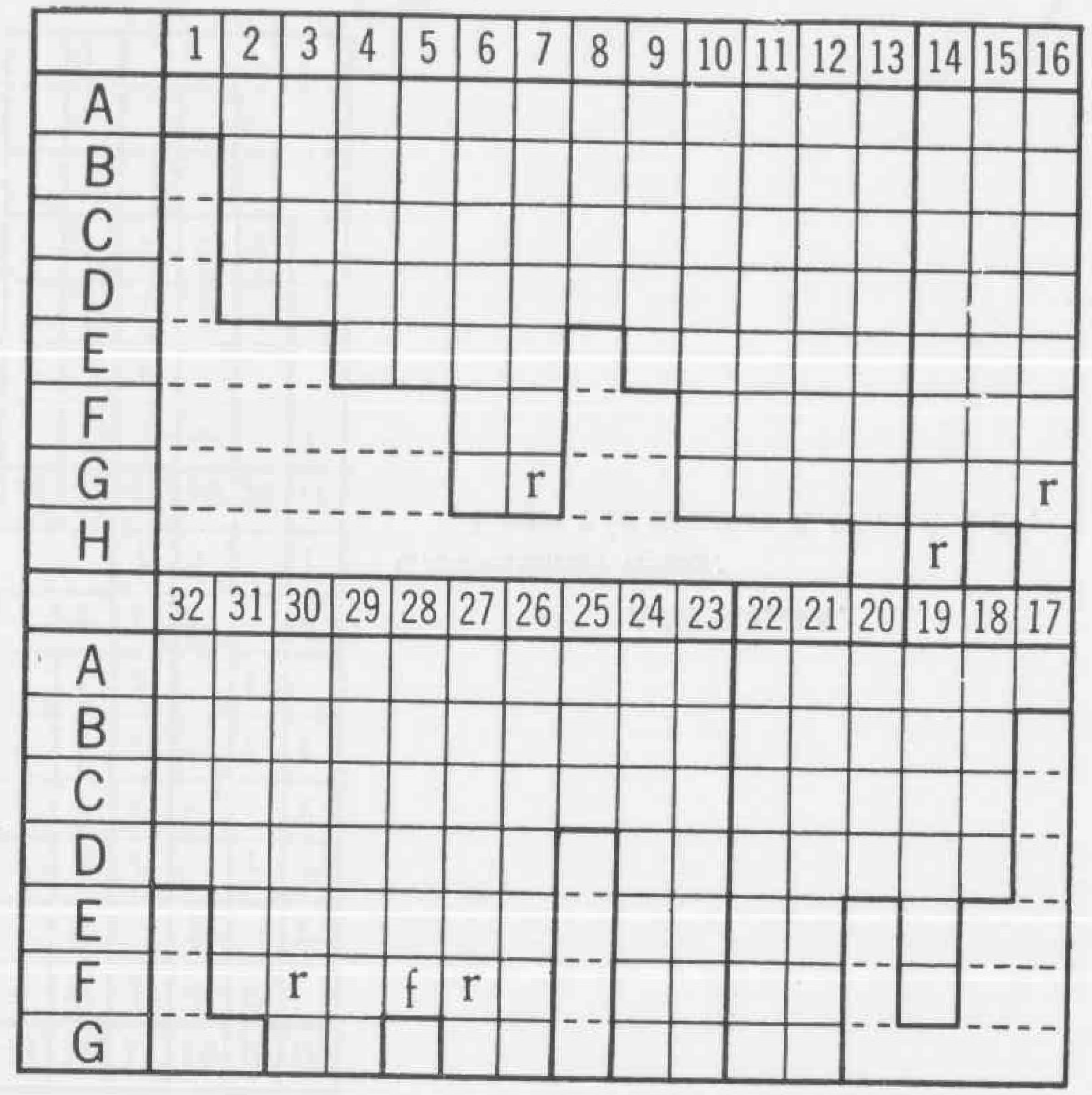
Reprint from "Commerce & Industry," October, 1964

Corycella (all spp.)

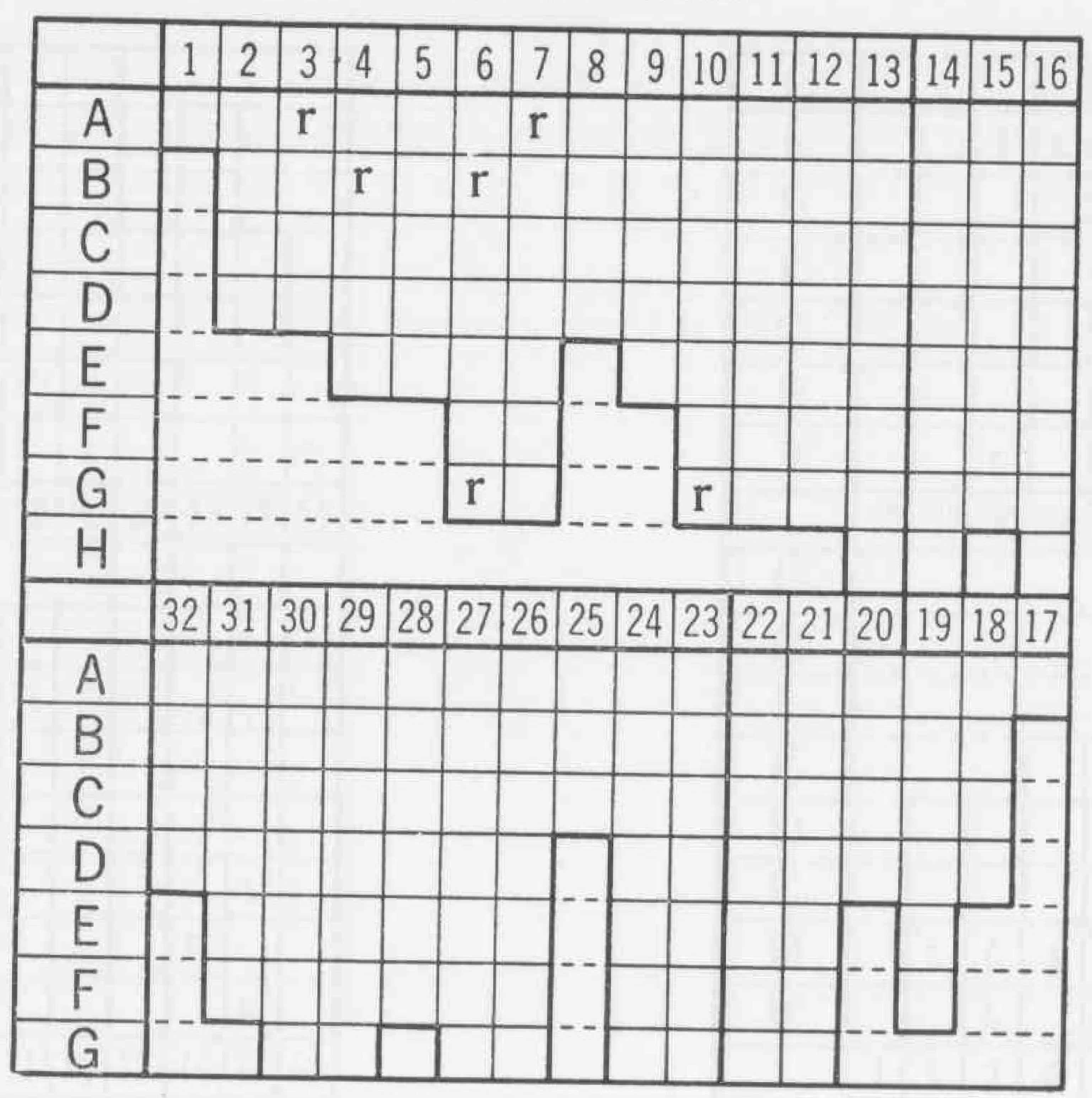
(A)



Euaugaptilus palumboi



Euaetidius acutus



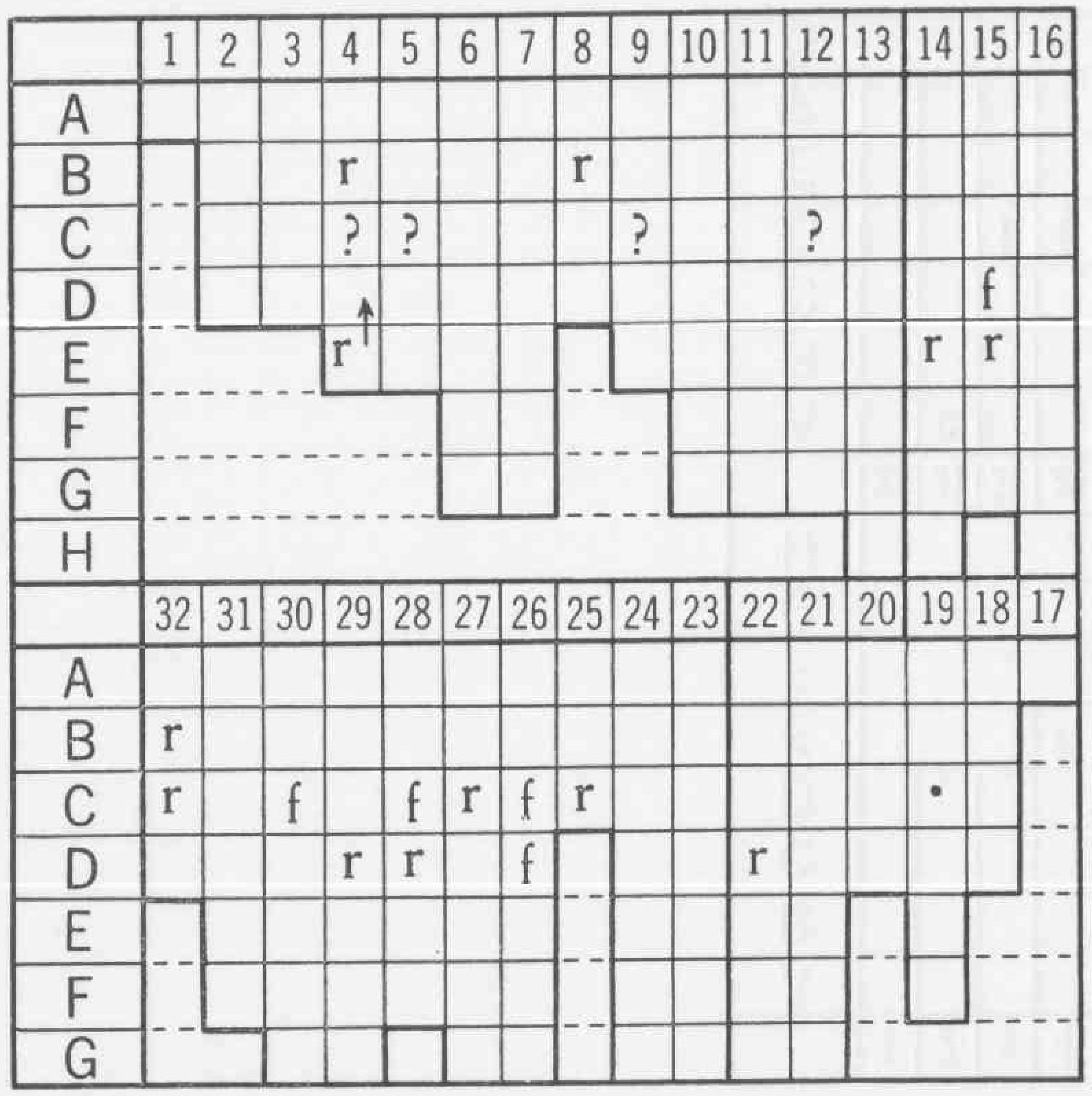
ADDENDUM.

Corycella (all spp.):
Insert + in square A 32.

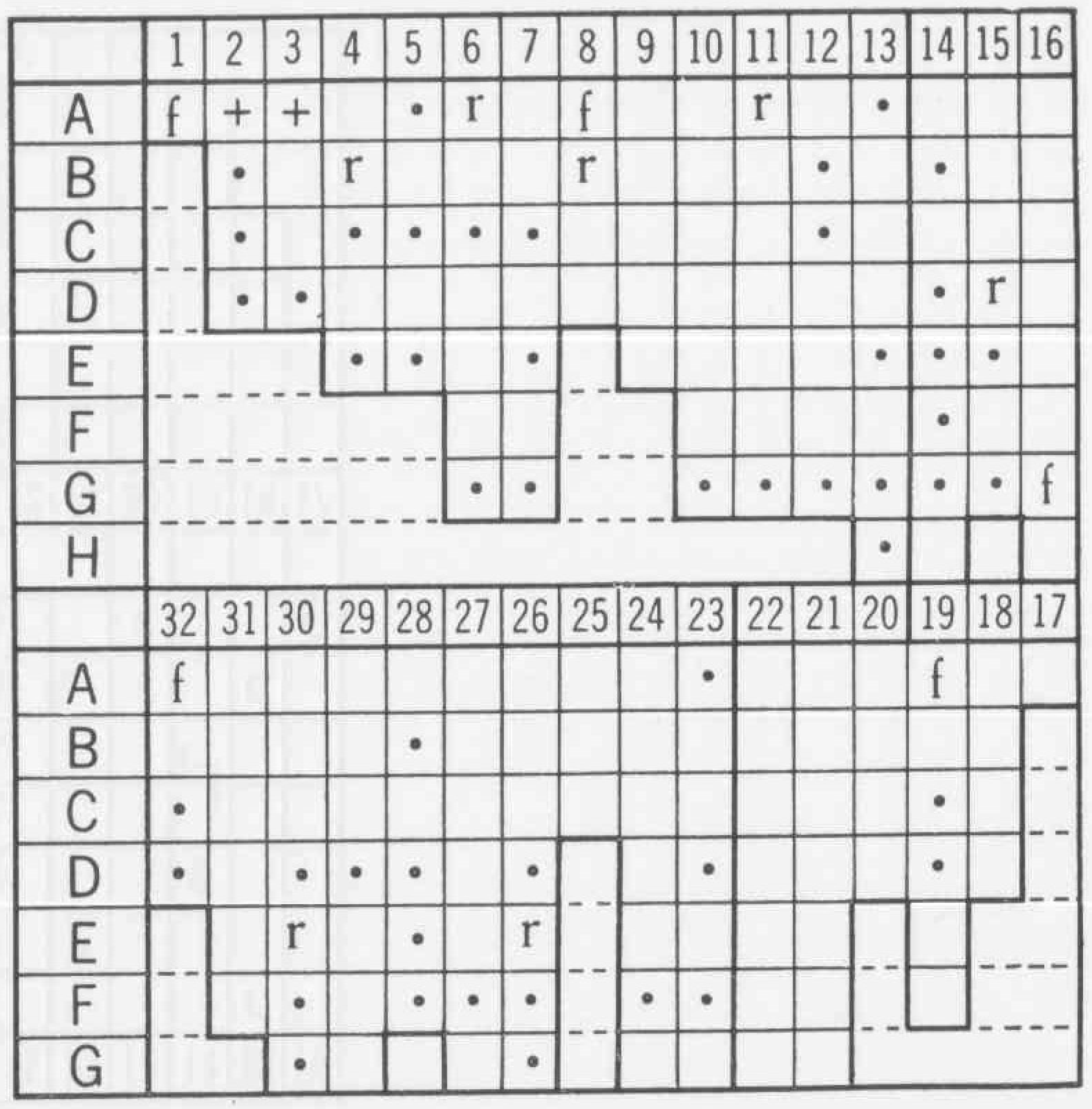
PLATE VII

(B)

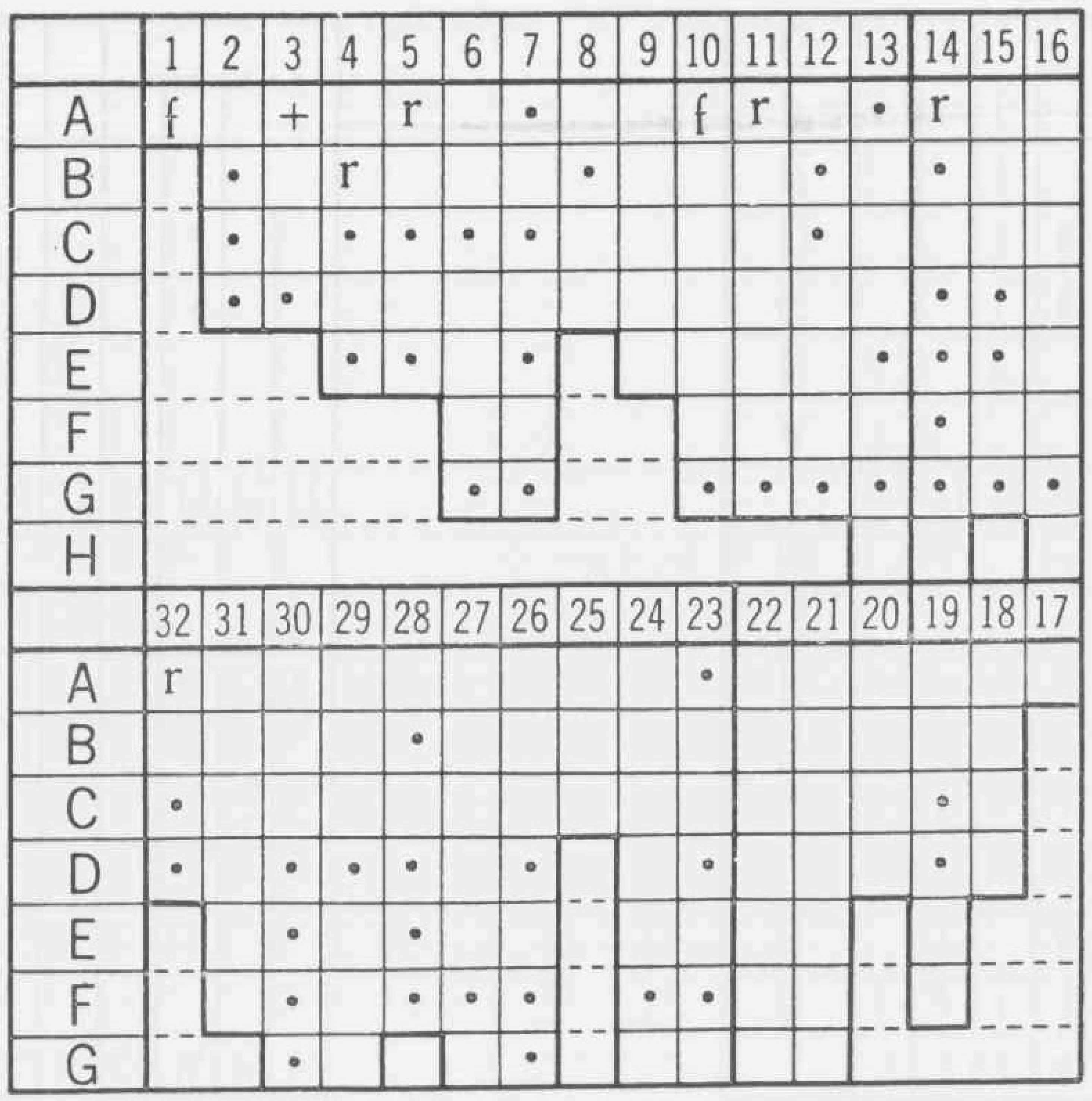
Euaetidius giesbrechti



Eucalanus attenuatus



Eucalanus crassus



ADDENDUM.

Eucalanus crassus:
Insert . in square H 13.

Trigsurvey 1964.

PLATE VII

(A)

Eucalanus elongatus

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	•		•		•		•			r	•		•			
B		•		•				•				•		•		
C		•		•	•	•	•					•				
D		•	•											•	•	
E				•	•		•						•	•	•	
F														r		r
G						•	•			•	•	•	•	•	•	f
H													•			
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A										•						
B					•											
C	•													•		
D	•		•	•	•		•			•				•		
E			r		•				r							
F			•		•	•	•		•	•						
G			r				•		r							

Euchaeta (all spp.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	f	f	1	f	2	2	1	+		r	f	r				
B		r		f		r		+								r
C				?	?	?		?	?				?	?	?	
D		r					r				r				f	
E				r		r	r				r		r	r	r	
F																
G						r	r					r				r
H													r			
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	f				r					f						r
B	f		r				r									
C			f	f	f	f	f	f	r	r	f					
D			f	f	f		+		f	f	+					
E			f		f		f		f		r					
F			f		r		r		r					r		
G									r		r					

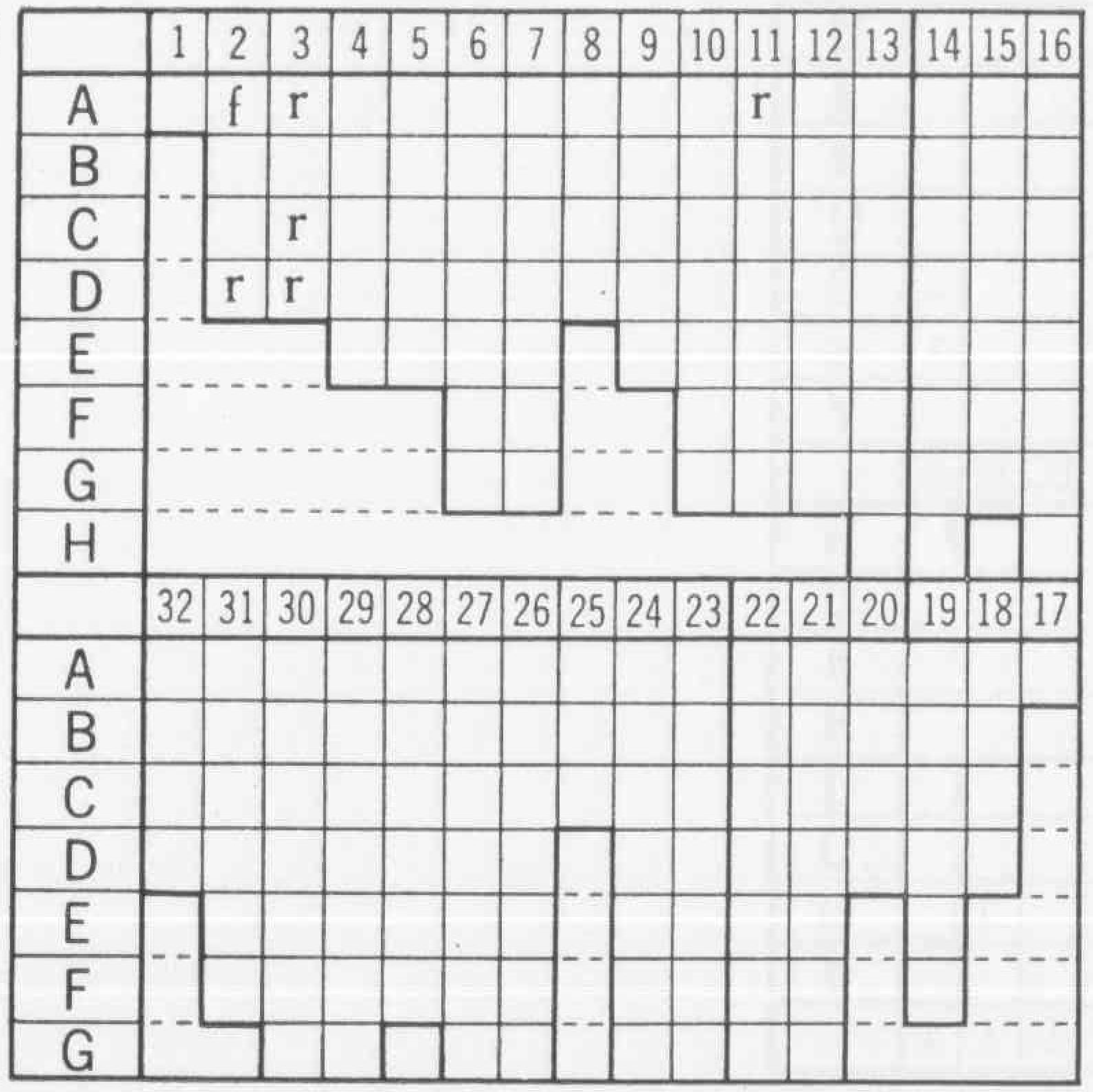
Euchirella (all spp.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A						r		r							r	
B												r				
C						r			r					r		
D																
E				r	f		f							r↑		
F															r	
G													r			r
H																
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A		r														
B																
C					r		r	r								
D			f	f			r									
E					f											
F					r											
G			r								r					

