I

Indexed for displays
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(1)
(1)

Cephalopoda

May 15, 1971
Porvenir (San Blas).

Making a brief visit to the island ca 1:00-1:30 p.m. Swimming near hotel (perhaps 50-75 ft. from hotel landing). Sky very overcast, but no rain (altho there was rain both earlier and later during the day — and this has been a particularly rainy May) Extensive area of turtle grass. Water: 5-15 ft. deep; moderately clear (visibility up to 30 ft. at times?)

Come across group of 5 squid. Sepiotheuthis ? Quite large and cuttle-fish-like. 15"-24"?

Group divided 3-1-1.

All the animals were associating with one another. But some much more closely than others. A "nucleus" of 3 individuals. Plus 2 others which were more "peripheral", apparently not more interested in one another than in me (see below) or the nuclear group.

I think that the "nucleus" was a courting party. Always same 3 inds. swimming very close together (6"-2' apart), in the same order. A very large individual (♀?) in the lead. Call this "1". Followed by a smaller individual, performing much more elaborate behavior. Call this "2". Followed by a third indiv

Ceph., May 18, 1971, II

(2)

dual, of the same size as the [illegible] (3 lbs?) 3 should think that 2 and 3 may have been ♂'s.

The males followed a very irregular course, swimming rapidly, all with middle [illegible], within a fairly limited area (60 ft.?) most of the time. Circles, figures-of-eight, irregular zig-zags, etc.

No. 1 just swam rapidly. No signs of display. Generally rather dark and nondescript (with blue spots on mantle?,??). No. 2 swam in an extremely distinctive manner. Obviously using funnel. But with exaggerated "fluttering" of fins. No. 3 swam in the same "normal" manner as 1, usually not quite as close to 2 as 2 was to 1. No. 2 usually was generally pink, blue, lavender, in very tiny dots. Flushing a little bit, but all very delicate (except when in "Zebra" — see below). No. 3 was always or almost always in a pattern which might be called "Pheasant". Rather yellowish, with irregular, broken up, often broad, transverse brown stripes across back, and an irregular white stripe (or series of discontinuous stripes and spots), longitudinal, down the center of the back. Plus bright yellow (ill-defined) spots above eyes.

Every now and again, 2 would stop and/or squirt forward, and give a "Zebra" display to 3. Black and white transverse stripes on all or almost all arms, probably not tentacles, perhaps not hectocotylus (eyes?)? Very conspicuous. Arms spread. Longest outside? At the same time assuming (adopting) low

Cephl., May 18, 1971, III.

(3) (3)

nucleus & nucleus!

extreme (dilled) version of some type of stimulus on back. I guess that this sort of display is threat. Perhaps in all cephalopods?

No. 3 always stopped, or perhaps even retreated, momentarily, in response to the feeding. As far as I could tell, it did not display back.

The usual swimming of these three animals was also interrupted from time to time by brief bursts of foam and movements. Perhaps accompanied by some smooth up and down "rocking". I can't guess at the significance of this.

When the animals were seen first, they fed occasionally, shooting out the tentacles with fast "stabbing" motions. But this stopped after a few minutes. None of the members of the nucleus did any more feeding during the rest of the period that they were observed (meaning continuously for approximately 45 mins.).

Apart from feeding, I don't think that I ever saw the tentacles of any of the animals at any time.

The two individuals which were not part of the nucleus were observed fascinated by me. One of them, no. "4", spent most of the time just hovering, looking at me, from a distance of only a few feet or yards

Ceph, May 18, 1971, IV

(4) (4)

Only moved around very occasionally (although it did follow the nucleus around, once, for a couple of minutes). At least while watching me, it was generally rather dark, grayish, indistinctly mottled, with very numerous small but conspicuous, apparently iridescent bright light blue spots, even scattered over back and perhaps fins (I think that I shall call this pattern "Oscillated").

The remaining individual, no. "5", stayed much less close to me. Usually in "Pheasant" pattern, without yellow above eyes. (Is "Pheasant" an alarm display, at least agonistic with escape relatively strong?). Sometimes hovered with many of its arms curled upward at the tips. Sometimes conspicuous because undersides of arms are whitish. Suckers revealed.

All the squid disappeared in a flash when a large barracuda appeared.

June 11, 1971
San Blas

Worked at three islands today: Yantupo (Carti) and Naranjo Chico in the morning, and Porvenir (same site as in May) in the afternoon. More or less cloudy all morning; sunny during the first part of the afternoon. Water dirty at Yantupo and Naranjo, clear at Porvenir.