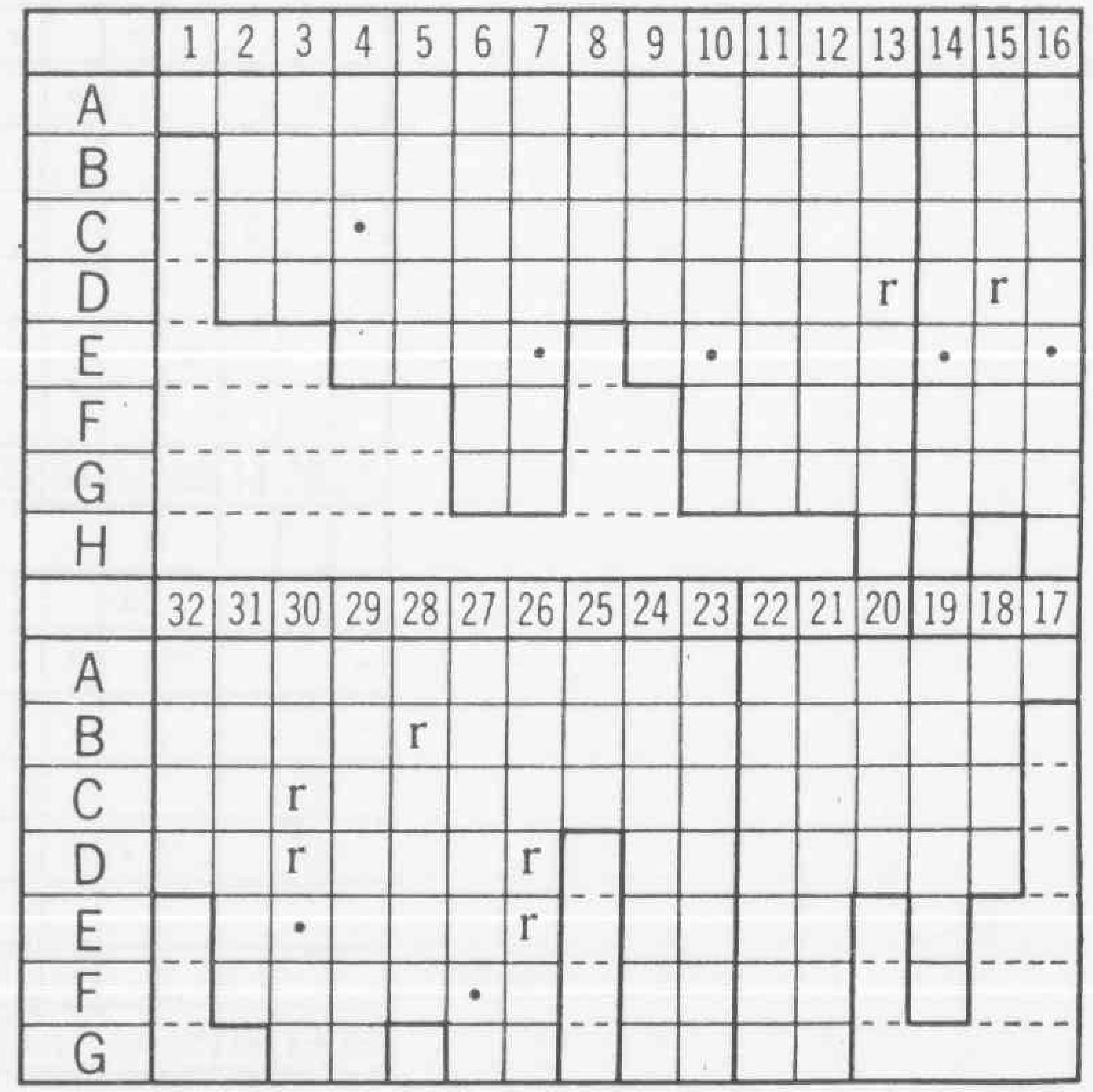
PLATE VIII

(B)

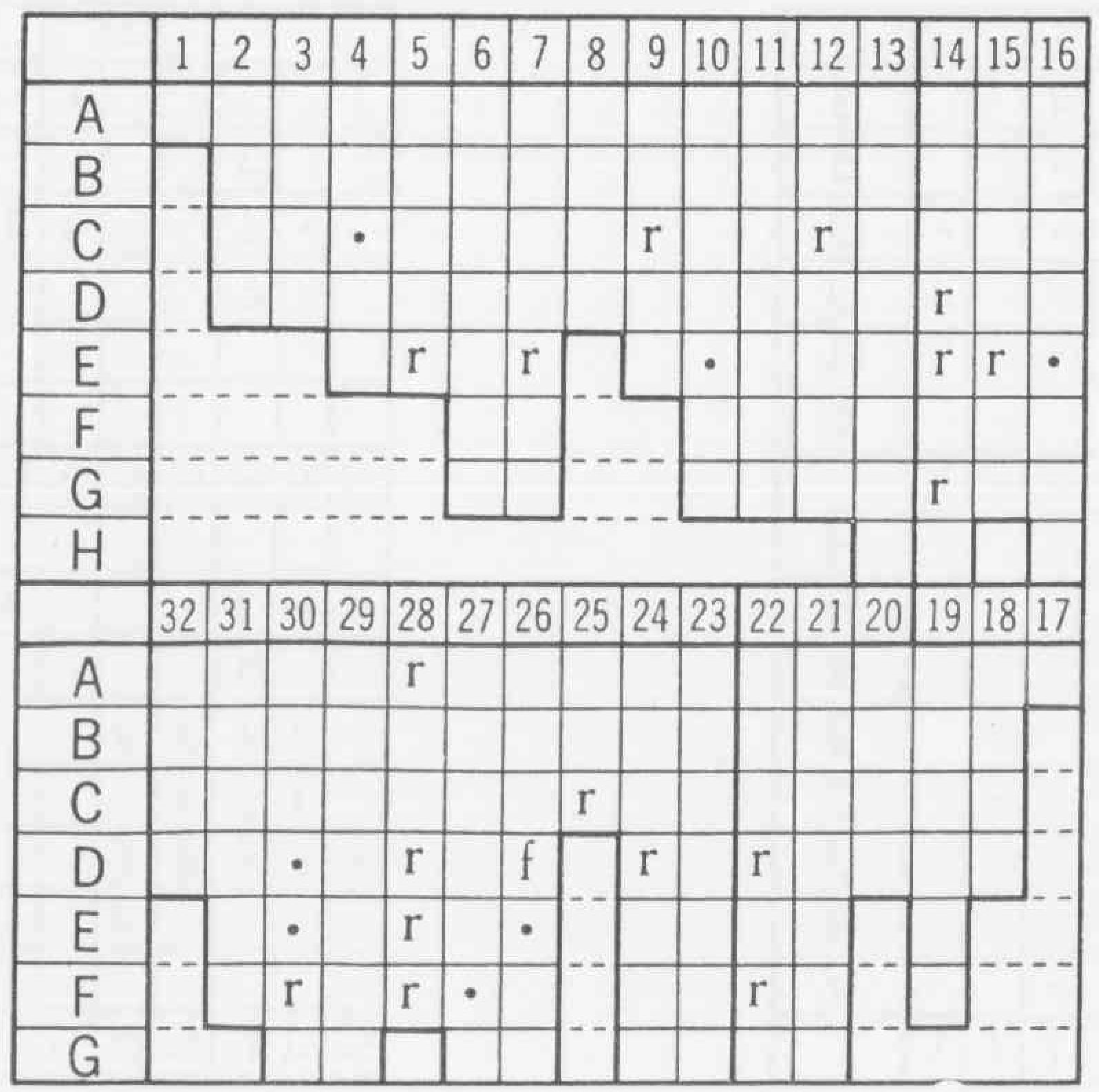
Euterpina acutifrons



Gaetanus miles



Gaetanus minor



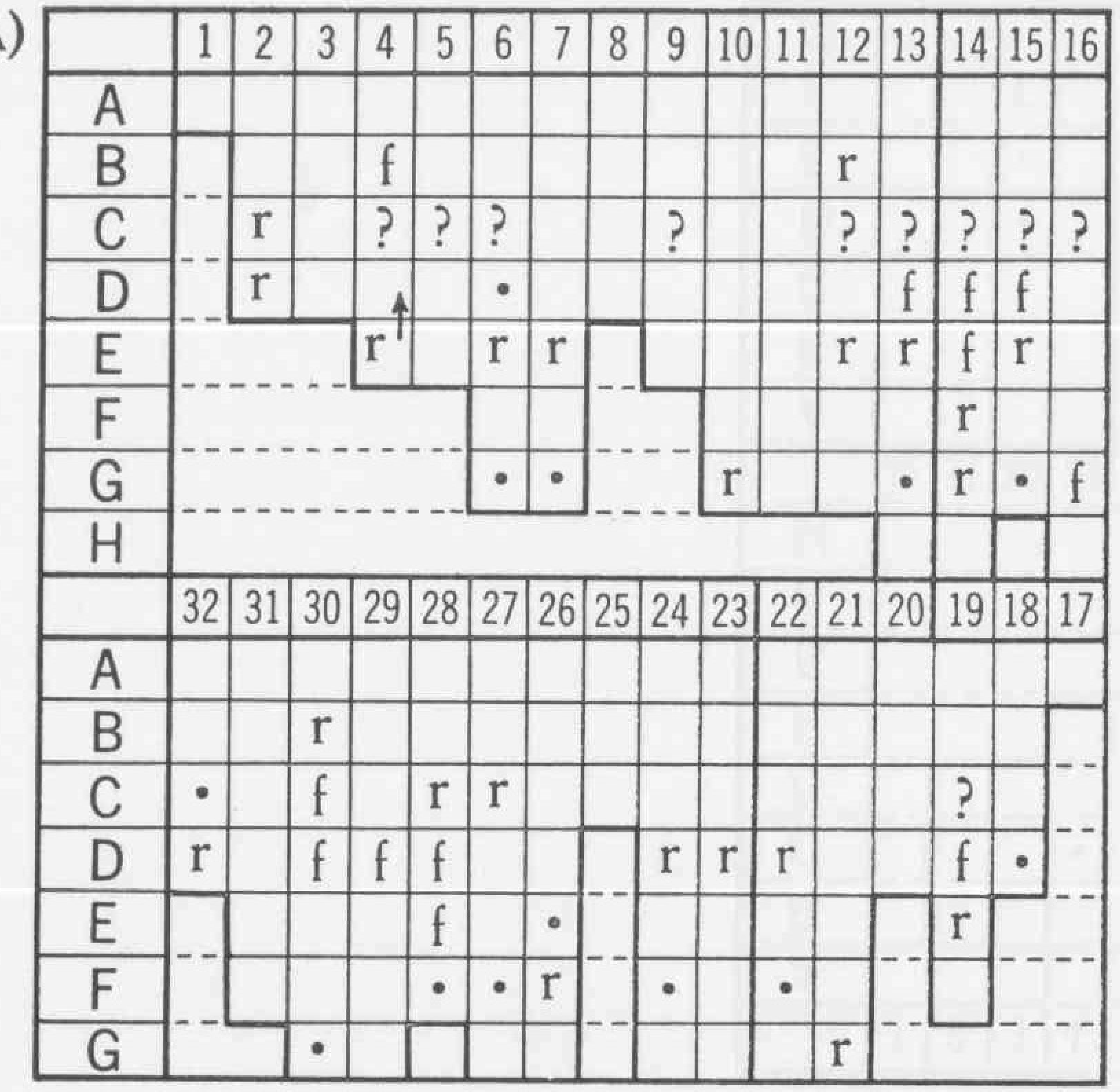
ADDENDUM.

Gaetanus minor:
Insert r in square A 21.

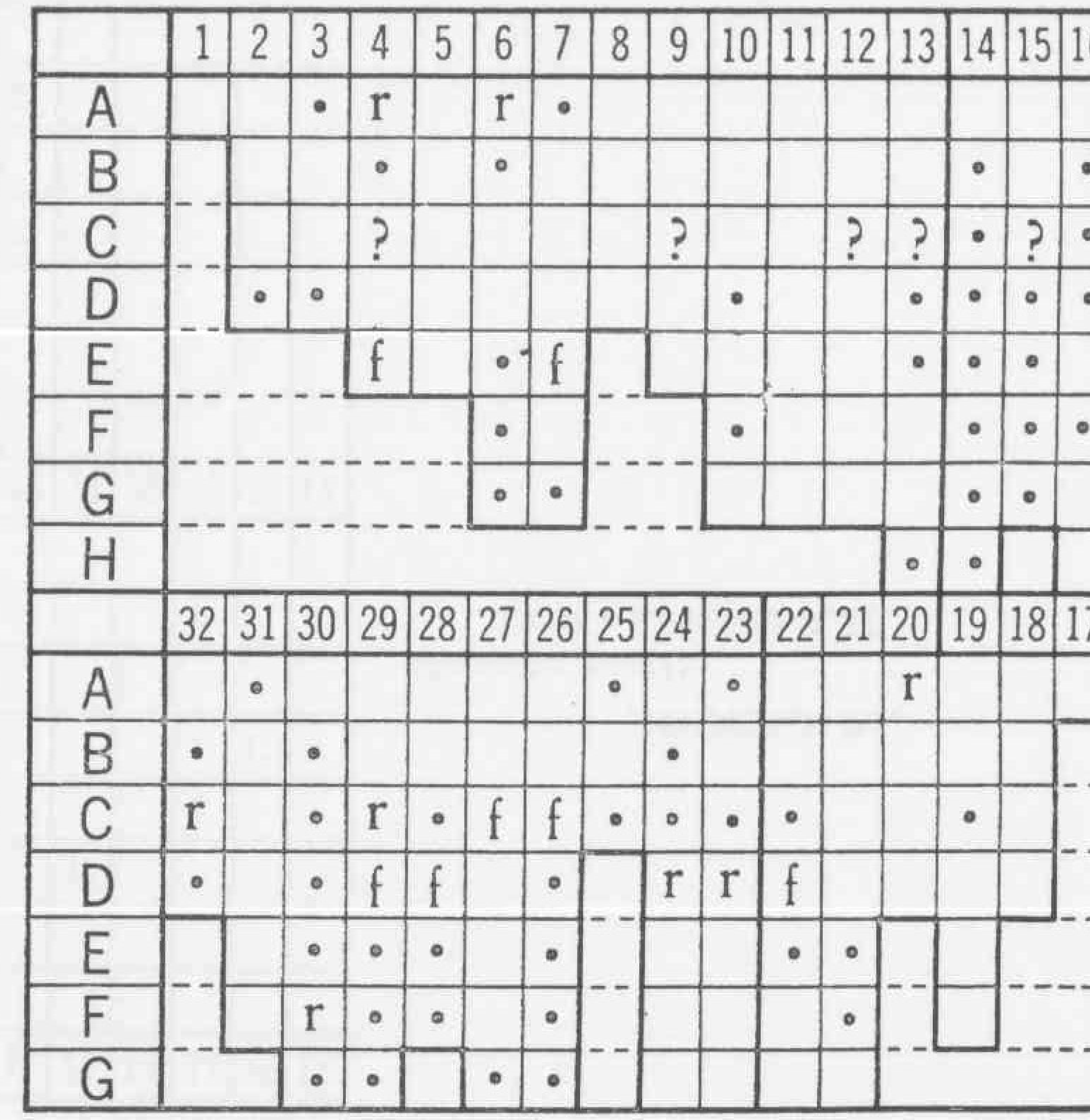
PLATE VIII

Trigsurvey 1964

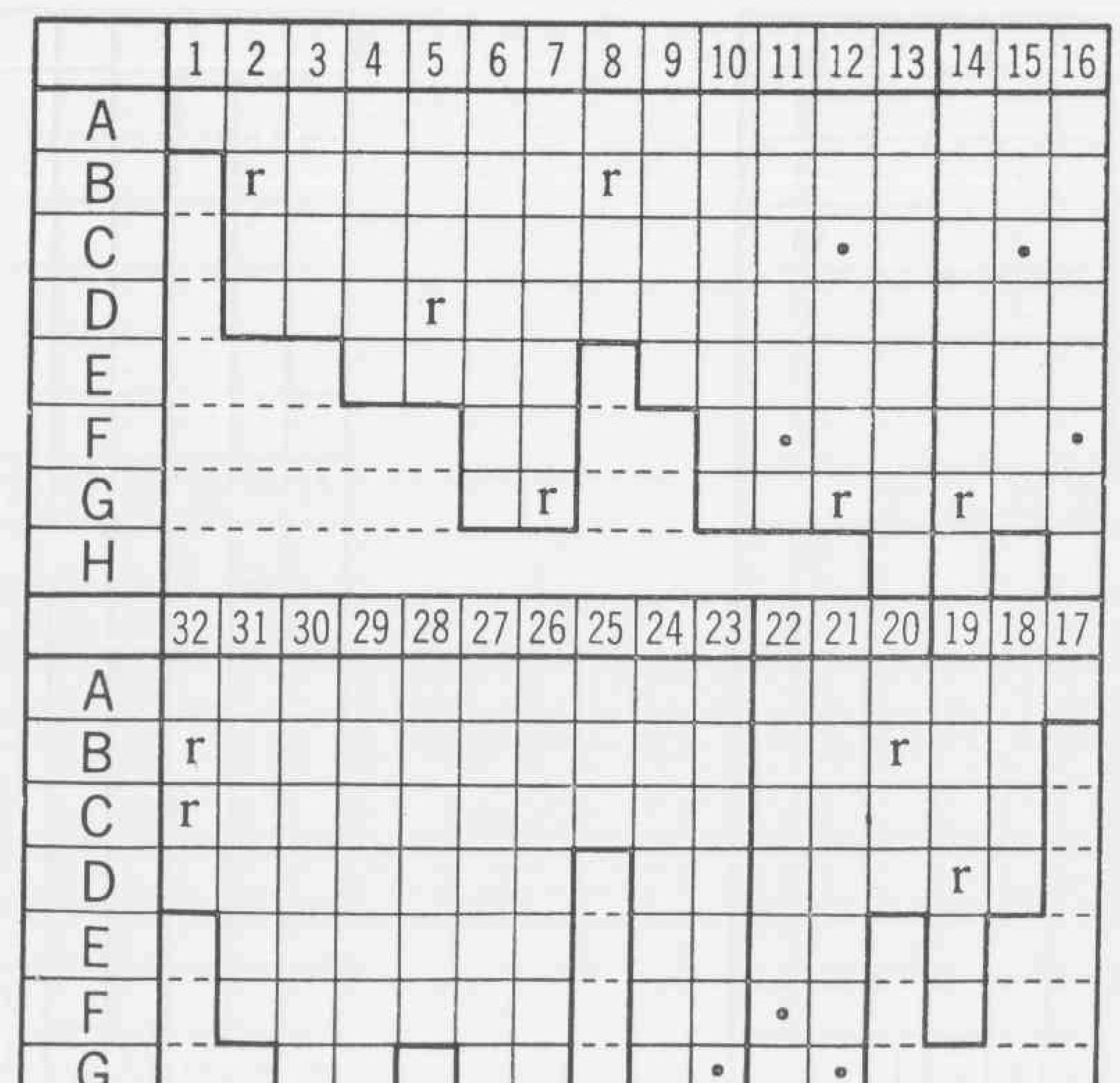
(A)



Haloptilus longicornis



Heterorhabdus spinifrons



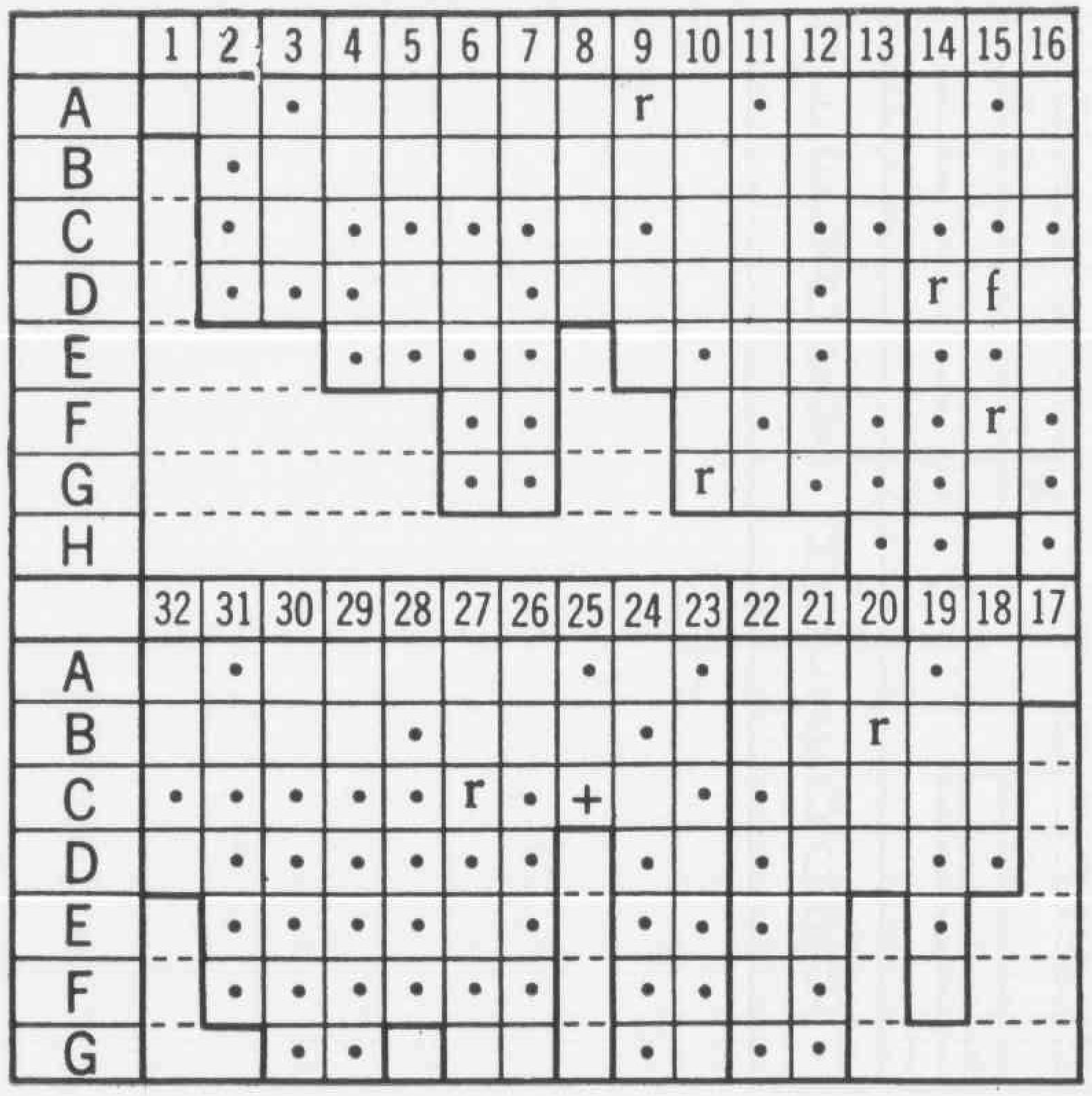
Lubbockia squillimana

PLATE IX

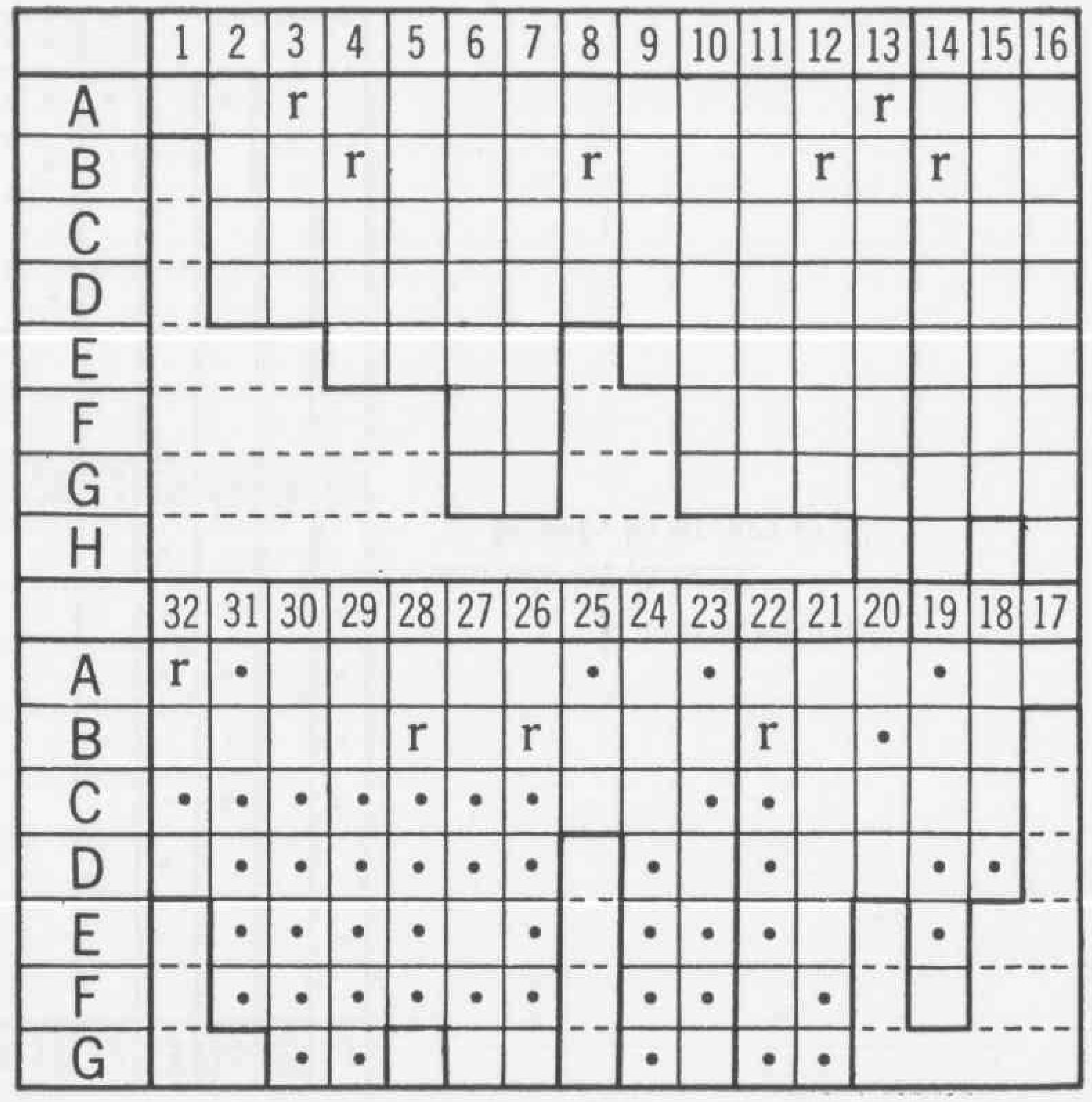
Trigsurvey 1964

(B)