Squid seen at all three areas. Apparently all

Eph., June 11, 1971, II.

(5)

Lepidentus.

GENERAL NOTES. Perhaps the most interesting data obtained today were concerned with social organization. The species certainly is highly gregarious. But groups are organized in age classes. I could recognize three categories: large (ca. 12"?), medium (8-9"?), small (3-4"?). The individuals within each category may differ, but the gaps between them seem to be rather well marked on the whole. Are these annual classes??? If so, then the species must have a single definite breeding season.

Inds. of different age classes may associate in the same school. But they do not mix completely. Inds. of the same age class stick together to form sub-groups within a school. And such sub-groups may separate from time to time.

The spatial organization of inds. is characteristic. Often in line or semi-circle; inds. usually (at least when swimmer present) facing in same direction. Occasionally facing in opposite direction. Commence:

or

Cephs., June 11, 1971, III

(6)

or

They do not appear to be very active most of the time. Perhaps all the kids seen today were simply fascinated by our appearance, and couldn't bear to tear themselves away. But they did not appear to be greatly upset most of the time.

This may suggest that they do not continuously search or hunt for prey over very long distances. But rather wait for the prey to approach them, and then advance to attack over short distances. See also below.

NARRATIVE:

Yantripo. Find group of 24 squid. 3 large and 21 medium. The 3 large ones all together at one end of the line of the group. All individuals more or less plain brown on back and sides, the top of the head and the

arms and tentacles, and the proximal part of the fins.
Notes. The fins extend to the front edge of the mantle, just as in cuttlefish. The tentacles are always visible, even when retracted.) The brown of the back and probably the fins, is spotted with blue "ocelli". On the back, these are arranged in transverse rows. . . . . .

. . . . .

All the individuals . . . . . .
show traces of a longit-
udinal whitish or yellowish stripe down the center of the back. This may be continuous or interrupted. It is not inconspicuous, but neither is it exaggerated, most of the time. The distal edge of the fins also is colorless or whitish. This may give the impression of another longitudinal light stripe when viewed from the side.

I shall call this pattern "Ordinary" ("ORD").

Suddenly a 4th large ind. appears. Joins the other 3 large. Then suddenly swims forward, toward me changes color. Becomes yellowish with large irregular dark brown blotches. (This may be what I called "Pheasant" — "PH" — earlier.) Also curls up tips of arms. Then shoots out tentacles, grabs fish. A silver anchovy type, probably 1/3-1/4 of its own (total) length. Fish is bitten immediately and does not struggle at all. The squid changes back to ORD immediately after the capture and rejoins its group and sub-group. None of the other members of the school makes any attempt to steal the

Cephs., June 11, 1971, V.

(8)

food! The fish is held in the arms, more or less [illegible] ally. Feeding is slow and/or begins late. Most of the fish is still visible 10 mins. after capture. When feeding does start, it begins with the head.

NOTE: Audio says that he has been watching 2 other large squid some distance away.

Now I see that some of the medium squid have yellow patches above the eyes. (These are really [illegible] Ex. Large, iridescent or "brass", surrounded by cut blue and green which is not always conspicuous on the water. I shall call this pattern "Y".)

Then all the large squid disappear. A few minutes later, the medium ones come closer to me. Most with rather exaggerated Y sup[illegible] superposed upon ORD. Several curl their arms upward and backward above their heads ("Curl").

This pattern is not always paired by any "real" color change. But the underside of the arms is conspicuously light.

Sat. June 11, 1971, VI.

Several uds. also show another pattern; "Point with angle change in lower-intensity

One ud. suddenly shows a brief trace of PH when a fish comes close. See also below.

Now the animals seem to be relaxing to have one quite close about my presence. And Y has gone!

Then a much smaller squid of the same species appear. Stay together on the outskirts of the school.

All these observations are made in an area of water 3'-9' deep. Bottom covered with Turtle Grass.

Arundio sees 3 large squid some distance away. The same 3 uds. seen with this school earlier ???

Cephl. June 11, 1971, VII

(10)

The squid here seem to ignore better a cylinder and a (water-drawn) wading school is getting near me. Further evidence that they cannot hear?

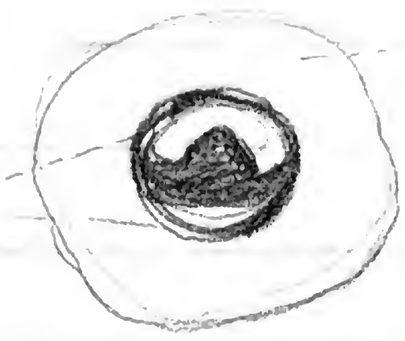
Navango Cuco. Some 20 in school of 14 more or less medium squids. (Some mature in age. Squids graded from left to right.

..... etc.

All in ORD. Some with Y.

Arcadio shoots one squid. It squirts ink when hit. The others retreat a few feet or yards without change of color. I.E. the sight of ink does not induce mechanism panic.

The eye of the species is rather peculiar. In the dead specimen comme ça:



iris & pupil (pupil black, iris white or silver).

light area, presumably eyeball covered with film

In live squids, the pupil is much less noticeable. Perhaps comme ça:

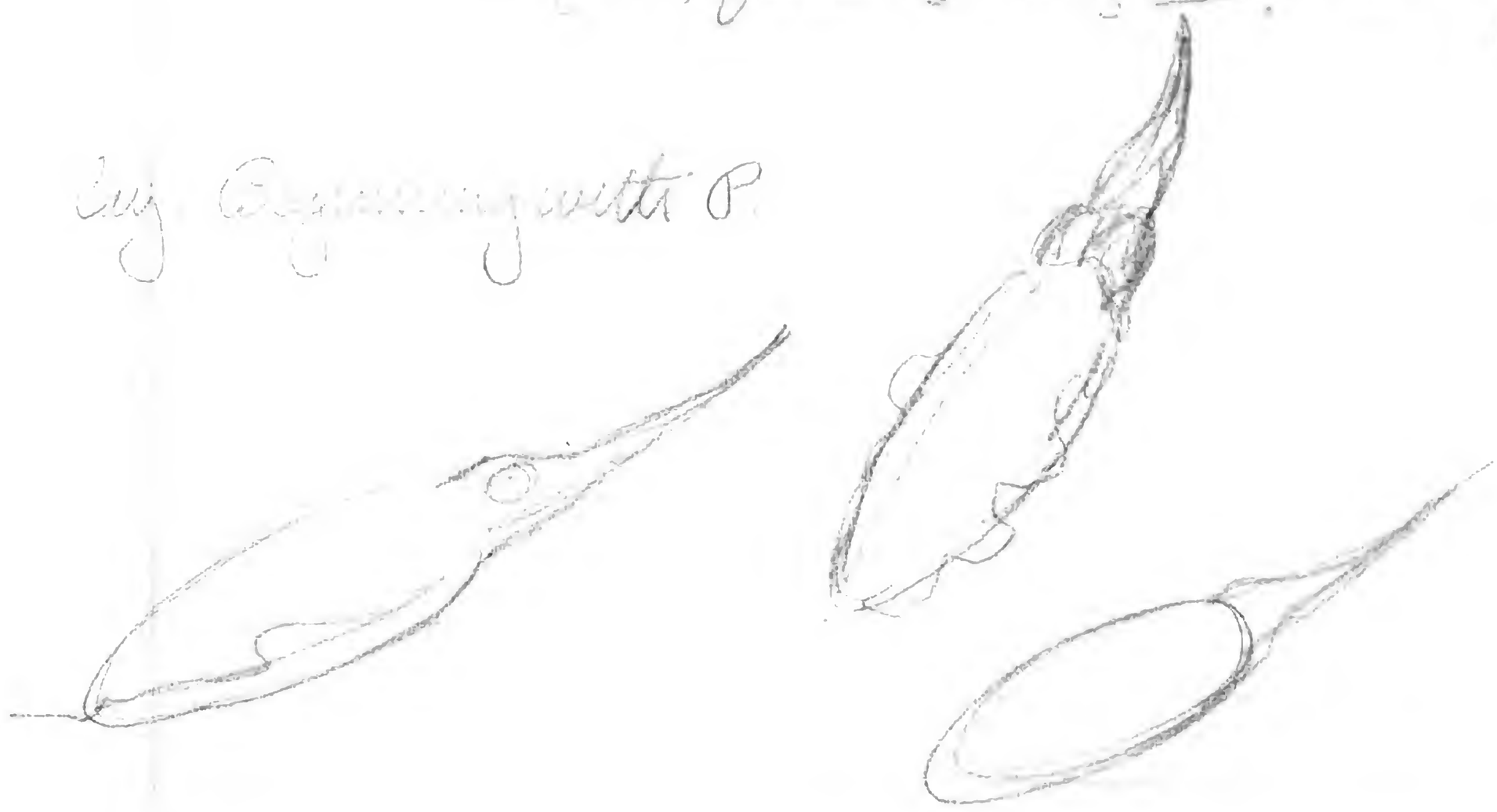
???