Lucicutia clausi



Lucicutia curta



Lucicutia flavicornis

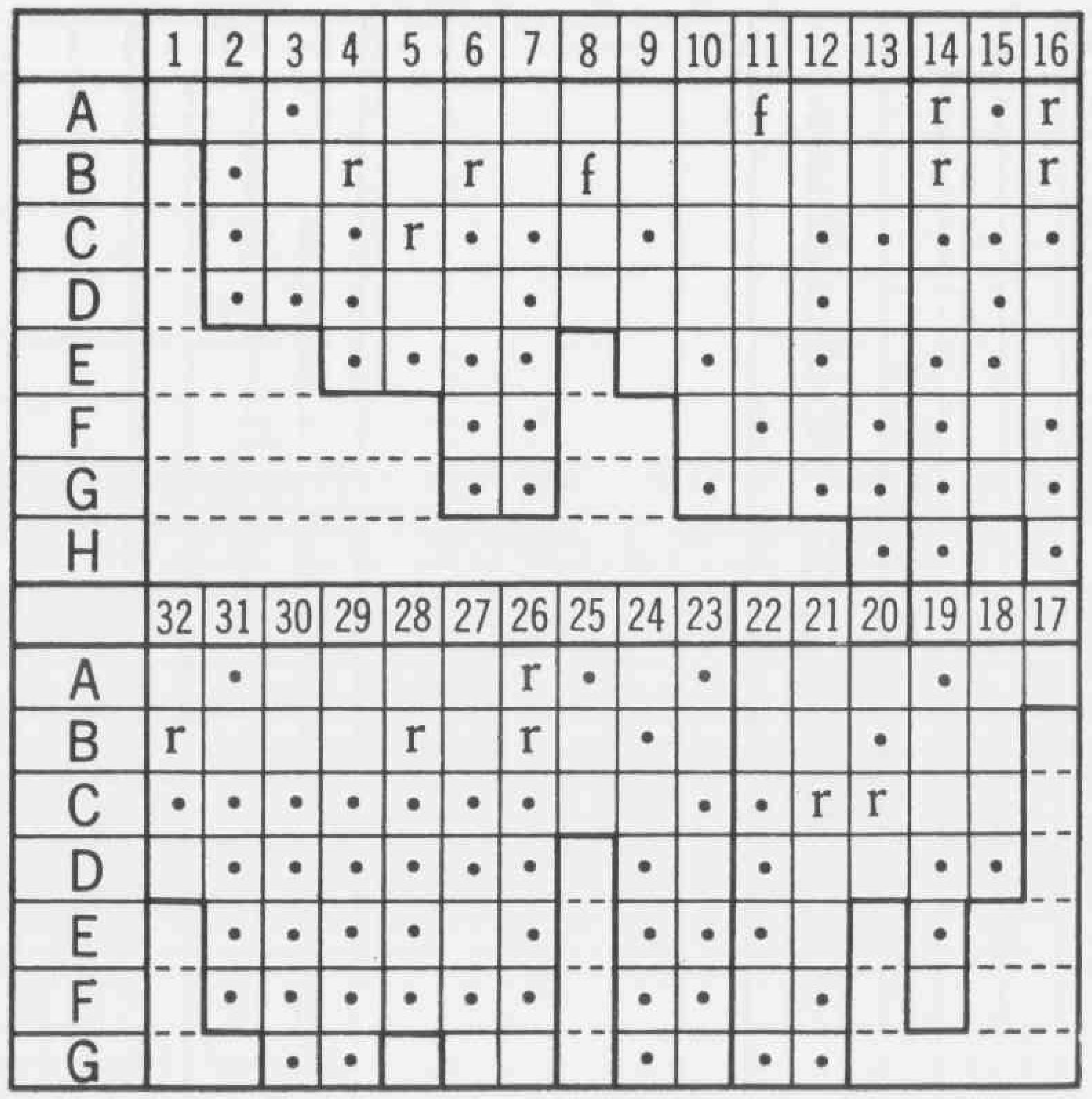


PLATE IX

ADDENDA.

Lucicutia curta:

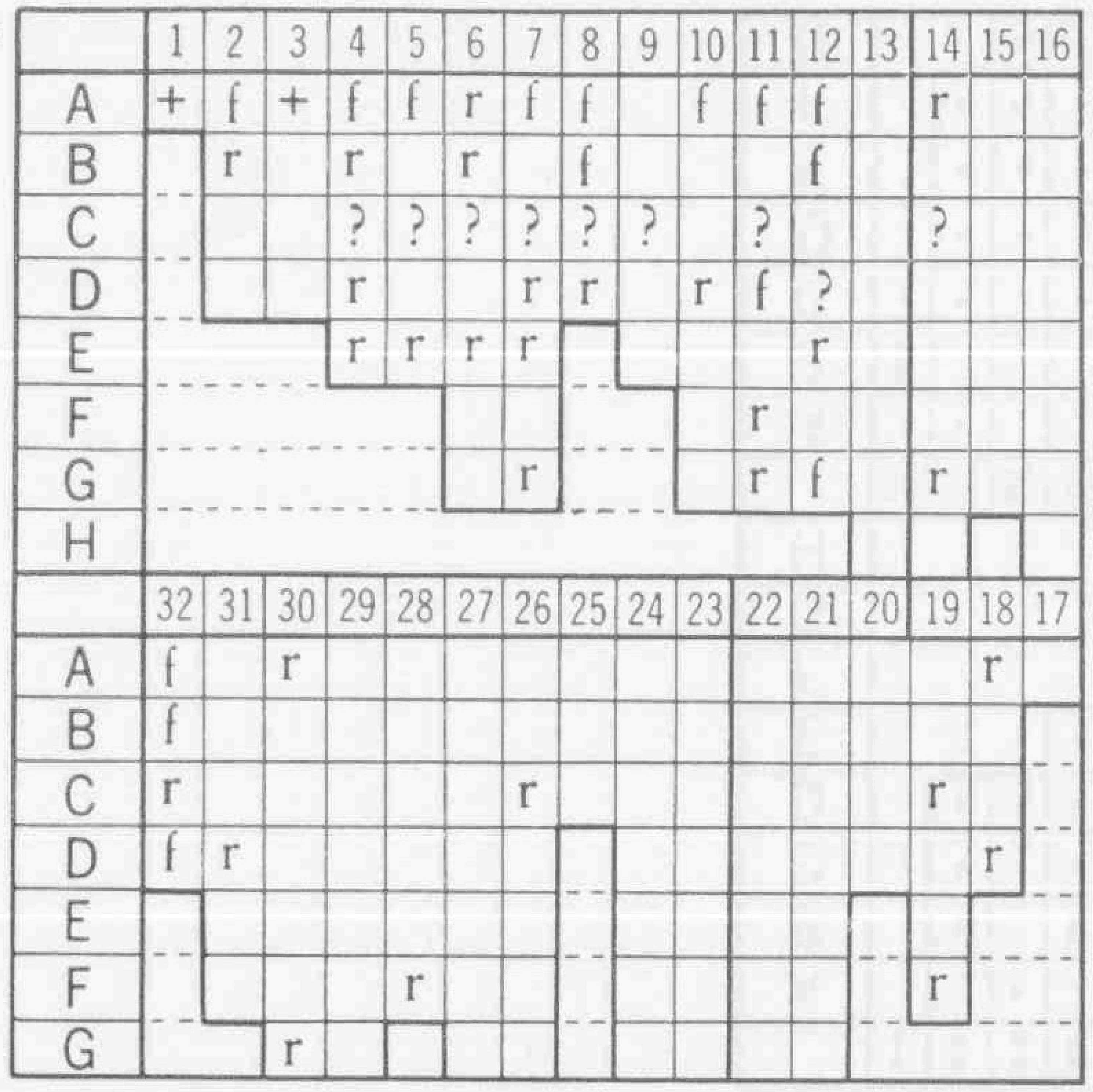
Insert . in same squares as in *L. clausi*, except where another symbol is already present in *L. curta*.

Insert . also in squares D 15, G 10.

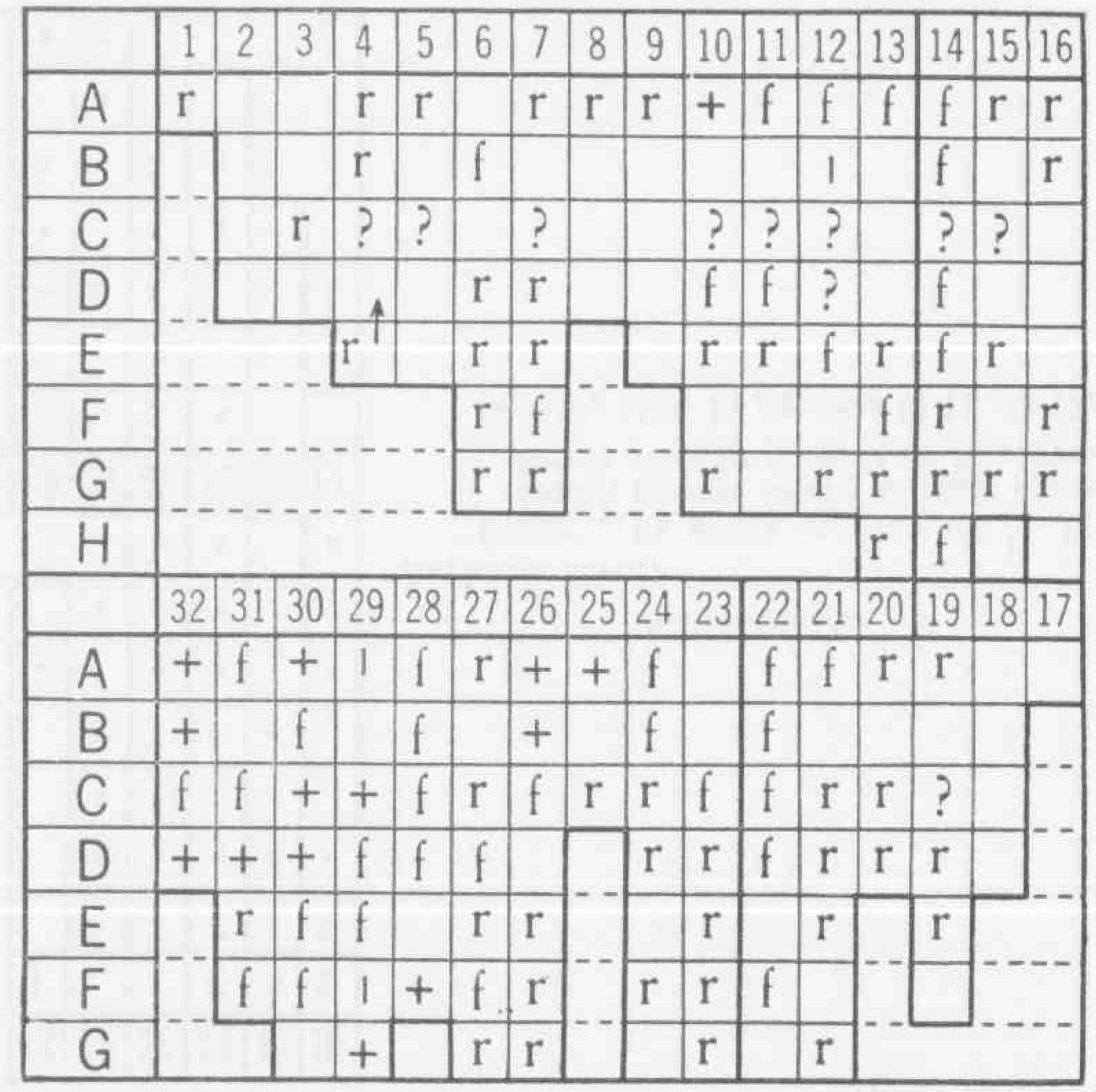
Trigsurvey 1964.

Macrosetella gracilis

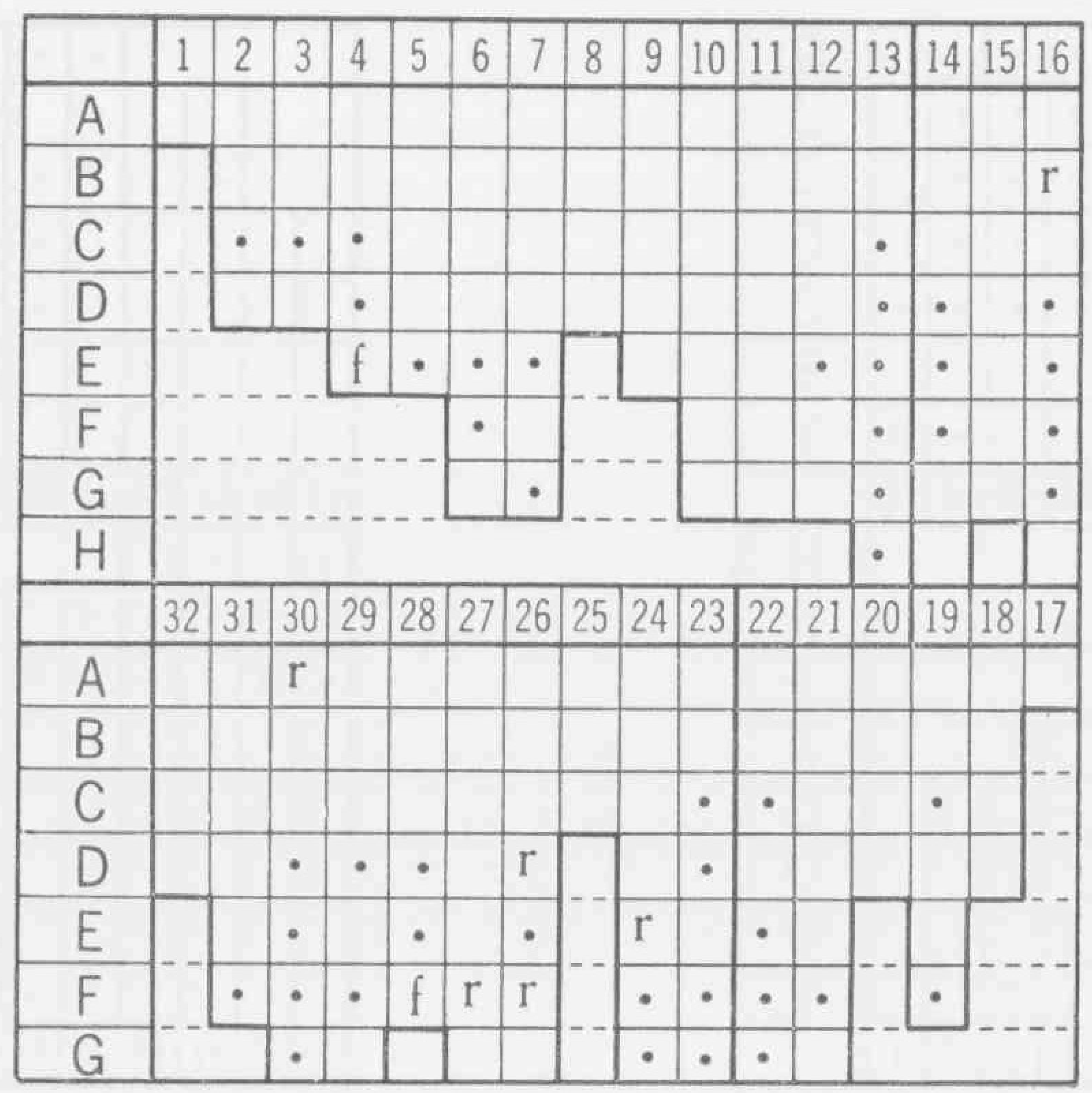
(A)



Mecynocera clausi



Metridia brevicauda



ADDENDUM.

Metridia brevicauda:

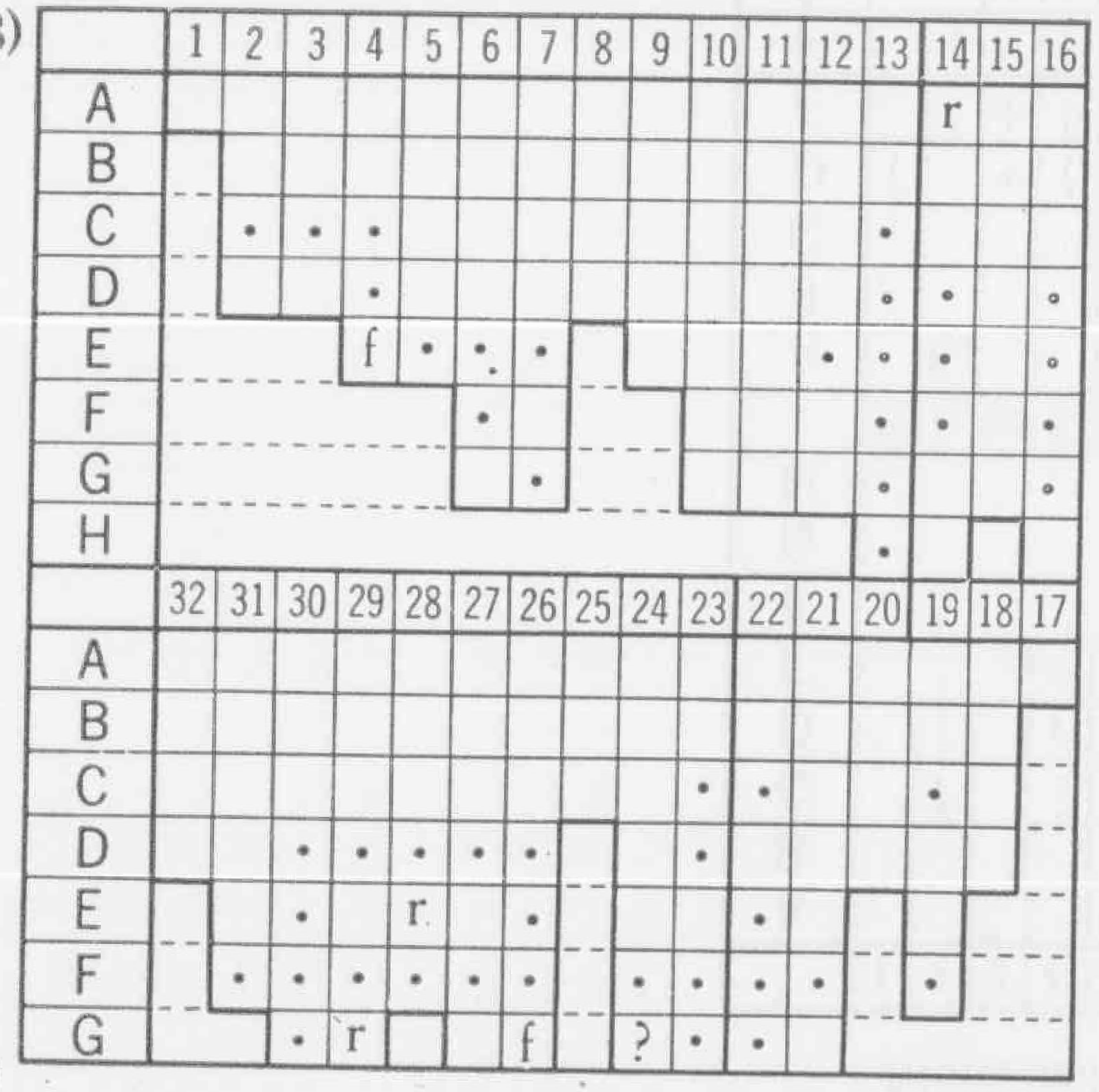
Insert . in square D 27.