Porvenir. Find 3 medium size squid looking at me as usual, in ORD. Not much reaction at first. Then 2 or perhaps all 3 of the squids start to disp-

Sat. June 11, 1977 VIII.

(11) (11)

Leg. Oyamaguchi P.



Then switching to a reversible "elephantine" ("E") posture. Apparently high intensity. Followed by rather extreme P's. And then by less extreme ones.

It is characteristic of all these P's and E's that the tail end is down. Is this a display in itself?

(The normal, relaxed or semi-relaxed posture of the species may be with tail slightly up and head and arms slightly down.

Both the E's and P's were done most frequently by animals with their backs toward me and toward their companions. White median line particularly prominent ("WS") These animals seem to be consciously "showing off" their back patterns.

Ceph., June 11, 1971, 1X

(12)

(12)

Then 2 small kids appear, coming from [illegible] a beyond the medium. One appears [illegible] and G with Paul behind. Cat Tail and WS. I feel that that this display with the [illegible] rather than to me.

Then I assume [illegible] with Y and WS.

I notice that one of the [illegible] stays closest to me. [illegible] has been [illegible] ed but seems to have received [illegible] at least 1 or 2 arms on left side.

Then the animals accelerate their retreat. At same time turn generally paler ("Pale") throughout.

Now the man small in limbical as a Pelvis all the time. Can P be submissive?

Then there is an E-P sequence by one of the mal-uns. Both postures with back shown to Cat Tail and other kids in the school.

20 ft away, we see a group of at least 7 small kids. One does lots of E. All with WS and

Cephs., June 11, 1974, X

(13) (13)

Back to [illegible] companions. Followed by P's [illegible]

P's and L's sequences may be typical. [illegible] Squids joins the others [illegible] P's back & back. One also [illegible] E. You [illegible] squirts.

Squids do P's to our surprise

Suddenly there is a general panic. Apparently triggered by [illegible] P. [illegible] 4,

A few minutes later, our little medium goes "dynamite" ("DM") [illegible] that provokes this. Whole [illegible] is colorless or whitish, except for 2 large dark spots fore and rear. (Possibly these spots are on sides of body rather than fins. But I don't think so.)

Perhaps with trace of E.

Some time during this general period one of the mediums assumes a "devilfish" posture after performing P.

Ceph., June 11, 1971, XI

(14) (7)

"DF"

I know that I have seen this at least once before in lobsters. Probably during the last (or 2 PS and 1 D) When I start to chase the [illegible] they escape rapidly. Yes Cable and also Cuff. DM!

I repeat these again & again & again. Almost all of them induce DM to one or more inds. DM is not always symmetrical. Spot can be much larger on one side than the other. Can be combined with ORD-Y-WS. Also seems to intergrade with PH!!! Often blotches appear on body at same time as DM spots!

NOTE: Some of the small inds. tend to be much yellower than others most of the time. Is this physiological motivational variance??

SUMMARY: What do I think about displays now? Y, WS, and Pale are large usage. Pale presumably higher intensity than the other two. P may be submissive in Cable and DF probably are related to PR "Zebra" ("Z") presumably is aggressive. Perhaps PH is also aggressive, although less so than Z. DM must be moderately high intensity — or perhaps more — with attack less minimal than in Y, WS, and Pale. E may be moderate intensity, again with attack less minimal than in Y, WS, and Pale, but perhaps relati

Ceph. June 11, 1971, XII

(15)

(15)

[illegible] "Pastel flushing" must be see[illegible]

[illegible] seem to figure all fishes even a bulls eye, [illegible] and [illegible]

June 12, 1971
San Blas

Started out [illegible] off [illegible] Matapa Peninsula, on [illegible] side of Mt. [illegible] clouds. The water is [illegible] water ca. 2:00 am. Continue [illegible] until 10:00 am.