Trigsurvey 1964

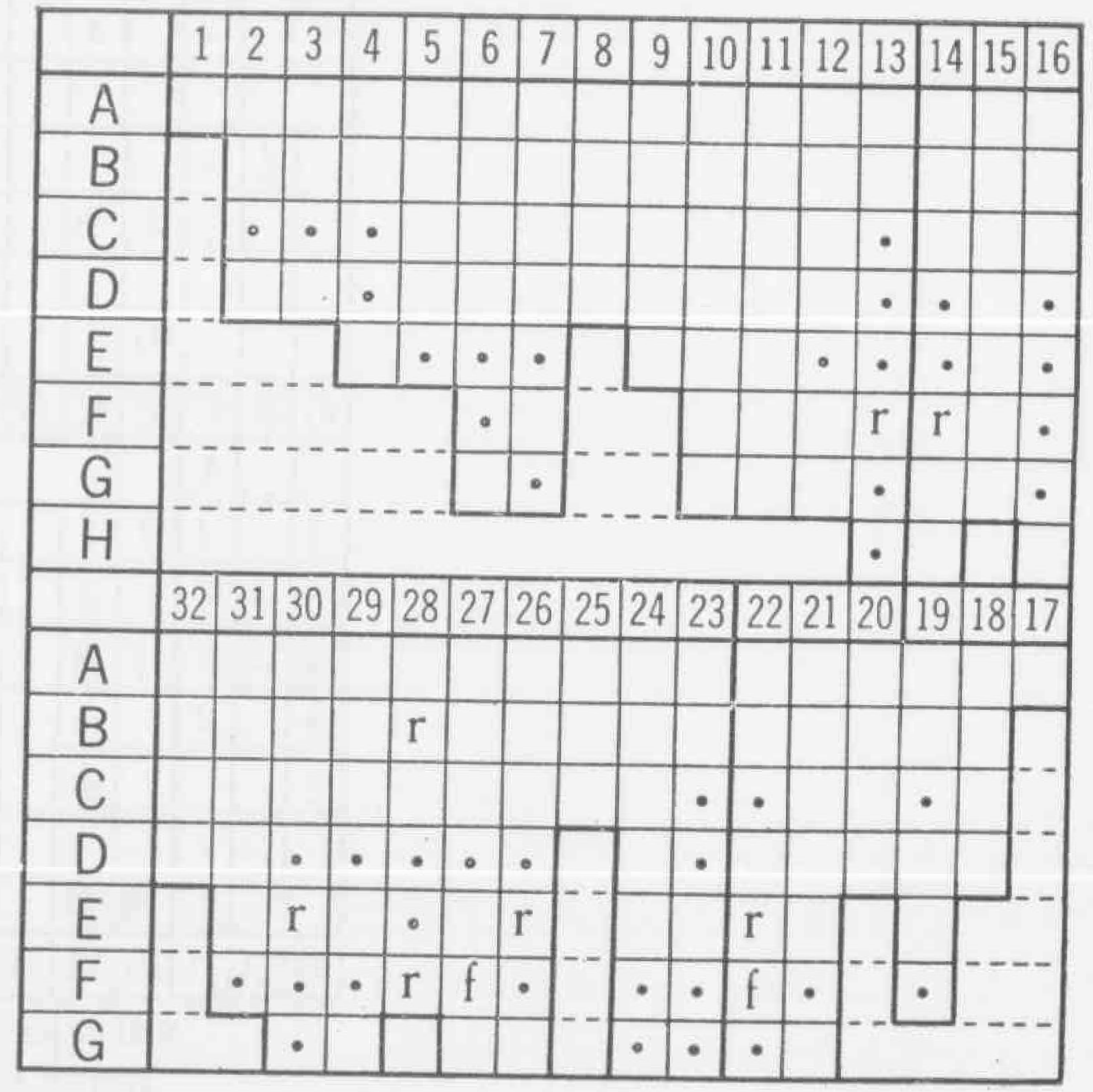
PLATE X

(B)

Metridia lucens



Metridia venusta



Monacilla typica

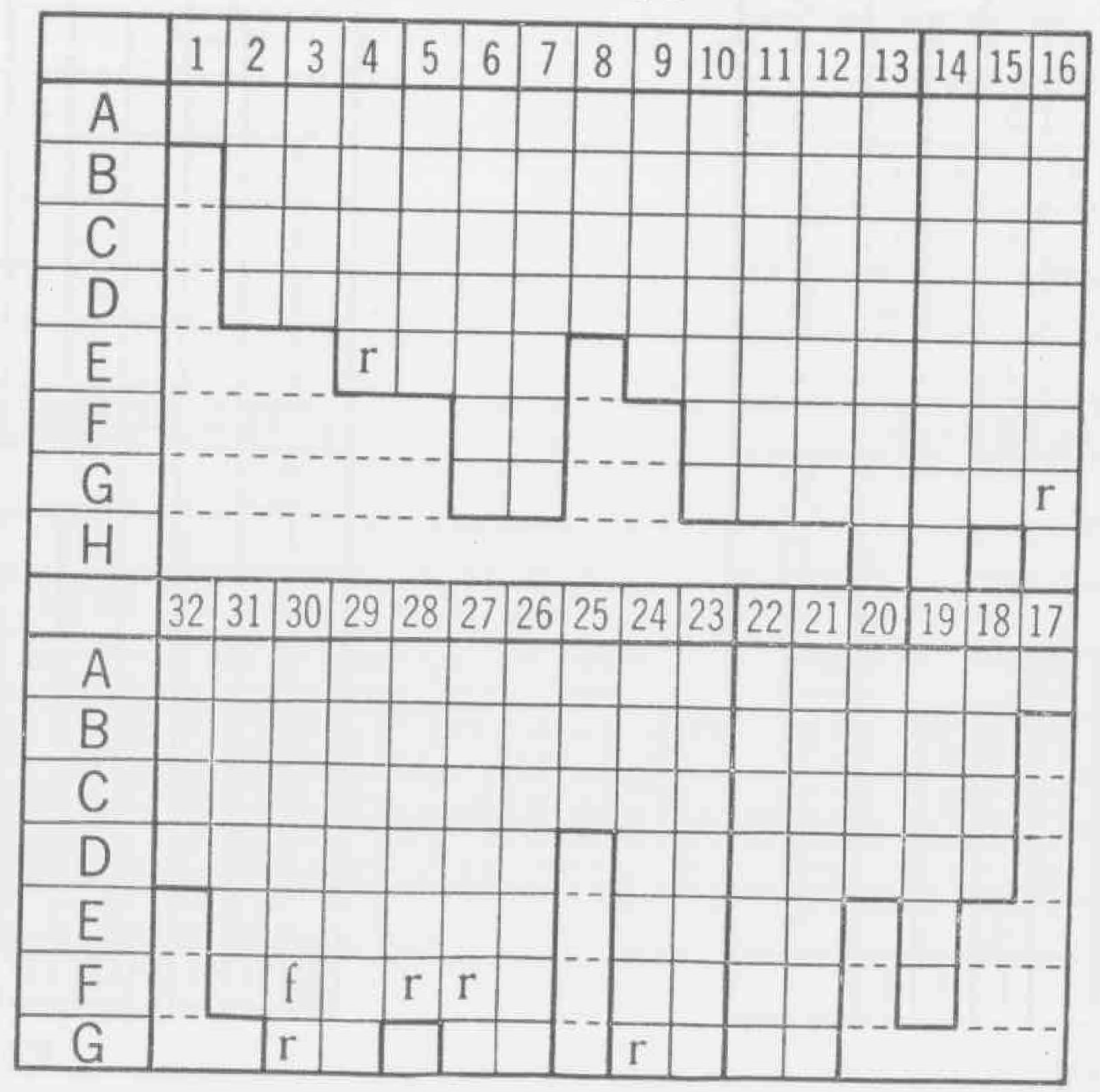


PLATE X

Trigsurvey 1964

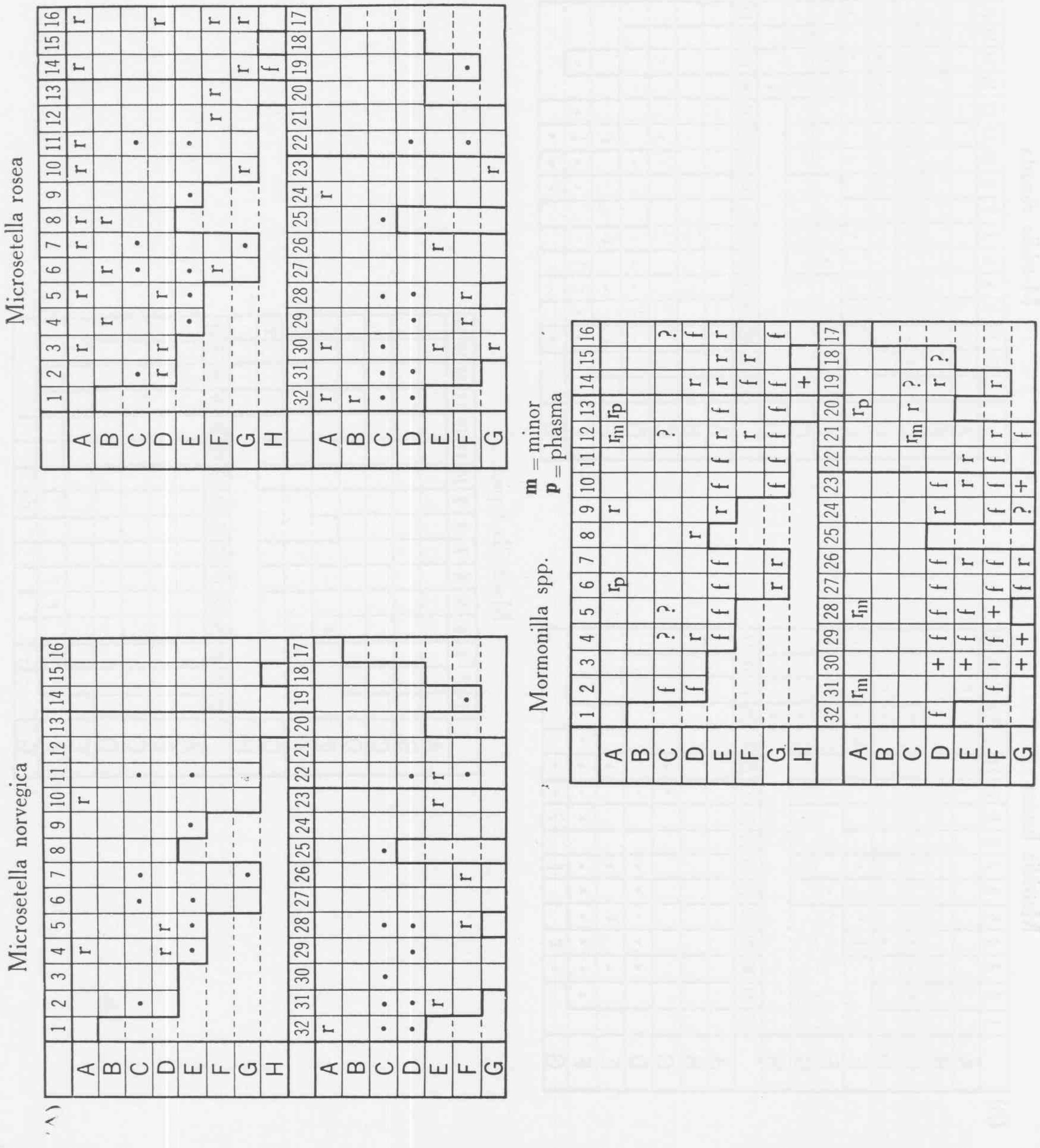


PLATE XI

Trigsurvey 1964.

(B)

Nannocalanus minor

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	+	+	2	r	f	r	f	f		r	+	f		r		
B				f		r		+				f		f		
C						?						?	?	?	?	
D							r	r					r	r ↑	f	
E				r ↑										f	r	
F							r								r	
G												f	?			
H													r	r		
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	+	f	f	f	r	r	r	r		r		f	r	f		f
B	+		r		f		f		r		f		r			
C			+	r	r	r	r		r		f			?		
D				f	r		+		f		r		r		r	
E											r					
F					r											
G																

Neocalanus gracilis

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	r	r		r			r	r		r	r					
B				f												
C				?	?	?						?	?	?		
D													r		r	
E							r							r	r	
F													r		r	
G												r	r	r		
H																
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	r		r													
B											f					
C			f	r	f	r	f	f	f		f			?		
D			+	+	r				+		2					
E			r		f				r		r					
F			r		f	r										
G						r					f					

Oithona (all spp.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	2	1	4	1	2	1	1	+	f	1	2	2	f	+	f	f
B		f		2		1		1				1		+		+
C		f	f	?	?	?	?	?	?	?	?	?	?	?	?	?
D		f	f	f	+	f	1	+	f	+	+	?		f	r	+
E				+	f	+	+		r	f	f	+	f	1	+	+
F						1				f	+	+	f	f	+	+
G						+	+			+	f	+	f	1	f	f
H													+	1		f
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	1	1	2	+	1	1	1	1	+	+	+		f	+	r	+
B	1		2		1		1		1		1		f			
C	+	1	+	+	1	+	+	1	+	1	+	f	r	?		
D	3	3	3	3	2	3	3		3	+	4	f	f	f	f	
E		1	1	1	1	1	1		+	+	+	f		+		
F		1	2	3	2	1	2		1	2	2	+				
G			1	1		+	+		?	1	1	+				

PLATE XI

Trigsurvey 1964.

(A)

Oncaea (all spp.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	2	2	4	1	2	2	1	+	f	f	2	+		f	f	r
B		+		2		1		+				1		f		f
C		f	f	?	?	?	?	?	?	?	?	?		?	?	?
D		f	f	f	f	f	+	+	f	+	f	?	r	f	r	f
E				+	f	+	+		r	f	f		f	+	f	+
F						1	+			f	f	+	f	+	f	f
G						+	+			+	f	+	r	+	+	f
H													+	1		f

	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	1	f	f		f	r	r	r	r	r		r	f	+		f
B	+		f				f		r		f		r			
C	+	1	1	r	1	+	+	1	f	r	f	r	r	?		
D	+	1	1	+	+	f	+			f	+	f	f	+	r	
E		+	+	+	+	f	1		+	f	f	r		+		
F		1	1	2	1	+	1		+	+	+	f		f		
G			1	+		+	+		?	1	1	+				

Paracalanus (all spp.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	2	1	1	f	1	f	+	f	f	f	+	1	r	f	r	r
B		r		+		+		+				f				r
C		r	r	?	?	?	?		?	?	?	?		?		
D			r	r		r			r	f	f	?				r
E				r	f	f	r		r	f	f	f	r	r	r	f
F										r	f	f		r	r	r
G						f	f			f	f	f	r	f	f	f
H													f	+		

	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	1	f	f	r	r	f	f	+	r		f	f	r	f	r	f
B	+		f		f		f				r					
C	f	+	r	f	f		r				r					
D	f	f		r		f	r			r			r	f		
E		f	r			f	r		f		f			r		
F		f	f	f	f	r	f		f	f	f	f		f		
G						r	r			r						

Phyllopus (all spp.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A																
B																
C																
D																
E					r		r							r	r	
F														r		
G										r			r	r		
H													r			

	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A																
B					r											
C																
D			f	f	r		f		r		r					
E			f		f		r			r	r					
F			r		f		r			r						
G											r					

ADDENDA and CORRIGENDA.

Oncaea (all spp.):
Delete f in A 28.

Paracalanus (all spp.):
Delete ? in C 5.

Phyllopus (all spp.):
Insert r in E 24.

PLATE XII

(B)

Pleuromamma xiphias

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A			•				•									
B												•		•		
C		•		•	•	•	•		•			•	•	•	•	•
D		•	•	•			•						•	•	•	•
E				f	•		f			•			f	•	•	•
F													•	•	•	•
G						•	•			•		•	•	•	•	r
H													•	•		
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A		•			r	•				•						
B			•		r		•		•		•					
C	•	•	•	•	•	•	•	f	•		•			•		
D		•	f	•	•	•	+		•	•	f	•		•		
E		•	•		•		•		•		•			•		
F			•		r		•			•	•					
G			•	•		•			•	•	•					

Rhincalanus cornutus

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	r	r	f													
B				f		?		r				r				
C		r		?		?			?			?				
D		r														
E				r↑			f									
F																
G																
H																
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	r															
B	f															
C					r			r			r					
D														r		
E																
F			r													
G																

Rhincalanus nasutus

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A																
B																
C														?		
D																
E					r		f						f	f		
F													r	f		
G														r		
H														r		
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A	r				r					r						
B	r															
C		r								r						
D			f													
E			f		f		f		r		f					
F			r		+		f			r	f					
G									?		r					

PLATE XII

ADDENDUM.

Rhincalanus cornutus:
Insert ? in C 5.

Trigsurvey 1964.

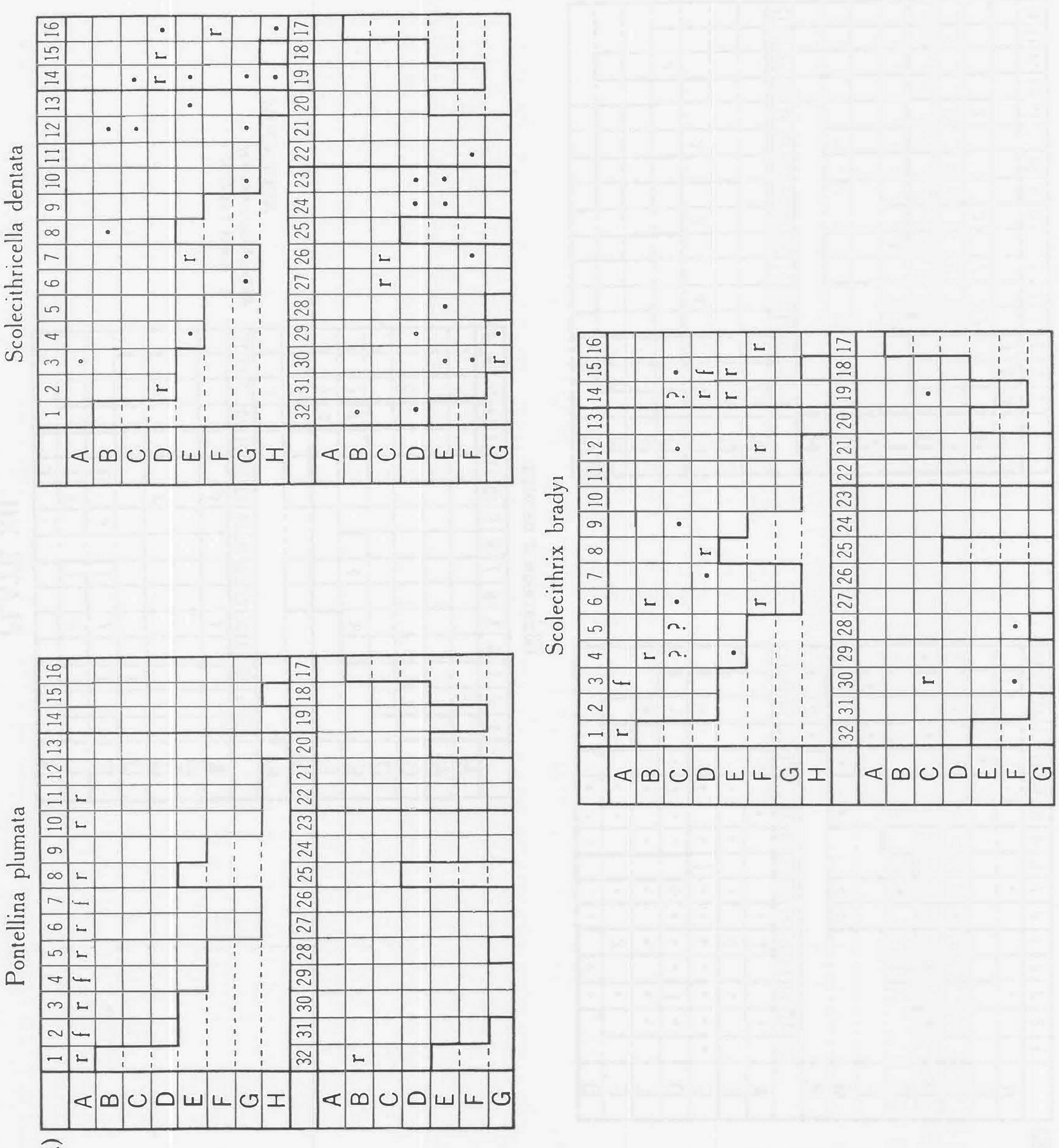
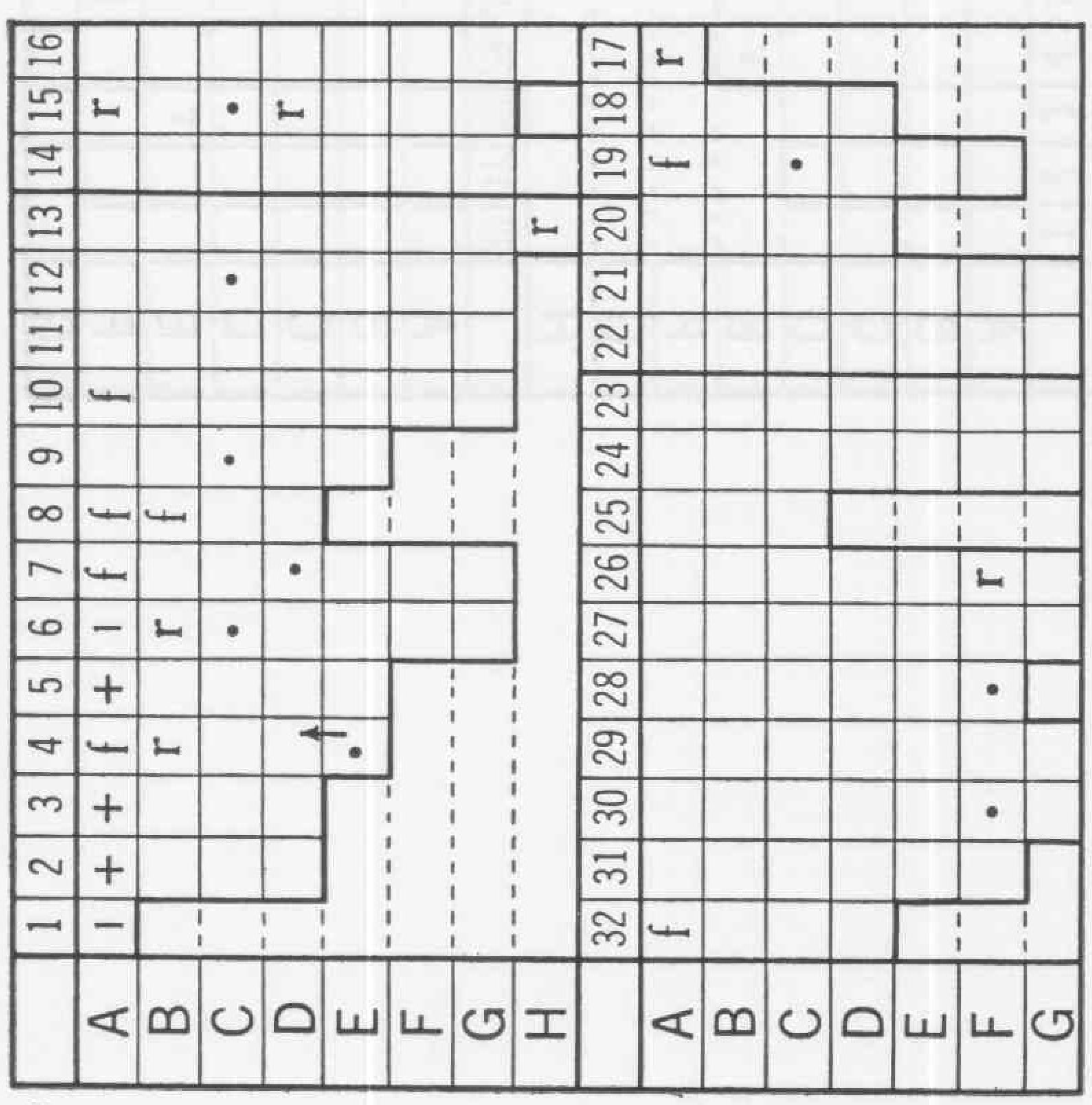


PLATE XIII

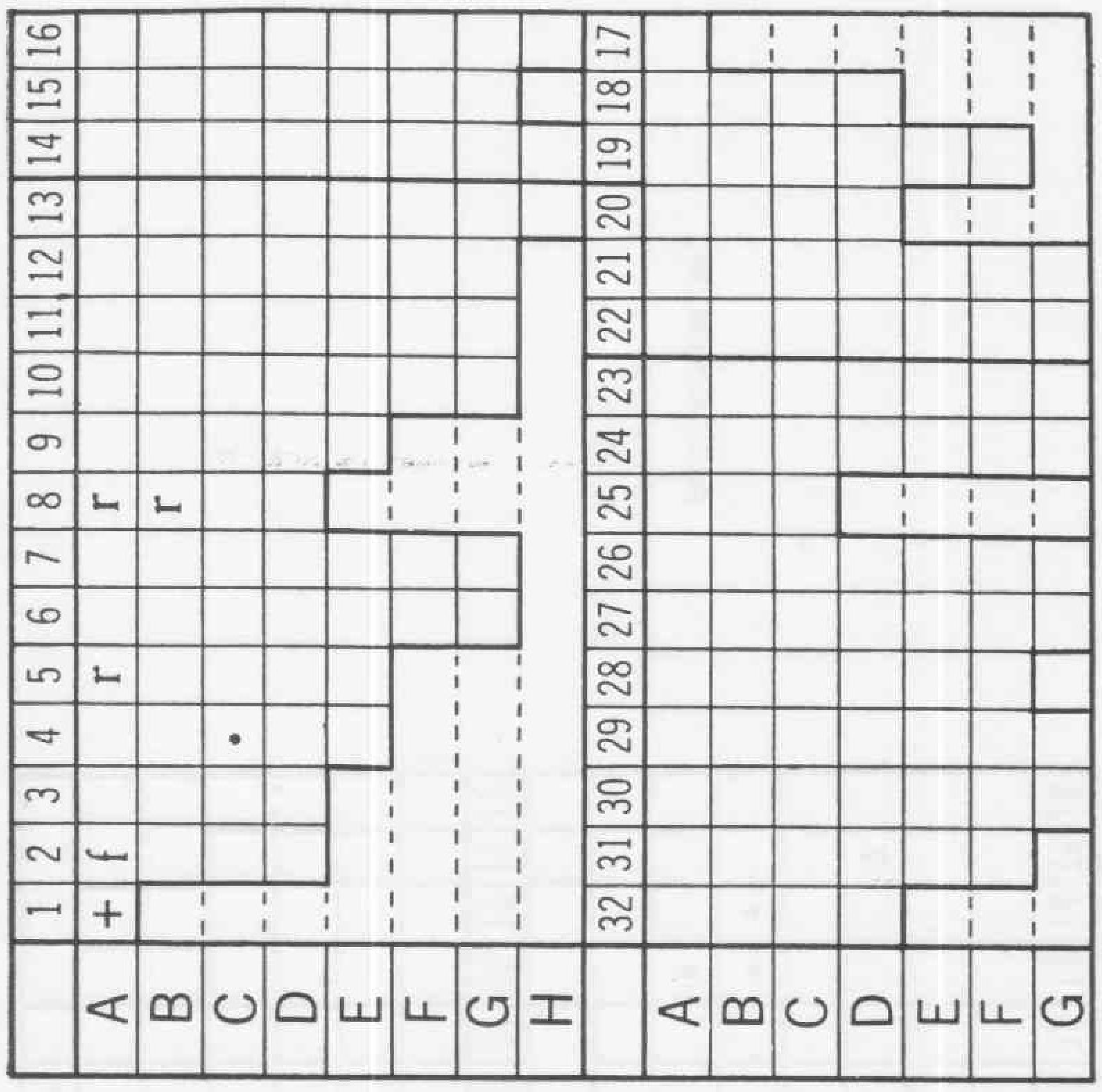
Trigsurvey 1964.