Come across group of 17 squid (usual Sepioteuthis type) almost immediately. At 8-9 ft of water. One turtle grass. Near edge of coral reef group includes approximately a dozen, 11 medium. Large inds. seem to be in pairs. Pairs tend to be on outskirts of group slightly apart from the main mass. Sometimes all the pairs are on one side of the group. More often scattered along several sides. The 2 inds. of a pair usually stick close to one another.

Inds. of the main mass tend to string out in lines, just like the groups seen yesterday.

All the (medium) inds. of the main mass are in ORD. So are some of the large inds, some of the time (see also below). Some inds. in ORD have Y and/or WS. Some also do brief P's from time to time. Can't tell if these are

Aph., June 12, 1971, II

(16)

[illegible] on the Red Tower [illegible] Collier [illegible] the school.

Then [illegible] group [illegible] large about 20 ft away.

Follow 2 pairs swim [illegible] All [illegible] swim normally most of [illegible] are a few bursts of swimming with [illegible] ("Flutter"). [illegible] turns lights [illegible] ("Pastel") along [illegible] lighter [illegible] 5:

The "eye ridge" of the Pastel side of the body is very conspicuously silver, iridescent.

This display lasts for only a few seconds. Then the 2 pairs gradually diverge.

A barracuda appears and everything [illegible] scattered. See what must be largely same 5 or 6 same and approximately 15 mins. later. But now it includes at least 36 inds.! At last 6 smalls as well as the mediums and large inds.

General organization more or less as before. Smalls

[illegible] very small, appears around outline. Illuminated [illegible] O.D. Pattern dark. Very little for 1/3 days [illegible] bottom [illegible] and small sub-[illegible] (Cant see entire area) [illegible] (and [illegible] and bottom and an apparent) [illegible] out. Looks to actual bleeding or stubs.

Pattern changes are [illegible] bottom edge, [illegible] Flattening [illegible] [illegible] Flashes of more orange. Total [illegible] The partial is extremely variable. Some times (as above) it is one side of the body which turns light. Sometimes it is the arms and tentacles. Most frequently it is a localized area at the rear tip of the body, a sort of "rear light" ("RL"). RL is frequent, assumed, and long continued by both members of a pair. Some inds. who have shown unilateral or weak general lightening of the body continue to have comparatively broad and conspicuous lateral median stripes after the rest of the body has returned to ORD. I do not think that I can distinguish this from "conventional" WS. But it may not have the same sexual significance.

In all pairs, one ind. usually leads while the other usually follows. In at least 2 pairs, the following ind. is larger than the followed. (In contrast with May observation. What does this suggest about ♂-♀ roles?)

Some inds. of some pairs containing stuck together

Cephs., June. 12, 1971, IV

(18) (18)

for more than ½ hour. Still I know you are "permanent".

But there outside, a some "Pudit" for a good time. One wd. of a pair gets separated from its partner. Finally after another pair. One wd. of the Cattery repeats the "[illegible]" [illegible] rapid forward darts after [illegible] of the "[illegible]" pair. It returns to [illegible] Finally [illegible] abandoned individual transfers its attention to [illegible] yet another pair. [illegible] the abandoned and remains [illegible] "pulsing" ORD, then [illegible] a pair it follows. Eventually, it is found (re-found) by a single large in Pale or semi-Pastel.

There are some Paud attack moves between members of one pair. Each time, the attacked shows traces of SPH while retaining RL!!!