(B)

Scolecithrix danae



Temora discaudata



Temora stylifera

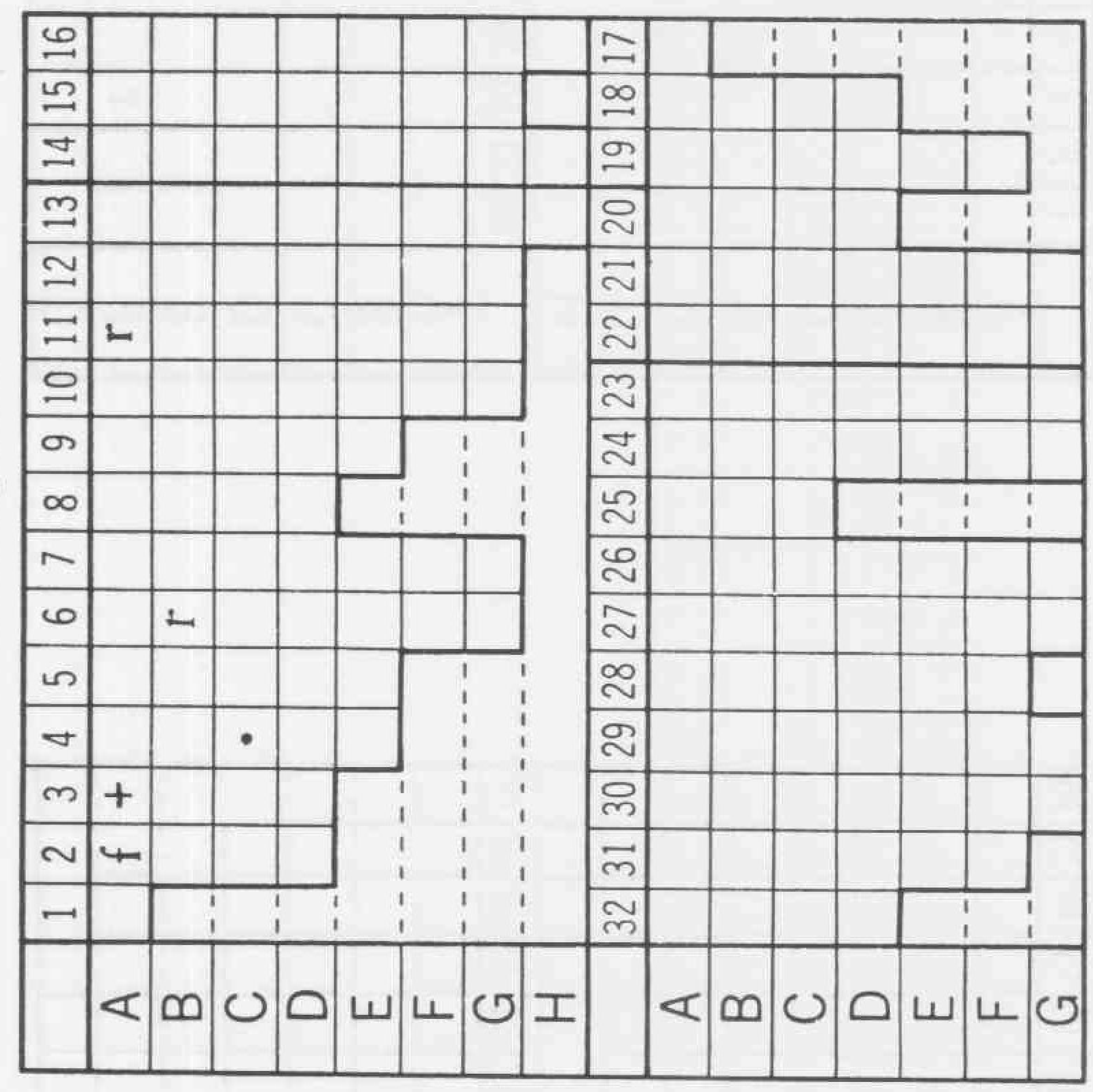
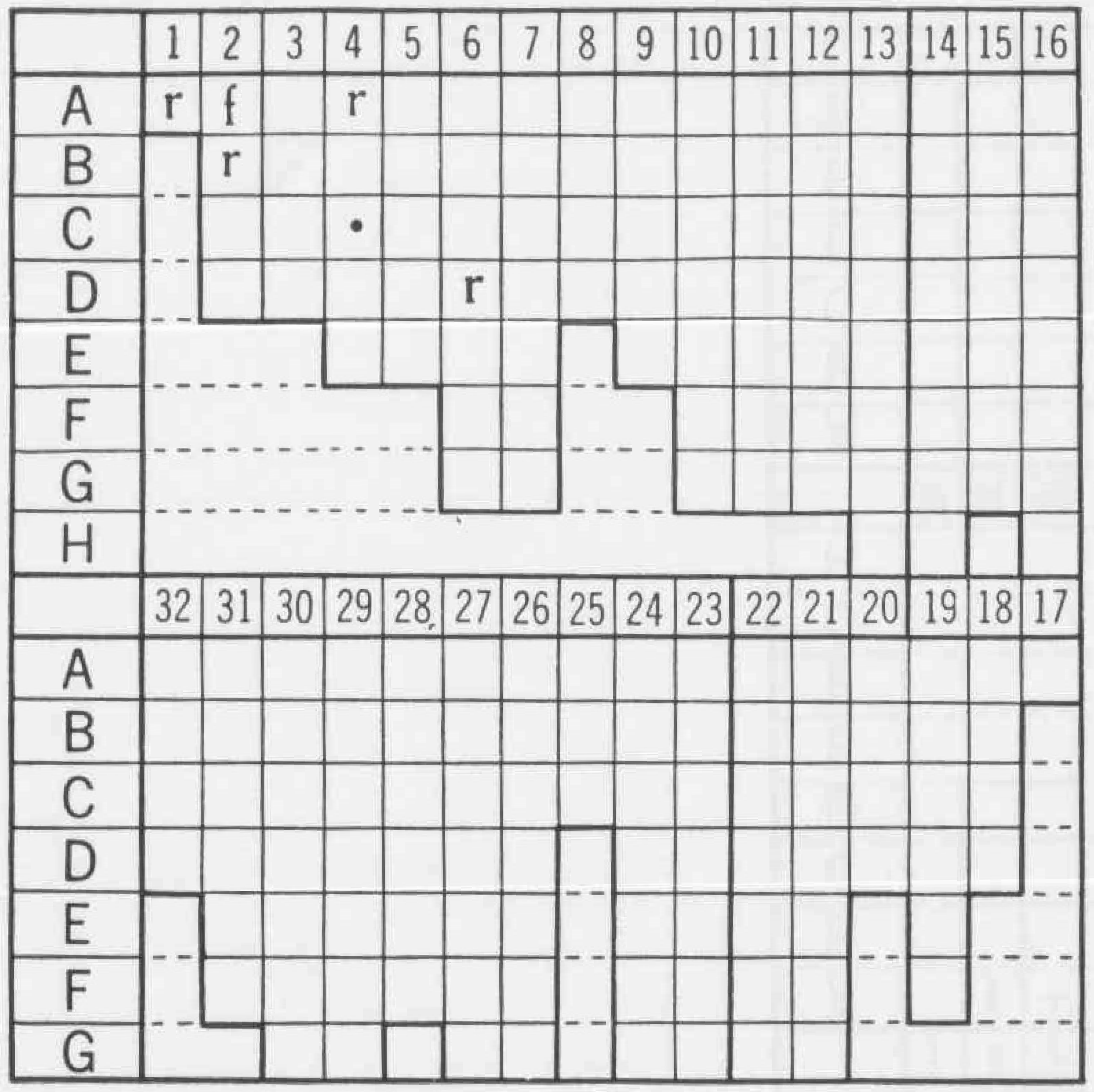


PLATE XIII

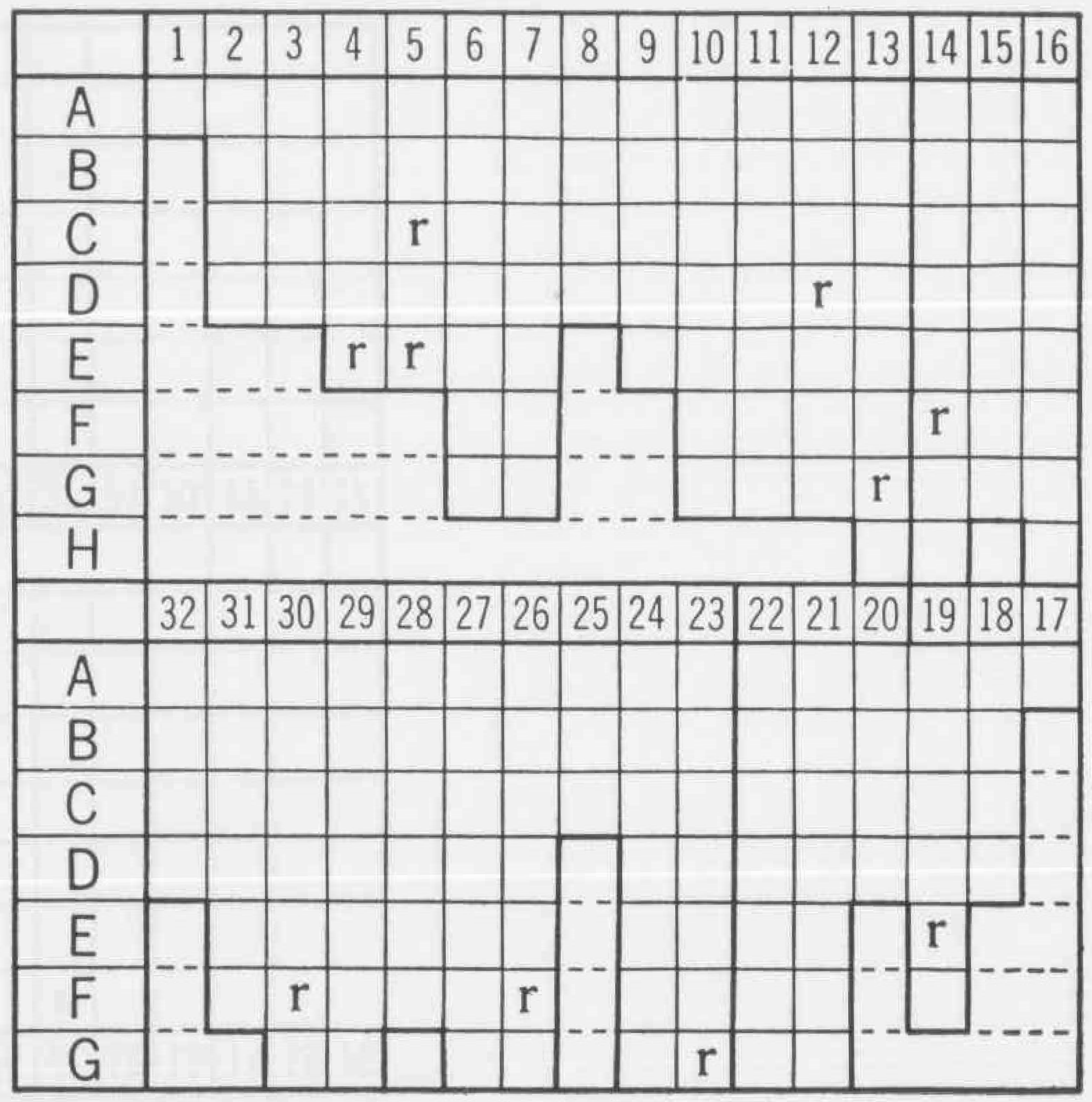
Trigsurvey 1964.

(A)

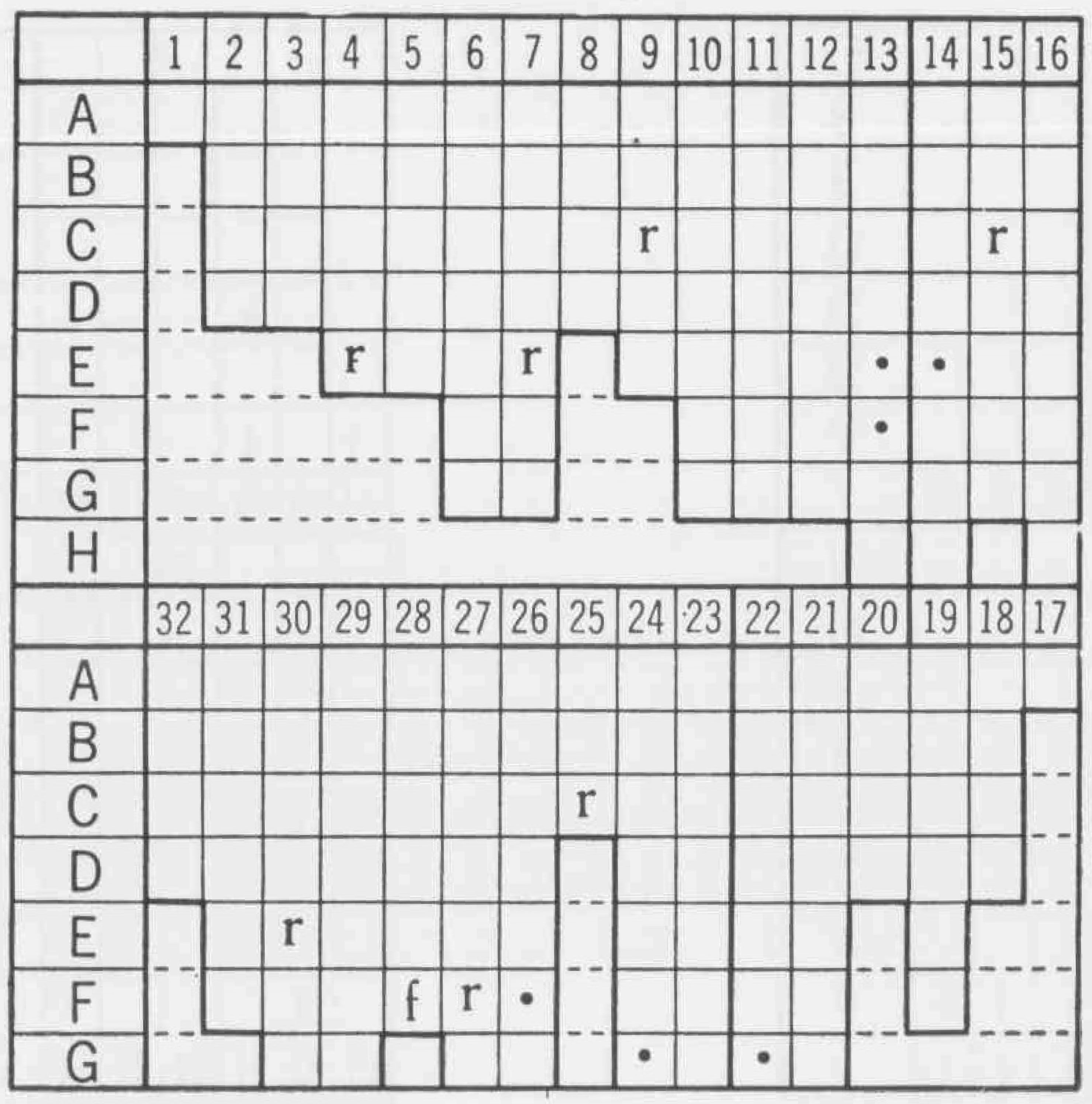
Temora turbinata



Temoropia mayumbaensis



Undeuchaeta plumosa

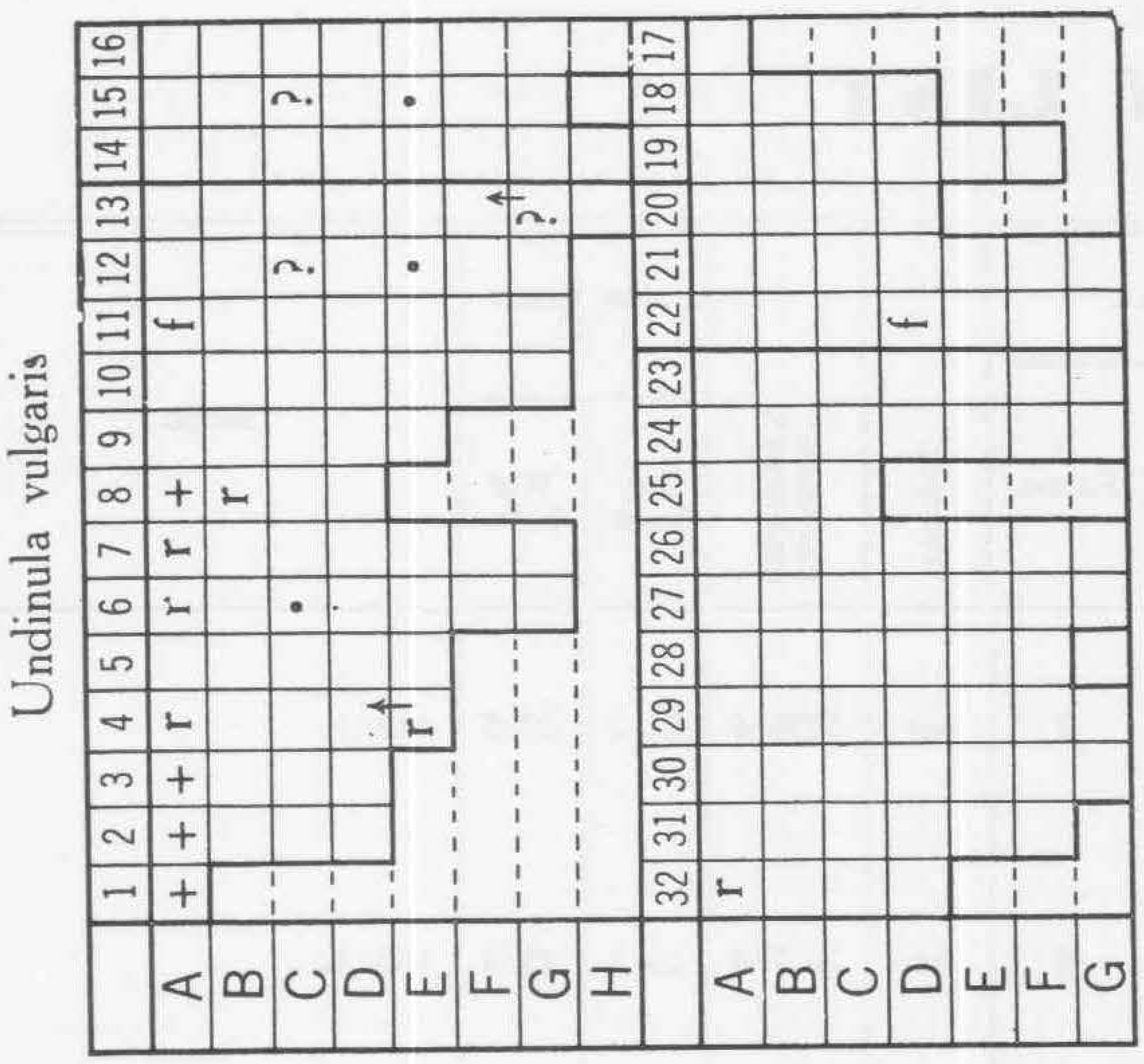


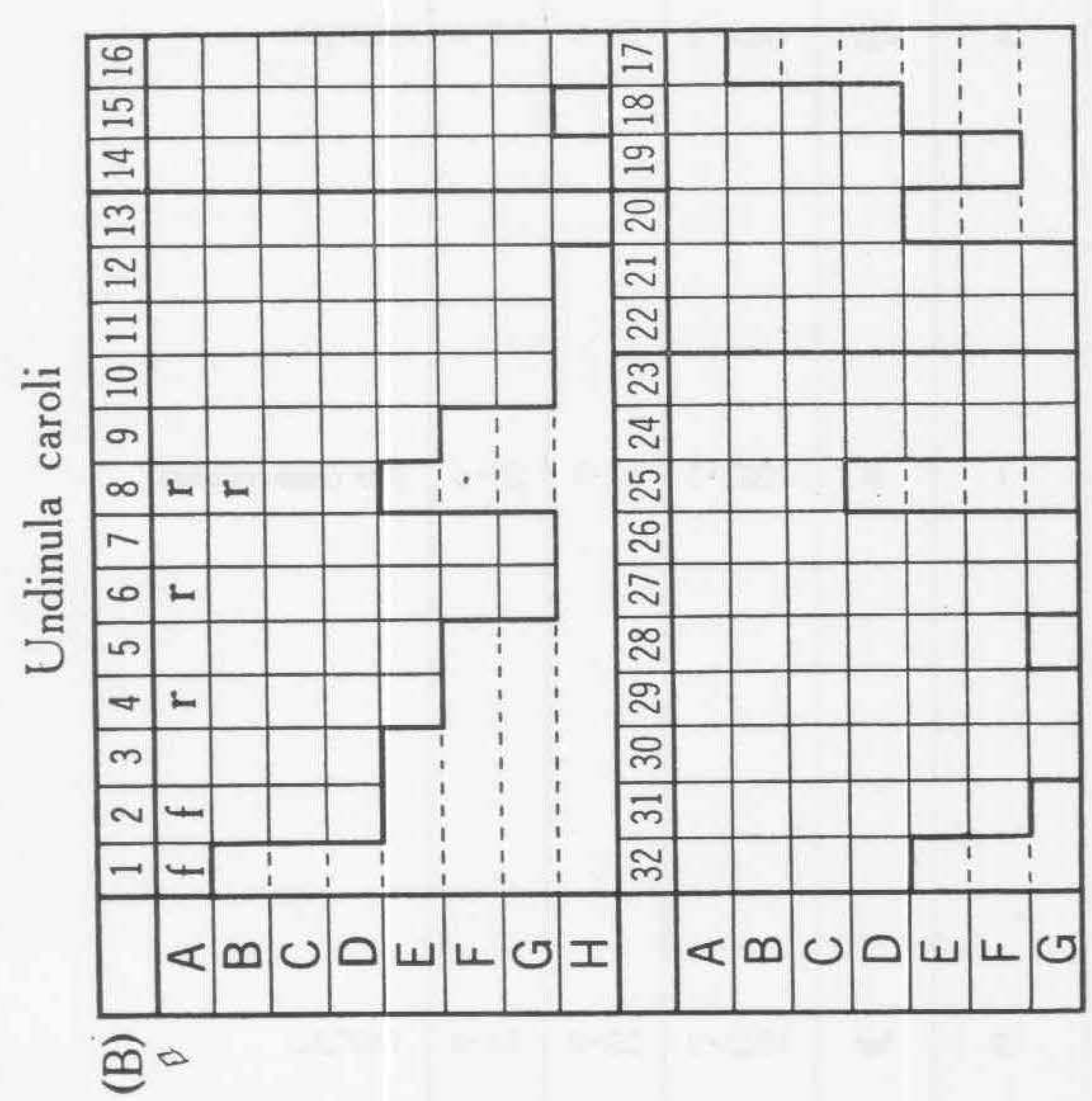
ADDENDUM.

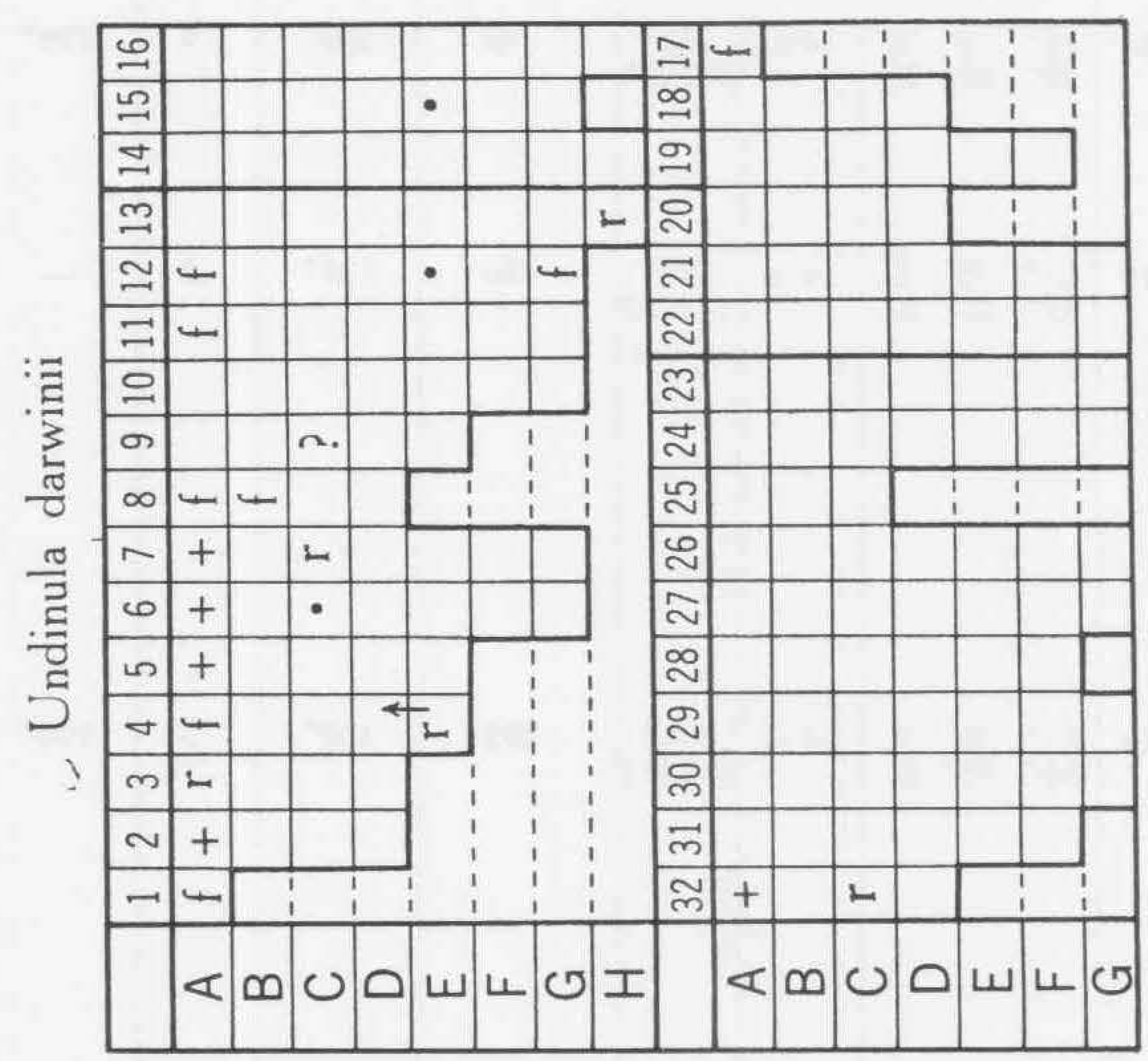
Undeuchaeta plumosa:
Insert . in D 2.

PLATE XIV

Trigsurvey 1964







ADDENDA.

Undinula caroli:
Insert . in C 6, E 12, E 15.

PLATE XIV

Trigsurvey 1964.

STATION LIST

Station.	Position.	Date.	Hour.	Sounding (metres).	Wind.		Sea.		Weather.	Barometer (millibars).	Air Temp. °C.		Swell.
					Direction.	Force (knots).	Direction.	Force.			Dry bulb.	Wet bulb.	
		1961											
A 1224	25° 50′ S, 33° 00′ E.	14.vi	0625 (0715)	49	190°	9	190°	2	bjp	1026·4	21·2	19·5	180°,1.
A 1225	25° 55′ S, 33° 33′ E.	14.vi	1003 (1315)	480	130°	2	—	0	bc	1027·6	23·3	18·9	160°,1.
A 1226	25° 56′ S, 34° 06′ E.	14.vi	1616 (1847)	495	100°	5	100°	1	cjp	1024·6	22·3	19·4	190°,1.
A 1227	26° 09′ S, 34° 30′ E.	15.vi	0500 (1021)	800	090°	5	090°	1	b	1023·3	22·7	19·4	No observation.
A 1228	26° 08′ S, 35° 06′ E.	15.vi	1430 (2207)	900	120°	9	120°	2	bc	1023·6	23·0	18·8	160°,1.

STATION LIST

Station.	Age of Moon (days).	Hydrological Observations. Depth (metres).	Depth by thermometer.	Temp. °C.	S°/₀₀.	σt.	Mg-atom/m³. P.	O_2 c.c./litre.	Gear.	Biological Observations. Depth. Metres.	Fathoms.	Time. From.	To.	Remarks.
A 1224	1	0	—	24·09	(35·41)	(23·95)	1·14	4·67	N 50 V	40–0	22–0	0654	0657	—
		10	—	24·09	35·41	23·95	1·58	4·81	N 70 V	40–0	22–0	0639	0641	—
		20	—	24·07	35·41	23·95	1·58	4·82	N 100 H	0–5	0–3	0705	0715	—
		30	—	23·98	35·39	23·96	1·70	4·84	—	—	—	—	—	—
A 1225	1	0	—	23·17	35·35	24·17	0·75	4·82	N 50 V	100–0	55–0	1009	1017	—
		10	—	23·12	35·34	24·18	0·79	4·82	N 70 V	50–0	27–0	1023	1026	—
		20	—	23·10	35·35	24·19	0·82	4·79	N 70 V	100–50	55–27	1039	1046	—
		30	—	23·10	35·35	24·19	1·05	4·84	N 70 V	250–100	136–55	1054	1106	—
		50	—	21·72	35·30	24·55	1·37	4·00	N 70 V	450–250	246–136	1115	1136	—
		75	—	17·54	35·31	25·64	1·61	3·62	N 100 H	0–5	0–3	1224	1234	—
		100	—	15·94	35·31	26·01	1·97	3·70	N 100 B	150–0	82–0	1224	1242	—
		150	—	14·47	35·29	26·33	—	4·15	N 200 B	300–0	164–0	1250	1314	—
		200	—	13·16	35·20	26·53	—	4·29	C 24	475	250	1153	1215	—
		300	281	11·48	35·03	26·73	—	4·73	—	—	—	—	—	—
		400	383	10·35	34·90	26·84	—	4·43	—	—	—	—	—	—
A 1226	1	0	—	23·47	35·34	24·07	0·72	4·82	N 50 V	100–0	55–0	1822	1832	—
		10	—	23·22	35·34	24·15	0·72	4·84	N 70 V	50–0	27–0	1816	1819	—
		20	—	23·27	35·34	24·15	0·78	4·85	N 70 V	100–0	55–0	1756	1801	—
		30	—	22·95	35·34	24·23	0·80	4·53	N 70 V	100–50	55–27	1805	1812	—
		50	—	18·93	35·29	25·28	1·33	3·54	N 70 V	250–100	136–55	1740	1754	—
		75	—	17·31	35·33	25·71	1·44	3·53	N 70 V	450–250	246–136	1717	1736	—
		100	—	15·51	35·31	26·11	1·93	3·76	N 100 H	0–5	0–3	1617	1627	—
		150	—	13·71	35·22	26·43	—	4·20	N 100 B	300–0	164–0	1646	1712	—
		200	—	13·03	35·17	26·54	—	4·29	N 200 B	300–0	164–0	1616	1640	—
		300	276	11·41	35·02	26·73	—	4·46	C 24	515	281	1837	1842	—
		400	386	9·84	34·83	26·87	—	4·62	—	—	—	—	—	—
A 1227	2	0	—	24·58	35·41	23·80	0·59	4·77	N 50 V	100–0	55–0	0842	0849	—
		10	—	24·58	35·42	23·80	0·58	4·84	N 70 V	50–0	27–0	0836	0839	—
		20	—	24·57	35·41	23·80	0·59	4·72	N 70 V	100–0	55–0	0508	0516	—
		30	—	24·58	35·42	23·80	0·61	4·69	N 70 V	100–50	55–27	0829	0832	—
		50	—	24·56	35·43	23·82	0·61	0·73	N 70 V	250–100	136–55	0815	0827	—
		75	—	23·47	35·36	24·07	0·64	4·63	N 70 V	500–250	273–136	0738	0801	—
		100	—	20·12	35·26	24·95	0·69	3·50	N 70 V	750–500	410–273	0701	0733	—
		150	—	16·32	35·34	25·95	—	3·66	N 70 V	750–0	410–0	0621	0653	—
		200	—	14·73	35·30	26·28	—	3·88	N 100 H	0–5	0–3	0915	0925	—
		300	281	12·78	35·17	26·59	—	4·38	N 100 B	300–0	164–0	0915	0953	—
		400	384	11·25	34·99	26·74	—	4·48	N 200 B	300–0	164–0	0958	1021	—
		500	476	9·94	34·84	26·85	—	4·45	C 24	825	451	0853	0910	—
		600	578	8·99	34·75	26·94	—	4·09	EEL-100	0	0	0830	0835	—
		—	—	—	—	—	—	—	EEL-10	27–5	14	0840	0845	—
		—	—	—	—	—	—	—	EEL-1	66	36	0850	0900	—
A 1228	2	0	—	24·64	35·41	23·78	0·42	4·79	N 50 V	100–0	55–0	1536	1542	—
		10	—	24·63	35·41	23·78	0·43	4·81	N 70 V	50–0	27–0	1545	1548	—
		20	—	24·54	35·41	23·81	0·43	4·72	N 70 V	100–0	55–0	2202	2207	—
		30	—	24·54	35·42	23·81	0·44	4·72	N 70 V	100–50	55–27	1552	1555	—
		50	—	24·48	35·42	23·83	0·45	4·78	N 70 V	250–100	136–55	1657	1708	—
		75	—	22·18	35·31	24·42	0·67	4·75	N 70 V	500–250	273–136	1634	1655	—
		100	—	19·73	35·40	25·16	0·85	4·00	N 70 V	750–500	410–273	1559	1631	—
		150	—	17·73	35·49	25·73	—	4·35	N 100 H	0–5	0–3	1430	1440	—
		200	—	16·76	35·49	25·96	—	4·61	N 100 B	300–0	164–0	1502	1526	—
		300	293	14·54	35·41	26·41	—	4·68	N 200 B	300–0	164–0	1430	1453	—
		400	390	12·96	35·23	26·60	—	4·83	C 24	780	426	1714	1725	—
		500	484	11·85	35·09	26·70	—	4·94	BN 55	0	0	1935	2035	—
		600	589	10·41	34·91	26·83	—	4·87	BN 55	0	0	2100	2130	—

Station.	Position.	Date.	Hour.	Sounding (metres).	Wind. Direction.	Wind. Force (knots).	Sea. Direction.	Sea. Force.	Weather.	Barometer (millibars).	Air Temp. °C. Dry bulb.	Air Temp. °C. Wet bulb.	Swell.
		1961											
A 1229	26° 12′ S, 36° 12′ E.	16.vi	0548 (1808)	2090	090°	18	090°	3	bcjp	1021·5	22·9	22·1	120°,1.
A 1230	26° 42′ S, 37° 41′ E.	17.vi	0504 (1900)	4575	110°	13	110°	2	bcl	1018·7	22·0	19·6	No observation.
A 1231	26° 43′ S, 39° 55′ E.	18.vi	1100 (1820)	4580	100°	18	100°	4	cjp	1021·9	23·5	21·3	100°,4.

Station.	Age of Moon (days).	Hydrological Observations. Depth (metres).	Depth by thermometer.	Temp. °C.	S °/°°.	σt.	Mg-atom/m³. P.	O_2 c.c./litre.	Biological Observations. Gear.	Depth. Metres.	Depth. Fathoms.	Time. From.	Time. To.	Remarks.
A 1229	3	0	—	24·01	35·40	23·96	0·35	4·72	N 50 V	100–0	55–0	1115	1120	—
		10	—	23·97	35·40	23·97	0·34	4·79	N 70 V	50–0	27–0	1108	1111	—
		20	—	23·97	35·40	23·97	0·43	4·77	N 70 V	100–0	55–0	**1800**	**1807**	—
		30	—	23·96	35·40	23·98	—	4·77	N 70 V	100–50	55–27	0645	0649	—
		50	—	22·58	35·33	24·32	0·61	4·45	N 70 V	250–100	136–55	0629	0642	—
		75	—	21·02	35·37	24·79	0·67	4·19	N 70 V	500–250	273–136	0655	0717	—
		100	—	21·02	35·53	24·91	0·35	4·87	N 70 V	750–500	410–273	0831	0905	—
		150	—	17·54	35·53	25·81	—	4·72	N 70 V	1000–750	547–410	0914	0957	—
		200	—	16·72	35·51	25·98	—	4·72	N 70 V	1500–1000	820–547	1006	1100	—
		300	298	14·72	35·41	26·37	—	4·79	N JAP	2000–0	1094–0	0730	0825	—
		400	392	13·33	35·28	26·56	—	4·88	N JAP	2000–0	1094–0	1230	1255	—
		500	490	11·99	35·10	26·69	—	4·87	N 100 H	0–5	0–3	1306	1316	—
		600	585	10·81	34·94	26·78	—	4·79	N 100 B	300–0	164–0	1305	1330	—
		800	785	7·41	—	—	—	4·88	N 200 B	300–0	164–0	**1725**	**1752**	—
		1000	954	5·39	34·51	27·26	2·77	4·02	C 24	2110	1153	1123	1200	—
		1200	(1150)	4·16	34·57	27·45	—	3·57	RBT 15	2000	1094	1430	1700	—
		1500	1448	3·39	34·68	27·61	2·55	3·50	EEL-100	0	0	1025	1027	—
		2000	1981	2·37	34·80	27·81	2·82	4·82	EEL-10	22	12	1030	1034	—
		—	—	—	—	—	—	—	EEL-1	74	40	1040	1047	—
A 1230	4	0	—	23·74	35·31	23·97	0·34	4·79	N 50 V	100–0	55–0	1357	1403	—
		10	—	23·69	35·29	23·97	0·33	4·86	N 70 V	50–0	27–0	0939	0942	—
		20	—	23·69	35·30	23·98	0·43	4·92	N 70 V	100–0	55–0	**1828**	**1833**	—
		30	—	23·69	35·30	23·98	0·43	4·86	N 70 V	100–50	55–27	0947	0952	—
		50	—	23·68	35·30	23·99	0·45	4·83	N 70 V	250–100	136–55	0956	1006	—
		75	—	23·57	35·31	24·02	0·45	4·83	N 70 V	500–250	273–136	1035	1057	—
		100	—	23·27	35·38	24·16	0·46	4·82	N 70 V	750–500	410–273	1100	1135	—
		150	—	20·22	35·41	26·04	—	4·59	N 70 V	1000–750	547–410	1138	1216	—
		200	—	18·42	35·51	25·57	—	4·72	N 70 V	1500–1000	820–547	1255	1353	—
		300	257	16·48	35·50	26·04	—	4·57	N 70 V	500–0	273–0	1010	1030	—
		400	344	14·91	35·42	26·34	—	4·68	N JAP	600–0	328–0	0555	0615	—
		500	432	13·45	35·29	26·54	1·16	4·99	N JAP	1500–0	820–0	0620	0705	—
		600	526	12·23	35·12	26·65	—	4·78	N JAP	4000–0	2187–0	0710	0920	—
		800	604	11·24	35·01	26·76	—	4·87	EEL-100	0	0	1005	1010	—
		1000	763	8·87	34·72	26·94	1·32	4·61	EEL-10	39	21	1010	1023	—
		1200	957	6·65	—	—	—	4·06	EEL-1	85	50	1023	1045	—
		1500	1216	4·31	34·53	27·40	2·11	3·75	N 100 H	0–5	0–3	1410	1420	—
		2000	1210	4·39	34·51	27·37	2·16	3·64	N 100 B	300–0	164–0	1410	1446	—
		2500	1571	3·33	34·67	27·61	—	3·26	N 200 B	250–0	136–0	**1837**	**1850**	—
		3000	1984	2·79	34·72	27·70	2·22	3·85	—	—	—	—	—	—
		4000	2770	2·24	34·80	27·82	2·29	4·59	—	—	—	—	—	—
A 1231	5	0	—	23·70	35·25	23·93	—	4·73	N 70 V	50–0	27–0	1652	1655	—
		10	—	23·69	35·24	23·93	0·26	4·90	N 70 V	100–50	55–27	1656	1701	—
		20	—	23·69	35·24	23·93	0·27	4·89	N 70 V	250–100	136–55	1703	1716	—
		30	—	23·65	35·24	23·94	0·36	4·62	N 70 V	500–250	273–136	**1718**	**1742**	—
		50	—	23·59	35·25	23·97	0·41	4·87	N JAP	600–0	328–0	1145	1215	—
		75	—	23·45	35·34	24·08	0·43	4·87	N JAP	2000–0	1094–0	1230	1317	—
		100	—	22·01	35·31	24·47	0·41	4·38	N JAP	2000–0	1094–0	1320	1415	—
		150	—	22·01	35·44	24·57	—	4·19	N JAP	4000–0	2187–0	1420	1645	—
		200	—	18·49	35·49	25·54	—	4·02	N 100 H	0–5	0–3	**1753**	**1803**	—
		300	288	15·85	35·52	26·19	—	4·75	N 100 B	250–0	136–0	**1753**	**1820**	—
		400	385	13·99	35·34	26·47	—	4·77	—	—	—	—	—	—
		500	—	12·91	35·24	26·61	0·59	4·97	—	—	—	—	—	—
		500	483	12·71	35·19	26·62	—	4·99	—	—	—	—	—	—
		600	581	11·60	35·04	26·72	—	4·62	—	—	—	—	—	—
		800	744	9·05	34·77	26·95	—	4·82	—	—	—	—	—	—
		1000	934	6·18	34·54	27·19	1·90	4·11	—	—	—	—	—	—
		1000	974	5·94	34·51	27·19	—	4·08	—	—	—	—	—	—
		1200	(1105)	4·21	—	—	—	4·69	—	—	—	—	—	—
		1500	1473	3·33	34·65	27·59	2·70	3·42	—	—	—	—	—	—
		2000	—	2·75	34·74	27·73	2·57	3·89	—	—	—	—	—	—
		2000	1940	2·77	34·70	27·69	—	3·94	—	—	—	—	—	—
		2500	2445	2·43	34·79	27·79	—	4·14	—	—	—	—	—	—
		3000	2935	2·16	34·84	27·84	2·90	4·67	—	—	—	—	—	—
		4000	3873	1·13	34·73	27·84	2·66	4·65	—	—	—	—	—	—

Station.	Position.	Date.	Hour.	Sounding (metres).	Wind. Direction.	Wind. Force (knots).	Sea. Direction.	Sea. Force.	Weather.	Barometer (millibars).	Air Temp. °C. Dry bulb.	Air Temp. °C. Wet bulb.	Swell.
		1961											
A 1232	27° 10′ S, 41° 45′ E.	19.vi	1150 (1928)	4400	100°	24	100°	5	b	1022·7	23·6	20·0	100°,4.
A 1233	27° 22′ S, 43° 35′ E.	20.vi	0707 (1708)	4130	100°	13	100°	3	bc	1019·4	22·5	19·7	110°,3.
A 1234	27° 47′ S, 45° 41′ E.	21.vi	0447 (1755)	2450	080°	13	080°	3	Cr_o	1016·6	22·5	21·2	No observation.

Station.	Age of Moon (days).	Hydrological Observations. Depth (metres).	Depth by thermometer.	Temp. °C.	S°/₀₀.	σt.	Mg-atom/m³. P.	O_2 c.c./litre.	Biological Observations. Gear.	Depth. Metres.	Depth. Fathoms.	Time. From.	Time. To.	Remarks.
A 1232	6	0	—	24·07	35·41	23·95	0·27	4·81	N 70 V	50–0	27–0	1713	1716	—
		10	—	24·07	35·43	23·96	0·25	4·88	N 70 V	100–50	55–27	1717	1722	—
		20	—	24·07	35·41	23·95	0·28	4·87	N 70 V	250–100	136–55	1724	1734	—
		30	—	24·07	35·40	23·94	0·32	4·82	N 70 V	500–250	273–136	1735	1755	—
		50	—	24·07	35·41	23·95	0·36	4·87	N 70 V	750–500	410–273	1758	1830	—
		75	—	23·98	35·41	23·98	0·36	4·83	N JAP	1200–0	656–0	1305	1400	—
		100	—	21·25	35·35	24·71	0·75	4·25	N JAP	2500–0	1367–0	1405	1509	—
		150	—	18·74	35·48	25·47	—	4·18	N JAP	4000–0	2187–0	1511	1709	—
		200	—	17·57	35·46	25·75	—	4·19	N 100 H	0–5	0–3	1840	1850	—
		300	—	15·16	35·45	26·30	—	4·77	N 100 B	250–0	136–0	1837	1903	—
		400	—	13·25	35·27	26·56	—	4·97	N 200 B	250–0	136–0	1908	1927	—
		500	—	11·68	35·06	26·71	1·19	5·13	—	—	—	—	—	—
		600	547	11·07	34·99	26·78	—	4·87	—	—	—	—	—	—
		800	721	8·89	34·76	26·96	—	4·78	—	—	—	—	—	—
		1000	887	6·31	34·53	27·16	1·86	4·16	—	—	—	—	—	—
		1200	1094	4·65	34·54	27·38	—	3·62	—	—	—	—	—	—
		1500	1423	3·48	34·65	27·58	2·08	3·57	—	—	—	—	—	—
		2000	1920	2·77	34·79	27·76	2·19	3·85	—	—	—	—	—	—
		2500	2427	2·41	34·81	27·81	—	4·52	—	—	—	—	—	—
		3000	2895	2·19	34·77	27·79	2·25	4·76	—	—	—	—	—	—
		4000	3840	1·31	34·75	27·85	2·03	4·80	—	—	—	—	—	—
A 1233	7	0	—	22·77	35·37	24·30	0·32	4·94	N 70 V	50–0	27–0	0945	0947	—
		10	—	22·78	35·34	24·27	0·35	4·99	N 70 V	50–0	27–0	0953	0955	—
		20	—	22·67	—	—	0·39	4·92	N 70 V	100–0	55–0	1703	1706	—
		30	—	22·58	35·37	24·36	0·41	4·92	N 70 V	100–50	55–27	0957	1000	—
		50	—	22·57	35·37	24·36	0·33	4·97	N 70 V	250–100	136–55	1108	1119	—
		75	—	21·84	35·41	24·59	0·43	4·62	N 70 V	500–250	273–136	1123	1143	—
		100	—	20·55	35·49	25·00	—	4·92	N 70 V	750–500	410–273	1146	1212	—
		150	—	18·02	35·53	25·70	—	4·33	N 70 V	1000–750	547–410	0822	0900	—
		200	—	16·70	35·51	25·98	—	4·41	N 70 V	1500–1000	820–547	0717	0815	—
		300	(275)	14·33	35·40	26·44	—	4·82	N JAP	800–0	438–0	0745	0809	—
		400	379	13·24	35·27	26·57	—	4·99	N JAP	2000–0	1094–0	0810	0910	—
		500	472	12·13	35·17	26·72	0·87	5·04	N JAP	4000–0	2187–0	0911	1105	—
		600	575	10·99	34·97	26·78	—	4·97	N 100 H	0–5	0–3	1632	1642	—
		800	775	8·51	34·67	26·96	—	4·84	N 100 B	250–0	136–0	1224	1250	—
		1000	917	6·38	34·54	27·17	1·94	4·19	N 200 B	250–0	136–0	1630	1653	—
		1200	1134	4·65	34·53	27·37	—	3·55	EEL-100	0	0	1115	1118	—
		1500	1397	3·67	34·57	27·50	2·53	3·67	EEL-10	34	18	1120	1122	—
		2000	1875	2·97	34·75	27·72	2·53	3·72	EEL-1	75	41	1123	1125	—
		2500	2170	2·59	34·77	27·76	—	4·09	I.L 6505	100–0	54–0	1345	1550	—
		3000	2620	2·31	34·79	27·80	2·12	4·57	—	—	—	—	—	—
		4000	3488	1·72	34·79	27·85	2·95	4·89	—	—	—	—	—	—
A 1234	8	0	—	23·27	35·34	24·13	0·26	4·88	N 50 V	100–0	55–0	0630	0639	—
		10	—	23·27	35·30	24·11	0·27	4·90	N 70 V	50–0	27–0	1056	1059	—
		20	—	23·25	35·30	24·11	0·29	4·88	N 70 V	100–0	55–0	1750	1755	—
		30	—	23·22	35·31	24·12	0·30	4·92	N 70 V	100–50	55–27	1049	1055	—
		50	—	22·58	35·42	24·40	0·33	4·91	N 70 V	250–100	136–55	0646	0658	—
		75	—	22·32	35·41	24·46	0·37	4·80	N 70 V	500–250	273–136	0702	0721	—
		100	—	20·97	35·41	24·83	0·63	4·32	N 70 V	750–500	410–273	0723	0758	—
		150	—	18·58	35·53	25·56	—	4·48	N 70 V	1000–750	547–410	0903	0945	—
		200	—	16·74	35·51	25·98	—	4·93	N 70 V	1500–1000	820–547	0948	1046	—
		300	(250)	15·67	35·50	26·22	—	4·93	N JAP	800–0	438–0	0534	0603	—
		400	357	14·29	35·37	26·43	—	4·88	N JAP	2000–0	1094–0	0605	0702	—
		500	448	13·01	35·26	26·61	1·35	5·03	N 100 H	0–5	0–3	1545	1555	—
		600	(548)	12·02	35·12	26·69	—	4·88	N 100 B	250–0	136–0	1545	1609	—
		800	748	9·72	34·81	26·88	—	4·92	N 200 B	250–0	136–0	1720	1745	—
		1000	934	7·08	34·56	27·08	1·90	4·44	C 24	2100	1148	1305	1430	—
		1200	1150	5·00	34·49	27·29	—	3·80	C 24	1950	1066	1103	1140	—
		1500	1441	3·06	34·58	27·57	2·57	3·97	C 24	1950	1066	1148	1230	—
		2000	1966	2·32	34·70	27·73	2·38	4·18	I.L 6505	100–0	54–0	1625	1650	—
									EEL-100	0	0	0945	0955	—
									EEL-10	46	25	1000	1005	—
									EEL-1	99	54	1005	1010	—

Station.	Position.	Date.	Hour.	Sounding (metres).	Wind. Direction.	Wind. Force (knots).	Sea. Direction.	Sea. Force.	Weather.	Barometer (millibars).	Air Temp. °C. Dry bulb.	Air Temp. °C. Wet bulb.	Swell.
		1961											
A 1235	27° 48′ S, 47° 19′ E.	22.vi	0440 (1826)	2220	130°	18	130°	3	cd	1016·5	20·0	19·0	No observation.
A 1236	28° 11′ S, 49° 20′ E.	23.vi	0620 (1808)	4650	020°	13	020°	2	bc	1019·7	21·8	20·6	040°,1.
A 1237	29° 29′ S, 50° 30′ E.	24.vi	0503 (1845)	4700	230°	5	230°	1	b	1023·3	20·1	19·0	No observation.

Station.	Age of Moon (days).	Hydrological Observations.							Gear.	Biological Observations.				Remarks.
		Depth (metres).	Depth by thermometer.	Temp. °C.	S°/°° .	σt.	Mg-atom/m³. P.	O_2 c.c./litre.		Depth. Metres.	Depth. Fa-thoms.	Time. From.	Time. To.	
A 1235	9	0	—	22·69	35·31	24·27	0·46	4·94	N 70 V	100–0	55–0	**1820**	**1825**	—
		10	—	22·69	35·32	24·28	0·52	5·01	N 70 V	50–0	27–0	1030	1035	—
		20	—	22·69	35·33	24·29	0·65	5·03	N 70 V	100–50	55–27	1020	1028	—
		30	—	22·69	35·32	24·28	0·65	4·99	N 70 V	250–100	136–55	1007	1018	—
		50	—	22·64	35·32	24·29	0·73	4·99	N 70 V	500–250	273–136	0942	1005	—
		75	—	22·57	35·38	24·36	0·75	5·06	N 70 V	750–500	410–273	0904	0937	—
		100	—	22·39	35·41	24·44	0·77	4·96	N 70 V	1000–750	547–410	0814	0900	—
		150	—	20·09	35·43	25·08	—	4 20	N 70 V	1500–1000	820–547	0710	0807	—
		200	—	18·24	35·51	25·61	—	4·40	N JAP	800–0	438–0	0527	0551	—
		300	282	16·23	35·48	26·08	—	4·89	N JAP	2000–0	1094–0	0552	0652	—
		400	379	14·61	35·40	26·38	—	4·94	N 100 H	0–5	0–3	1245	1255	—
		500	471	13·33	35·27	26·55	1·38	5·06	N 100 B	250–0	136–0	1245	1305	—
		600	575	12·30	35·18	26·69	—	5·01	N 200 B	250–0	136–0	**1750**	**1808**	—
		800	765	10·02	34·85	26·84	—	5·03	C 24	2300	1258	1040	1120	—
		1000	901	7·62	34·60	27·03	2·28	4·67	D	1600	875	1530	1710	—
		1200	1107	5·09	—	—	—	—	EEL-100	0	0	1110	1115	—
		1500	1376	3·60	34·53	27·48	3·70	4·05	EEL-10	37	20	1116	1120	—
		2000	1834	2·55	34·71	27·71	2·84	4·20	EEL-1	78	42	1121	1126	—
A 1236	10	0	—	21·11	35·49	24·85	0·38	5·08	N 50 V	100–0	55–0	1535	1542	—
		10	—	21·11	35·51	24·86	0·34	5·14	N 70 V	100–0	55–0	**1802**	**1807**	—
		20	—	21·10	35·46	24·84	0·36	5·18	N 70 V	50–0	27–0	1141	1145	—
		30	—	21·01	35·46	24·86	0·37	5·15	N 70 V	100–50	55–27	1133	1137	—
		50	—	20·60	35·69	25·14	0·41	5·16	N 70 V	250–100	136–55	0810	0820	—
		75	—	19·49	35·56	25·34	0·44	5·29	N 70 V	500–250	273–136	0823	0847	—
		100	—	17·85	—	—	0·58	5·00	N 70 V	750–500	410–273	0850	0925	—
		150	—	16·76	35·53	26·00	—	4·99	N 70 V	1000–750	547–410	0930	1017	—
		200	—	16·25	35·50	26·09	—	5·01	N 70 V	1500–1000	820–547	0650	0745	—
		300	292	14·93	35·41	26·32	—	4·91	N 70 V	1500–1000	820–547	1020	1130	—
		400	391	13·67	35·31	26·51	—	5·03	N 70 V	3700–1500	2024–820	1155	1530	—
		500	484	12·69	35·18	26·61	1·41	5·03	N JAP	800–0	438–0	0702	0740	—
		600	582	11·41	35·02	26·74	—	4·88	N JAP	2000–0	1094–0	0741	0844	—
		800	795	8·91	34·71	26·92	—	4·88	N JAP	4000–0	2187–0	0845	1100	—
		1000	973	6·11	34·47	27·14	1·97	4·48	N 100 H	0–5	0–3	1553	1603	—
		1200	1187	4·15	34·43	27·34	—	4·08	N 100 B	250–0	136–0	1553	1625	—
		1500	1468	3·08	34·56	27·55	2·43	3·96	N 200 B	250–0	136–0	1632	**1755**	—
		2000	1966	2·51	34·72	27·73	2·51	4·17	EEL-100	0	0	1100	1110	—
		2500	2394	2·30	34·77	27·78	—	4·35	EEL-10	41	22	1111	1116	—
		3000	2955	1·76	34·76	27·82	2·82	4·06	EEL-1	74	40	1117	1140	—
		4000	3915	1·09	34·71	27·82	2·43	4·51	—	—	—	—	—	—
A 1237	11	0	—	21·44	35·39	24·69	0·41	5·11	N 50 V	100–0	55–0	1221	1229	—
		10	—	21·44	35·39	24·69	0·47	5·16	N 70 V	100–0	55–0	**1832**	**1835**	—
		20	—	21·44	35·41	24·71	0·63	5·21	N 70 V	50–0	27–0	1215	1219	—
		30	—	21·21	35·42	24·77	0·62	5·26	N 70 V	100–50	55–27	1209	1214	—
		50	—	20·39	35·46	25·03	0·67	5·23	N 70 V	250–100	136–55	0655	0706	—
		75	—	18·83	35·54	25·50	0·60	5·52	N 70 V	500–250	273–136	0732	0754	—
		100	—	17·21	35·53	25·89	0·63	5·38	N 70 V	750–500	410–273	0927	1004	—
		150	—	16·02	35·48	26·13	—	5·01	N 70 V	1000–750	547–410	1006	1053	—
		200	—	15·20	35·44	26·28	—	5·13	N 70 V	1500–1000	820–547	1055	1203	—
		300	—	14·32	35·37	26·43	—	5·23	N 70 V	3000–1500	1641–820	1233	1508	—
		400	387	13·37	35·27	26·55	—	5·18	N 70 V	250–0	136–0	0640	0653	—
		500	484	12·51	35·17	26·65	0·79	5·13	N 70 V	500–0	273–0	0708	0730	—
		600	590	11·59	35·02	26·72	—	5·01	N 70 V	750–0	410–0	0832	0905	—
		800	790	8·91	34·69	26·90	—	4·94	N JAP	1000–0	547–0	0557	0623	—
		1000	973	6·03	34·47	27·15	2·55	4·74	N JAP	2500–0	1364–0	0624	0725	—
		1200	1165	4·29	34·44	27·33	—	4·13	N JAP	4000–0	2187–0	0727	0908	—
		1500	1466	3·20	34·57	27·54	2·93	3·93	N 100 H	0–5	0–3	1539	1549	—
		2000	1960	2·51	34·73	27·74	2·63	4·06	N 100 B	250–0	136–0	1539	1605	—
		2500	2448	2·27	34·75	27·78	—	4·30	N 200 B	1000–0	547–0	1625	**1830**	—
		3000	(2870)	1·97	34·76	27·80	2·87	4·35	LL 6505	50–0	27–0	1100	1435	—
		4000	3870	1·11	34·71	27·82	2·82	4·54	—	—	—	—	—	—

Station.	Position.	Date.	Hour.	Sounding (metres).	Wind. Direction.	Wind. Force (knots).	Sea. Direction.	Sea. Force.	Weather.	Barometer (millibars).	Air Temp. °C. Dry bulb.	Air Temp. °C. Wet bulb.	Swell.
		1961											
A 1238	30° 50′ S, 51° 36′ E.	25.vi	**0600** **(1837)**	4950	170°	18	170°	3	c	1027·7	17·2	14·0	No observation.
A 1239	32° 07′ S, 52° 49′ E.	26.vi	**0540** **(1743)**	4920	130°	13	130°	2	b	1030·5	15·7	11·5	No observation.
A 1240	20° 28·8′ S, 57° 15·9′ E.	1.vii	0910 (0925)	65	120°	5	120°	3	cjp	1022·4	22·6	—	120°,4.
A 1241	22° 25′ S, 57° 00′ F.	2.vii	0900 1122	4760	110°	24	110°	4	bcjp	1023·1	22·4	18·8	110°,4.
A 1242	26° 16′ S, 56° 21′ E.	3.vii	0903 (1148)	5220	130°	2	130°	1	b	1024·5	22·0	17·0	060°,2.

Station.	Age of Moon (days).	Hydrological Observations.							Gear.	Biological Observations.				Remarks.
		Depth (metres).	Depth by thermometer.	Temp. °C.	S°/₀₀.	σt.	Mg-atom/m³. P.	O₂ c.c./litre.		Depth. Metres.	Depth. Fa-thoms.	Time. From.	Time. To.	
A 1238	12	0	—	20·31	35·48	25·06	0·42	5·20	N 70 V	100–0	55–0	**1828**	**1837**	—
		10	—	20·32	35·47	25·06	0·42	5·22	N 70 V	50–0	27–0	1244	1246	—
		20	—	20·31	35·47	25·06	0·45	5·31	N 70 V	100–50	55–27	0700	0705	—
		30	—	20·31	35·46	25·06	0·46	5·27	N 70 V	100–50	55–27	1247	1250	—
		50	—	20·31	35·47	25·06	0·46	5·29	N 70 V	250–100	136–55	0628	0650	—
		75	—	18·80	35·48	25·45	0·47	5·37	N 70 V	500–250	273–136	1253	1315	—
		100	—	17·32	35·55	25·88	0·52	5·26	N 70 V	750–500	410–273	1318	1352	—
		150	—	16·19	35·50	26·10	—	5·09	N 70 V	1000–750	547–410	1354	1430	—
		200	—	15·31	35·45	26·27	—	5·12	N 70 V	1500–1000	820–547	1438	1541	—
		300	—	14·46	35·39	26·41	—	5·23	N JAP	1000–0	547–0	0716	0750	—
		400	378	13·27	35·27	26·56	—	5·11	N JAP	2500–0	1367–0	0754	0910	—
		500	(478)	12·49	35·16	26·63	1·19	5·18	N JAP	4000–0	2187–0	0915	1112	—
		600	579	11·61	35·04	26·70	—	4·94	N 100 H	0–5	0–3	1547	1557	—
		800	784	9·11	34·72	26·90	—	4·94	N 100 B	250–0	136–0	1545	1610	—
		1000	969	6·24	(34·49)	(27·13)	1·95	4·63	N 200 B	1000–0	547–0	1620	**1825**	—
		1200	1184	4·37	34·45	27·33	—	4·08	—	—	—	—	—	—
		1500	1474	3·01	34·54	27·54	2·11	3·99	—	—	—	—	—	—
		2000	1965	2·58	34·70	27·71	2·00	4·11	—	—	—	—	—	—
		2500	2450	2·27	34·76	27·78	—	4·32	—	—	—	—	—	—
		3000	2963	1·87	34·76	27·81	2·13	4·26	—	—	—	—	—	—
		4000	3932	1·17	34·72	27·83	2·43	4·46	—	—	—	—	—	—
A 1239	13	0	—	18·78	35·45	25·44	0·25	5·34	N 50 V	100–0	55–0	0959	1007	—
		10	—	18·79	35·45	25·43	0·41	5·38	N 70 V	100–0	55–0	**1737**	**1743**	—
		20	—	18·78	35·45	25·44	0·47	5·38	N 70 V	50–0	27–0	0954	0956	—
		30	—	18·78	35·45	25·44	0·51	5·38	N 70 V	100–50	55–27	0943	0953	—
		50	—	18·18	35·48	25·61	0·57	5·38	N 70 V	250–100	136–55	0925	0940	—
		75	—	17·77	35·47	25·71	0·56	5·38	N 70 V	500–250	273–136	0900	0920	—
		100	—	17·31	35·49	25·83	0·63	5·34	N 70 V	750–500	410–273	0825	0859	—
		150	—	15·45	35·59	26·34	—	5·31	N 70 V	1000–750	547–410	0740	0820	—
		200	—	14·53	35·40	26·40	—	5·29	N 70 V	1500–1000	820–547	0626	0737	—
		300	—	13·76	35·32	26·50	—	5·26	N 70 V	3000–1500	1641–820	1246	1500	—
		400	362	13·27	35·26	26·56	—	5·19	N JAP	1000–0	547–0	0637	0712	—
		500	(460)	12·60	35·16	26·61	1·24	5·14	N JAP	2500–0	1367–0	0714	0824	—
		600	556	11·76	35·07	26·70	—	5·00	N JAP	4000–0	2187–0	0827	1040	—
		800	743	9·77	34·79	26·85	—	4·95	N 100 H	0–5	0–3	1044	1054	—
		1000	930	6·99	34·53	27·07	2·16	4·73	N 100 B	250–0	136–0	1042	1110	—
		1200	1127	4·81	34·44	27·27	—	4·39	N 200 B	1000–0	547–0	1600	**1730**	—
		1500	1396	3·33	34·46	27·44	2·82	3·58	—	—	—	—	—	—
		2000	1905	2·59	34·67	27·68	2·59	3·88	—	—	—	—	—	—
		2500	2370	2·23	34·74	27·77	—	4·32	—	—	—	—	—	—
		3000	2685	1·99	34·75	27·80	2·82	4·32	—	—	—	—	—	—
		4000	3605	1·24	34·72	27·82	2·68	4·56	—	—	—	—	—	—
A 1240	18	0	—	25·87	35·21	23·26	0·31	4·74	N 70 V	50–0	27–0	0915	0919	—
A 1241	19	0	—	24·69	35·27	23·67	0·31	4·99	N 70 V	50–0	27–0	1042	1045	—
		10	—	24·69	35·27	23·67	0·34	5·01	N 70 V	100–50	55–0	1046	1054	—
		20	—	24·69	35·28	23·67	0·47	5·09	N 70 V	500–100	273–55	1055	1115	—
		30	—	24·69	35·27	23·67	0·47	5·21	N JAP	1000–0	547–0	1011	1040	—
		50	—	24·68	35·27	23·67	0·46	5·04	N 100 H	0–5	0–3	0904	0914	—
		75	—	24·28	35·23	23·75	0·55	4·99	N 100 B	150–0	83–0	0902	0917	—
		100	—	24·19	35·25	23·79	0·57	4·94	—	—	—	—	—	—
		150	—	21·15	35·39	24·77	—	4·37	—	—	—	—	—	—
		200	—	19·53	35·50	25·28	—	4·33	—	—	—	—	—	—
		300	—	16·87	35·55	25·98	—	4·33	—	—	—	—	—	—
		400	—	14·85	35·46	26·38	—	4·77	—	—	—	—	—	—
		500	466	13·67	35·33	26·53	1·71	4·94	—	—	—	—	—	—
		600	563	11·89	35·13	26·73	—	4·92	—	—	—	—	—	—
		800	745	6·89	34·61	27·16	—	4·06	—	—	—	—	—	—
		1000	924	5·13	34·58	27·35	2·55	3·47	—	—	—	—	—	—
A 1242	20	0	—	22·48	(35·32)	(24·34)	0·26	4·96	N 50 V	100–0	55–0	1106	1112	—
		10	—	22·48	35·33	24·35	0·28	5·16	N 70 V	50–0	27–0	0904	0907	—
		20	—	22·48	35·34	24·36	0·29	5·13	N 70 V	100–50	55–27	0908	0913	—
		30	—	22·48	35·35	24·37	0·31	5·06	N 70 V	250–100	136–55	0914	0925	—
		50	—	22·46	35·35	24·38	0·35	5·10	N 70 V	500–250	273–136	0927	0946	—
		75	—	18·97	35·58	25·48	0·43	5·32	N 70 V	750–500	410–273	0947	1017	—
		100	—	17·71	35·60	25·82	0·53	4·95	N 70 V	1000–750	547–410	1019	1103	—
		150	—	16·32	35·53	25·90	—	4·77	N JAP	800–0	438–0	0945	1011	—
		200	—	15·24	35·45	26·28	—	4·85	N JAP	2000–0	1094–0	1014	1105	—
		300	—	13·73	35·30	26·50	—	5·12	N 100 H	0–5	0–3	1132	1142	—
		400	377	12·81	35·24	26·63	—	5·13	N 100 B	150–0	82–0	1131	1148	—
		500	471	11·81	35·11	26·72	1·15	5·22	LL 6505	50–0	27–0	0910	1105	—
		600	582	10·82	34·98	26·81	—	5·07	EEL-100	0	0	1105	1110	—
		800	775	8·60	34·69	26·95	—	5·01	EEL-10	32	17	1112	1120	—
		1000	954	5·95	34·47	27·16	1·88	4·34	EEL-1	78	43	1121	1130	—
		1200	1174	4·41	34·55	27·40	—	3·69	—	—	—	—	—	—
		1500	1434	3·35	34·63	27·58	2·19	3·69	—	—	—	—	—	—
		2000	(1920)	2·50	34·72	27·73	2·08	3·98	—	—	—	—	—	—

Station.	Position.	Date.	Hour.	Sounding (metres).	Wind. Direction.	Wind. Force (knots).	Sea. Direction.	Sea. Force.	Weather.	Barometer (millibars).	Air Temp. °C. Dry bulb.	Air Temp. °C. Wet bulb.	Swell.
		1961											
A 1243	29° 43′ S, 55° 57′ E.	4.vii	0901 (1126)	5040	110°	24	110°	4	ojp	1028·2	15·7	12·2	140°,4.
A 1244	33° 24′ S, 55° 32′ E.	5.vii	0902 (1245)	2960	020°	24	020°	4	cjp	1023·0	15·6	12·7	020°,4.
A 1245	36° 16′ S, 56° 45′ E.	6.vii	0708 (1459)	3900	150°	18	150°	4	c	1020·0	13·2	10·5	150°,3.
A 1246	37° 56′ S, 58° 03′ E.	7.vii	0312 (1315)	5240	230°	24	230°	4	bc	1021·8	13·3	10·7	No observation.

Station.	Age of Moon (days).	Hydrological Observations. Depth (metres).	Depth by thermometer.	Temp. °C.	S°/₀₀.	σt.	Mg-atom/m³. P.	O_2 c.c./litre.	Gear.	Biological Observations. Depth. Metres.	Fathoms.	Time. From.	To.	Remarks.
A 1243	21	0	—	20·31	35·68	25·21	0·31	5·21	N 70 V	50–0	27–0	1047	1050	—
		10	—	20·30	35·69	25·22	0·39	5·16	N 70 V	100–50	55–27	1051	1055	—
		20	—	20·30	35·69	25·22	0·43	5·21	N 70 V	250–100	136–55	1056	1106	—
		30	—	20·30	35·67	25·20	0·43	5·24	N 70 V	500–250	273–136	1108	1126	—
		50	—	20·30	35·68	25·21	0·48	5·31	N JAP	800–0	438–0	1020	1044	—
		75	—	20·30	35·71	25·24	0·49	5·31	N 100 H	0–5	0–3	0905	0915	—
		100	—	19·31	35·68	25·47	0·51	5·41	N 100 B	150–0	82–0	0903	0920	—
		150	—	16·51	35·56	26·08	—	5·41	—	—	—	—	—	—
		200	—	15·55	35·48	26·23	—	5·31	—	—	—	—	—	—
		300	—	13·85	35·32	26·48	—	5·24	—	—	—	—	—	—
		400	—	13·25	35·24	26·54	—	5·31	—	—	—	—	—	—
		500	436	12·64	35·26	26·69	0·85	5·38	—	—	—	—	—	—
		600	540	12·09	35·14	26·70	—	5·26	—	—	—	—	—	—
		800	725	10·49	34·90	26·81	—	5·24	—	—	—	—	—	—
A 1244	22	0	—	17·65	35·55	25·80	0·48	5·50	N 70 V	50–0	27–0	1232	1236	—
		10	—	17·67	35·55	25·79	0·53	5·71	N 70 V	100–50	55–27	1221	1225	—
		20	—	17·67	35·54	25·78	0·57	5·62	N 70 V	250–100	136–55	1208	1220	—
		30	—	17·66	35·56	25·80	0·57	5·56	N 70 V	500–250	273–136	1146	1206	—
		50	—	17·66	35·53	25·78	0·56	5·54	N 70 V	750–500	410–273	1115	1144	—
		75	—	17·66	35·55	25·79	0·58	5·52	N 70 V	1000–750	547–410	1035	1114	—
		100	—	16·80	35·50	25·96	0·59	5·56	N 70 V	1500–1000	820–547	0927	1029	—
		150	—	14·73	35·41	26·37	—	5·52	N JAP	800–0	438–0	1020	1040	—
		200	—	14·02	35·34	26·46	—	5·42	N JAP	2000–0	1094–0	1042	1147	—
		300	—	13·25	35·25	26·55	—	5·36	N 100 H	0–5	0–3	0905	0915	—
		400	380	12·61	35·25	26·67	—	5·35	N 100 B	150–0	82–0	0903	0921	—
		500	469	11·92	35·10	26·70	1·01	5·36	EEL-100	0	0	1200	1209	—
		600	576	10·93	34·98	26·79	—	5·09	EEL-10	50	27	1210	1215	—
		800	775	8·95	34·75	26·95	—	5·06	EEL-1	103	56	1217	1230	—
		1000	957	6·23	34·47	27·13	1·72	4·64	—	—	—	—	—	—
		1200	1165	4·45	34·44	27·31	—	4·43	—	—	—	—	—	—
		1500	1434	3·18	34·55	27·54	2·25	4·09	—	—	—	—	—	—
		2000	1935	2·49	34·75	27·76	2·36	4·23	—	—	—	—	—	—
A 1245	23	0	—	15·92	35·50	26·17	0·45	5·60	N 70 V	50–0	27–0	0712	0716	—
		10	—	15·92	35·50	26·17	0·46	5·68	N 70 V	100–50	55–27	0717	0723	—
		20	—	15·92	35·50	26·17	0·56	5·70	N 70 V	250–100	136–55	0725	0736	—
		30	—	15·91	35·48	26·15	0·61	5·70	N 70 V	500–250	273–136	0739	0800	—
		50	—	15·91	35·52	26·18	0·62	5·75	N 70 V	750–500	410–273	1122	1147	—
		75	—	15·91	35·53	26·20	0·61	5·70	N 70 V	1000–750	547–410	1153	1232	—
		100	—	15·93	35·52	26·17	0·65	5·65	N 70 V	1500–0	820–0	1235	1333	—
		150	—	15·92	35·52	26·18	—	5·65	N JAP	600–0	328–0	0811	0827	—
		200	—	15·80	35·51	26·19	—	5·63	N JAP	1500–0	820–0	0828	0912	—
		300	292	14·45	35·49	26·48	—	5·46	N JAP	3000–0	1641–0	0913	1040	—
		400	386	14·07	35·38	26·48	—	5·46	N 100 H	0–5	0–3	1342	1352	—
		500	482	13·55	35·32	26·54	0·89	5·46	N 100 B	150–0	82–0	1340	1356	—
		600	591	12·91	35·22	26·60	—	5·41	N 200 B	500–0	273–0	1404	1458	—
		800	780	11·49	35·00	26·71	—	5·19	EEL-100	0	0	1045	1050	—
		1000	971	8·64	34·67	26·94	1·79	4·89	EEL-10	25	13	1051	1106	—
		1200	1178	6·11	34·46	27·13	—	4·60	EEL-1	55	30	1107	1117	—
		1500	1456	3·79	34·45	27·39	2·43	4·45	—	—	—	—	—	—
		2000	1916	2·79	34·63	27·63	2·59	4·15	—	—	—	—	—	—
		2500	2393	2·41	34·75	27·75	—	4·57	—	—	—	—	—	—
		3000	2908	2·05	34·78	27·81	2·13	4·57	—	—	—	—	—	—
A 1246	24	0	—	15·79	35·49	26·19	0·51	5·58	N 70 V	100–0	55–0	**1819**	**1827**	—
		10	—	15·79	35·50	26·20	0·51	5·64	N 70 V	50–0	27–0	0914	0916	—
		20	—	15·79	35·50	26·20	0·53	5·57	N 70 V	100–50	55–27	0917	0923	—
		30	—	15·79	35·50	26·20	0·52	5·57	N 70 V	250–100	136–55	0926	0936	—
		50	—	15·79	35·50	26·20	0·52	5·57	N 70 V	500–250	273–136	0943	1005	—
		75	—	15·79	35·49	26·19	0·60	5·57	N 70 V	750–500	410–273	1007	1037	—
		100	—	15·80	35·49	26·19	0·61	5·56	N 70 V	1000–750	547–410	1045	1126	—
		150	—	15·52	35·44	26·22	—	5·57	N 70 V	1500–1000	820–547	1133	1235	—
		200	—	15·34	35·42	26·23	—	5·50	N JAP	1000–0	547–0	**0425**	**0500**	—
		300	—	14·24	35·35	26·43	—	5·28	N JAP	2500–0	1367–0	**0502**	**0622**	—
		400	—	13·46	35·28	26·53	—	5·37	N JAP	4000–0	2187–0	**0625**	0840	—
		500	453	13·03	35·22	26·57	0·93	5·30	N 100 H	0–5	0–3	1302	1312	—
		600	554	12·25	35·11	26·64	—	5·13	N 100 B	250–0	136–0	1245	1315	—
		800	742	10·30	34·84	26·79	—	5·12	N 200 B	500–0	273–0	1715	**1815**	—
		1000	940	8·05	34·60	26·97	1·74	4·88	—	—	—	—	—	—
		1200	1047	6·54	34·49	27·10	—	4·43	—	—	—	—	—	—
		1500	1303	4·17	34·38	27·30	2·03	4·54	—	—	—	—	—	—
		2000	1776	2·91	34·59	27·58	2·25	4·05	—	—	—	—	—	—
		2500	2288	2·43	34·73	27·74	—	4·33	—	—	—	—	—	—
		3000	2956	1·92	34·76	27·80	2·11	4·47	—	—	—	—	—	—
		4000	3912	0·91	34·71	27·84	2·16	4·73	—	—	—	—	—	—

Station.	Position.	Date.	Hour.	Sounding (metres).	Wind. Direction.	Wind. Force (knots).	Sea. Direction.	Sea. Force.	Weather.	Barometer (millibars).	Air Temp. °C. Dry bulb.	Air Temp. °C. Wet bulb.	Swell.
		1961											
A 1247	37° 17·5′ S, 54° 36·0′ E.	8.vii	0817 (1801)	3640	290°	9	290°	1	bc	1035·3	13·7	10·3	220°,4.
A 1248	36° 48′ S, 52° 08′ E.	9.vii	0735 (1125)	310	340°	13	340°	2	c	1030·8	15·4	11·9	350°,1.
A 1249	36° 31′ S, 51° 10′ E.	9.vii	1606 (1951)	3200	260°	13	260°	2	bc	1028·7	16·1	12·6	210°,2.
A 1250	35° 55′ S, 48° 06′ E.	10.vii	0932 (1357)	3800	010°	05	010°	1	c	1026·7	15·1	13·7	240°,4.

Station.	Age of Moon (days).	Hydrological Observations. Depth (metres).	Depth by thermometer.	Temp. °C.	S°/₀₀.	σt.	Mg-atom/m³. P.	O_2 c.c./litre.	Gear.	Biological Observations. Depth. Metres.	Fathoms.	Time. From.	To.	Remarks.
A 1247	25	0	—	15·80	35·47	26·18	0·45	5·61	N 50 V	100–0	55–0	1234	1240	—
		10	—	15·80	35·48	26·18	0·55	5·61	N 70 V	100–0	55–0	1756	1801	—
		20	—	15·79	35·46	26·17	0·53	5·61	N 70 V	50–0	27–0	1227	1230	—
		30	—	15·79	35·48	26·18	0·55	5·61	N 70 V	100–50	55–27	1218	1225	—
		50	—	15·79	35·48	26·18	0·56	5·61	N 70 V	250–100	136–55	1159	1215	—
		75	—	15·77	35·47	26·18	0·66	5·61	N 70 V	750–500	410–273	1105	1135	—
		100	—	15·79	35·48	26·18	0·71	5·61	N 70 V	1000–750	547–410	0953	1030	—
		150	—	15·78	35·48	26·18	—	5·56	N 70 V	1500–1000	820–547	0850	0952	—
		200	—	15·15	35·39	26·26	—	5·39	N 70 V	500–0	273–0	1137	1157	—
		300	277	14·27	35·35	26·42	—	4·98	N 70 V	750–0	410–0	1035	1103	—
		400	375	13·21	35·21	26·53	—	5·17	N JAP	800–0	438–0	0933	0954	—
		500	468	12·27	35·10	26·64	1·15	5·27	N JAP	2000–0	1094–0	0955	1043	—
		600	570	11·07	34·93	26·73	—	5·17	N JAP	3000–0	1641–0	1044	1155	—
		800	765	8·74	34·65	26·90	—	5·12	N 100 H	0–5	0–3	0822	0830	—
		1000	922	6·45	34·47	27·10	1·95	4·78	N 100 B	250–0	136–0	0819	0841	—
		1200	1119	4·67	34·42	27·27	—	4·51	N 200 B	1500–0	820–0	1621	1748	—
		1500	1377	3·47	34·45	27·42	2·47	4·78	LL 6505	50–0	27–0	1300	1545	—
		2000	1849	2·71	34·63	27·64	2·51	4·29	EEL-100	0	0	1230	1235	—
		2500	2285	2·37	34·73	27·75	—	4·56	EEL-10	36	20	1236	1241	—
		3000	2776	1·90	34·74	27·80	2·36	4·75	EEL-1	75	41	1242	1255	—
A 1248	26	0	—	16·39	35·54	26·10	0·51	5·47	N 50 V	100–0	55–0	0759	0810	—
		10	—	16·39	35·54	26·10	0·51	5·61	N 70 V	50–0	27–0	0737	0740	—
		20	—	16·39	35·53	26·10	0·52	5·59	N 70 V	100–50	55–27	0741	0745	—
		30	—	16·39	35·52	26·07	0·52	5·51	N 70 V	250–100	136–55	0747	0757	—
		50	—	16·31	35·51	26·08	0·54	5·49	N JAP	515–0	281–0	0834	0840	—
		75	—	16·31	35·51	26·08	0·58	5·47	N 100 H	0–5	0–3	1055	1105	—
		100	—	16·29	35·52	26·09	0·57	5·48	N 100 B	250–0	136–0	1056	1120	—
		150	—	16·22	35·50	26·10	—	5·47	C 24	460	251	0813	0825	—
		200	—	16·17	35·49	26·10	—	5·47	D	450	246	0930	1015	—
		300	—	15·20	35·40	26·26	—	5·12	EEL-100	0	0	0845	0850	—
		400	—	13·77	35·29	26·48	—	5·21	EEL-10	37	20	0852	0900	—
									EEL-1	89	59	0905	0920	—
A 1249	26	0	—	16·81	35·56	26·01	0·53	5·71	N 50 V	100–0	55–0	1634	1638	—
		10	—	16·79	35·55	26·00	0·61	5·68	N 70 V	100–0	55–0	1925	1931	—
		20	—	16·79	35·55	26·00	0·62	5·68	N 70 V	50–0	27–0	1642	1645	—
		30	—	16·66	35·53	26·02	0·62	5·63	N 70 V	100–50	55–27	1646	1650	—
		50	—	16·39	35·51	26·06	0·64	5·54	N 70 V	250–100	136–55	1651	1700	—
		75	—	16·18	35·52	26·12	0·67	5·54	N 70 V	500–250	273–136	1701	1718	—
		100	—	16·12	35·51	26·12	0·76	5·54	N 70 V	750–500	410–273	1720	1743	—
		150	—	16·12	35·51	26·12	—	5·49	N 70 V	1000–750	547–410	1745	1827	—
		200	—	16·05	35·49	26·13	—	5·46	N 70 V	1500–1000	820–547	1828	1917	—
		300	283	15·85	35·47	26·16	—	5·51	N 70 V	100–50	55–27	1920	1924	—
		400	377	14·61	35·37	26·36	—	5·10	N JAP	800–0	438–0	1715	1734	—
		500	471	13·47	35·26	26·52	1·25	5·24	N JAP	2000–0	1094–0	1735	1830	—
		600	580	12·73	35·19	26·61	—	5·27	N JAP	3000–0	1641–0	1832	1950	—
		800	773	10·58	34·87	26·77	—	5·32	N 100 H	0–5	0–3	1606	1616	—
		1000	945	8·45	34·64	26·94	1·72	4·88	N 100 B	250–0	136–0	1607	1630	—
		1200	1153	5·97	34·49	27·17	—	4·54	—	—	—	—	—	—
		1500	(1433)	3·79	34·39	27·34	2·61	4·54	—	—	—	—	—	—
		2000	1905	2·78	34·63	27·63	2·95	4·24	—	—	—	—	—	—
		2500	2384	2·31	34·73	27·75	—	4·56	—	—	—	—	—	—
		3000	2873	1·95	34·75	27·80	2·41	4·78	—	—	—	—	—	—
A 1250	27	0	—	16·89	35·56	25·99	0·37	5·51	N 50 V	100–0	55–0	1303	1306	—
		10	—	16·89	35·55	25·98	0·41	5·65	N 70 V	100–0	55–0	1757	1804	—
		20	—	16·89	35·55	25·98	0·43	5·59	N 70 V	50–0	27–0	1255	1258	—
		30	—	16·89	35·54	25·98	0·44	5·55	N 70 V	100–50	55–27	1248	1254	—
		50	—	16·89	35·56	25·99	0·47	5·56	N 70 V	250–100	136–55	1236	1247	—
		75	—	16·89	35·55	25·98	0·52	5·61	N 70 V	500–250	273–136	1212	1234	—
		100	—	16·91	35·55	25·97	0·55	5·59	N 70 V	750–500	410–273	1139	1210	—
		150	—	15·87	35·46	26·15	—	5·15	N 70 V	1000–750	547–410	1100	1138	—
		200	—	15·08	35·41	26·29	—	5·08	N 70 V	1500–1000	820–547	1005	1059	—
		300	(285)	14·92	35·34	26·27	—	5·14	N 70 V	100–20	55–11	1751	1755	—
		400	(386)	13·85	35·19	26·38	—	5·18	N JAP	800–0	438–0	1120	1145	—
		500	483	11·91	35·06	26·67	0·99	5·13	N JAP	2000–0	1094–0	1147	1240	—
		600	591	11·15	34·94	26·72	—	4·99	N JAP	3000–0	1641–0	1242	1356	—
		800	788	8·77	34·69	26·93	—	4·93	N 100 H	0–5	0–3	0934	0944	—
		1000	968	5·89	34·44	27·14	1·95	4·65	N 100 B	250–0	136–0	0933	1000	—
		1200	1188	4·34	34·41	27·30	—	4·44	N 200 B	500–0	273–0	1637	1745	—
		1500	1460	3·25	34·49	27·47	2·29	4·20	LL 6505	50–0	27–0	1015	1330	—
		2000	1964	2·68	34·67	27·67	2·13	4·28	EEL-100	0	0	1000	1005	—
		2500	2411	2·36	34·74	27·76	—	4·48	EEL-10	32	17	1006	1014	—
		3000	2955	1·62	34·74	27·82	2·08	4·65	EEL-1	69	38	1015	1030	—

Station.	Position.	Date.	Hour.	Sounding (metres).	Wind.		Sea.		Weather.	Barometer (millibars).	Air Temp. °C.		Swell.
					Direction.	Force (knots).	Direction.	Force.			Dry bulb.	Wet bulb.	
		1961											
A 1251	35° 04′ S, 44° 17′ E.	11.vii	0934 (1335)	1140	300°	18	300°	3	bc	1019·5	17·5	15·8	250°,1.
A 1252	34° 17′ S, 40° 46′ E.	12.vii	0930 (1555)	5000	200°	13	200°	2	c	1027·5	16·1	12·1	230°,4.
A 1253	33° 35′ S, 37° 51′ E.	13.vii	0550 (1235)	5200	020°	9	020°	2	c	1024·8	17·0	13·2	No observation.

Station.	Age of Moon (days).	Hydrological Observations.							Gear.	Biological Observations.				Remarks.
		Depth (metres).	Depth by thermometer.	Temp. °C.	S°/₀₀.	σt.	Mg-atom/m^3. P.	O_2 c.c./litre.		Depth. Metres.	Depth. Fa-From.	Time. From.	Time. To.	
A 1251	28	0	—	17·43	35·59	25·88	0·53	5·49	N 70 V	100–0	55–0	1742	1747	—
		10	—	17·43	35·58	25·87	0·55	5·54	N 70 V	50–0	27–0	1116	1119	—
		20	—	17·42	35·57	25·87	0·53	5·56	N 70 V	100–50	55–27	1120	1122	—
		30	—	17·42	35·57	25·87	0·65	5·51	N 70 V	250–100	136–55	1250	1303	—
		50	—	17·42	35·58	26·87	0·66	5·51	N 70 V	500–250	273–136	1230	1249	—
		75	—	17·40	35·57	25·87	0·69	5·51	N 70 V	750–500	410–273	1043	1111	—
		100	—	17·30	35·56	25·89	0·78	5·46	N 70 V	1000–750	547–410	1002	1042	—
		150	—	17·12	35·55	25·92	—	5·34	N 70 V	250–190	136–103	1124	1135	—
		200	—	16·70	35·51	25·98	—	5·03	N 70 V	250–180	136–98	1205	1215	—
		300	238	16·04	35·49	26·13	—	4·93	N JAP	600–0	328–0	1103	1121	—
		400	319	14·77	35·42	26·37	—	5·03	N JAP	1500–0	820–0	1122	1204	—
		500	414	13·91	35·24	26·40	1·42	5·17	N 100 H	0–5	0–3	0935	0946	—
		600	507	12·94	35·23	26·60	—	5·07	N 100 B	250–0	136–0	0935	0958	—
		800	604	12·15	35·10	26·66	—	5·00	N 200 B	500–0	273–0	1635	1740	—
		1000	788	9·70	34·79	26·86	2·39	4·76	EEL-100	0	0	1000	1005	—
		1200	989	7·27	34·66	27·13	—	4·51	EEL-10	31	17	1006	1012	—
		1500	1238	4·50	34·40	27·27	3·16	4·63	EEL-1	69	37	1013	1025	—
									D	600	328	1455	1550	—
									LL 6505	20–0	11–0	1010	1300	—
A 1252	29	0	—	18·03	35·58	25·72	0·48	5·31	N 70 V	100–0	55–0	1752	1756	—
		10	—	18·03	35·58	25·72	0·50	5·37	N 70 V	50–0	27–0	1306	1312	—
		20	—	18·03	35·58	25·72	0·51	5·35	N 70 V	100–50	55–27	1257	1305	—
		30	—	18·03	35·57	25·72	0·51	5·32	N 70 V	250–100	136–55	1240	1255	—
		50	—	18·03	35·57	25·72	0·54	5·37	N 70 V	500–250	273–136	1214	1239	—
		75	—	18·03	35·58	25·72	0·61	5·33	N 70 V	750–500	410–273	1144	1211	—
		100	—	18·05	35·58	25·72	0·71	5·37	N 70 V	1000–750	547–410	1102	1141	—
		150	—	18·06	35·57	25·71	—	5·46	N 70 V	1500–1000	820–547	1001	1055	—
		200	—	17·97	35·56	25·73	—	5·39	N JAP	2500–0	1367–0	1149	1254	—
		300	—	16·29	35·49	26·07	—	4·91	N JAP	4000–0	2187–0	1256	1450	—
		400	—	15·16	35·39	26·25	—	4·84	N 100 H	0–5	0–3	0930	0940	—
		500	(475)	14·74	35·28	26·25	1·33	4·95	N 100 B	250–0	136–0	0930	0949	—
		600	570	12·86	35·19	26·59	—	4·94	N 200 B	500–0	273–0	1500	1555	—
		800	765	10·52	34·88	26·79	—	5·07	LL 6505	20–0	11–0	1000	1430	—
		1000	959	8·10	34·63	26·99	2·63	4·78	EEL-100	0	0	0955	1000	—
		1200	1149	6·00	34·52	27·19	—	4·42	EEL-10	42	22	1002	1009	—
		1500	1440	3·69	34·44	27·39	2·77	4·27	EEL-1	85	46	1010	1020	—
		2000	1902	2·97	34·67	27·65	2·98	4·03	—	—	—	—	—	—
		2500	2384	2·63	34·78	27·75	—	4·65	—	—	—	—	—	—
		3000	2847	2·31	34·82	27·83	2·47	4·84	—	—	—	—	—	—
		4000	3775	1·47	34·76	27·84	2·82	4·86	—	—	—	—	—	—
A 1253	1	0	—	19·99	35·48	25·14	0·54	5·28	N 50 V	100–0	55–0	0928	0935	—
		10	—	19·99	35·51	25·16	0·57	5·31	N 70 V	100–0	55–0	0558	0604	—
		20	—	19·97	35·50	25·17	0·56	5·31	N 70 V	50–0	27–0	0855	0858	—
		30	—	19·97	35·49	25·16	0·64	5·26	N 70 V	100–50	55–27	0844	0849	—
		50	—	19·97	35·52	25·18	0·69	5·26	N 70 V	250–100	136–55	0831	0843	—
		75	—	19·49	35·51	25·29	0·70	4·96	N 70 V	500–250	273–136	0809	0829	—
		100	—	18·91	35·51	25·44	0·74	4·96	N 70 V	750–500	410–273	0737	0807	—
		150	—	17·68	35·53	25·78	—	4·74	N 70 V	1000–750	547–410	0701	0735	—
		200	191	16·93	35·52	25·94	—	4·81	N 70 V	1500–1000	820–547	0605	0658	—
		300	291	15·94	35·47	26·14	—	4·84	N 70 V	50–20	27–11	0851	0854	—
		400	389	14·43	35·35	26·39	—	4·84	N 70 V	750–500	410–273	0859	0926	—
		500	482	13·38	35·25	26·54	1·77	5·01	N 70 V	100–0	55–0	1751	1756	—
		600	581	12·21	35·11	26·65	—	4·96	N JAP	400–0	219–0	0851	0901	—
		800	780	10·14	34·84	26·81	—	4·96	N JAP	1000–0	547–0	0826	0850	—
		1000	973	7·65	34·59	27·02	2·51	4·69	N JAP	2500–0	1367–0	0728	0825	—
		1200	1184	5·43	34·46	27·20	—	4·22	N JAP	4000–0	2187–0	0548	0727	—
		1500	1455	3·77	34·50	27·43	3·29	4·02	N 100 H	0–5	0–3	1012	1022	—
		2000	1955	3·01	34·69	27·65	3·29	3·97	N 100 B	250–0	136–0	1011	1035	—
		2500	2440	2·62	34·76	27·75	—	4·59	N 200 B	500–0	273–0	1115	1235	—
		3000	2940	2·32	34·81	27·82	3·36	4·96	N 200 B	500–0	273–0	1640	1745	—
		4000	3912	1·35	34·75	27·85	3·04	4·96	EEL-100	0	0	0925	0934	—
									EEL-10	32	17	0935	0945	—
									EEL-1	65	34	0950	1005	—
									LL 6505	100–0	55–0	0630	1045	—

Station.	Position.	Date.	Hour.	Sounding (metres).	Wind.		Sea.		Weather.	Barometer (millibars).	Air Temp. °C.		Swell.
					Direction.	Force (knots).	Direction.	Force.			Dry bulb.	Wet bulb.	
		1961											
A 1254	33° 01′ S, 34° 49′ E.	14.vii	0700 (1730)	1260	320°	18	320°	3	c	1011·0	20·9	19·5	320°,3.
A 1255	32° 22′ S, 32° 48′ E.	15.vii	0530 0935	3540	230°	18	230°	3	c	1016·0	18·2	13·8	No observation.

Station.	Age of Moon (days).	Hydrological Observations.							Gear.	Biological Observations.				Remarks.
		Depth (metres).	Depth by thermometer.	Temp. °C.	S°/₀₀.	σt.	Mg-atom/m³. P.	O_2 c.c./litre.		Depth. Metres.	Depth. Fathoms.	Time. From.	Time. To.	
A 1254	2	0	—	19·19	35·53	25·40	0·47	5·27	N 70 V	50–0	27–0	0707	0711	—
		10	—	19·17	35·53	25·40	0·50	5·42	N 70 V	100–50	55–27	0737	0742	—
		20	—	19·11	35·53	25·42	0·47	5·40	N 70 V	250–100	136–55	0722	0735	—
		30	—	19·04	35·52	25·42	0·48	5·36	N 70 V	500–250	273–136	0843	0909	—
		50	—	18·97	35·53	25·46	0·51	5·36	N 70 V	750–500	410–273	0912	0944	—
		75	—	18·75	35·54	25·52	0·53	5·22	N 70 V	1000–750	547–410	0948	1027	—
		100	—	18·51	35·54	25·58	0·61	5·31	N 70 V	100–80	55–44	0712	0721	—
		150	—	17·72	35·51	25·74	—	4·73	N JAP	500–0	273–0	0750	0810	—
		200	192	16·93	35·51	25·93	—	4·70	N JAP	1200–0	656–0	0810	0844	—
		300	297	15·81	35·46	26·16	—	4·85	N 100 H	0–5	0–3	1039	1049	—
		400	391	14·21	35·32	26·40	—	4·87	N 100 B	250–0	136–0	1038	1100	—
		500	488	13·31	35·26	26·55	1·35	4·94	N 200 B	500–0	273–0	1110	1250	—
		600	587	12·11	35·10	26·66	—	4·82	N 200 B	500–0	273–0	1630	1730	—
		800	787	9·73	34·80	26·87	—	4·91	C 24	1460	798	1302	1330	—
		1000	973	7·04	34·56	27·09	2·68	4·32	D	1300	711	1420	1550	—
		1200	1186	5·13	34·48	27·27	—	4·12	LL 6505	50–0	27–0	1600	1620	—
A 1255	3	0	—	22·30	35·40	24·46	0·49	5·26	N 70 V	50–0	27–0	0733	0736	—
		10	—	22·30	35·40	24·46	0·51	5·23	N 70 V	100–50	55–27	0635	0640	—
		20	—	22·30	35·40	24·46	0·52	5·21	N 70 V	250–100	136–55	0641	0655	—
		30	—	22·30	35·41	24·47	0·59	5·21	N 70 V	500–250	273–136	0657	0725	—
		50	—	22·30	35·41	24·47	0·61	5·21	N 70 V	50–30	27–16	0727	0731	—
		75	—	21·77	35·45	24·64	0·59	4·81	N JAP	600–0	328–0	0611	0634	—
		100	—	21·35	35·43	24·74	0·62	4·69	N JAP	1500–0	820–0	0635	0725	—
		150	—	19·82	35·43	25·15	—	4·22	N JAP	3000–0	1641–0	0726	0912	—
		200	186	17·97	35·52	25·69	—	4·47	—	—	—	—	—	—
		300	(275)	16·41	35·54	26·09	—	4·74	—	—	—	—	—	—
		400	368	14·95	35·43	26·33	—	4·79	—	—	—	—	—	—
		500	467	13·75	35·33	26·51	0·98	4·91	—	—	—	—	—	—
		600	575	12·55	35·20	26·66	—	4·91	—	—	—	—	—	—
		800	759	10·43	34·91	26·82	—	4·76	—	—	—	—	—	—
		1000	947	7·85	34·63	27·03	2·24	4·47	—	—	—	—	—	—
		1200	1160	5·63	34·61	27·32	—	4·32	—	—	—	—	—	—
		3400	3175	1·97	34·83	27·86	2·70	4·93	—	—	—	—	—	—