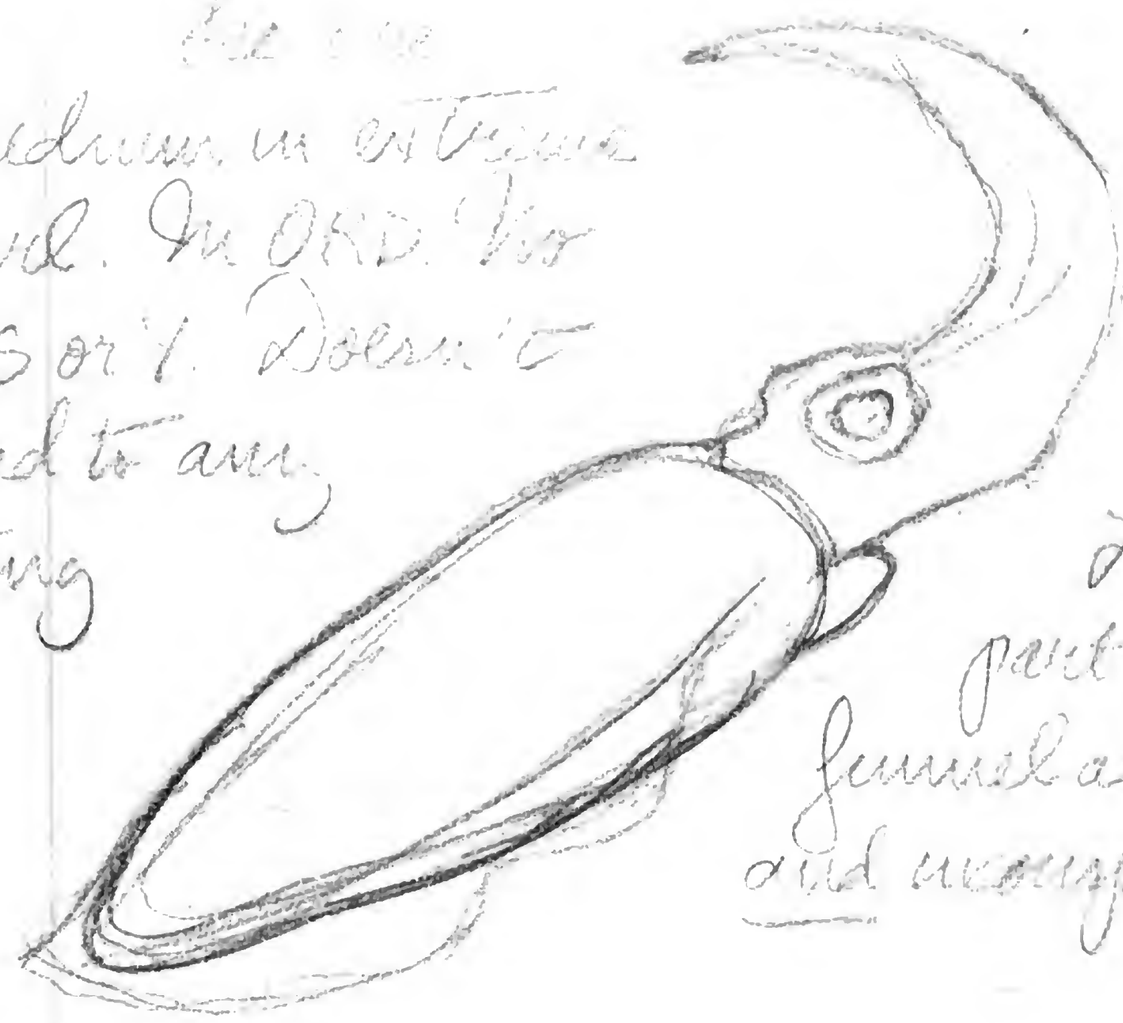
Observations interrupted temporarily. Resume approximately ½ hr later.

Follow a pair (large, of course) One member of pair turns completely Pastel. I have not this morning been able to distinguish real flushes of different colors or tones in Pastels, although they may be occurring. I presume that Pastels are sexual or closely related. But they are low intensity on the average this morning. Easily inhibited by even slight degree of alarm. Inds. show this behavior only when relatively far away from me. Alarm seems to inhibit sexual behavior more easily or frequently than it does feeding. (See below.) The Pastel ind. darts toward its partner. The Cattery leaps away with extreme RL. The first ind. goes back

Cph., June 12, 1971, V.

with OR [illegible] on [illegible] the second when so still [illegible]

medium or [illegible] Aud. or ORD. for WS or V. Doesn't lead to any thing



The part of the eyeball which is covered with skin is conspicuous Light colored. Looks like part of the exposed eyeball. The funnel also is quite large. But light and inconspicuous.

One large wid. behaves similarly with a similar absence of visible results.

Then one medium does P with WS. Again no results. Get a good view of feeding behavior. A moderately large school of very small minnows appears. Swimming near surface of water. Well above the squid which are 6-10 ft down. Squid tend to retreat in front of school of minnows as the latter advances. But every once in a while a small or medium squid will dart forward and upward and seize a minnow. Usually paling just as it shoots its tentacles. This behavior would seem to confirm the suggestion made yesterday that these squid tend to wait for their food to come to them rather than relentlessly hunting it down. And it also suggests that the PH with

Cpl., June 12, 1971, VI

(20) (20)

feeding seen yesterday was a matter to me rather than to the prey.

General panic. All inds. shoot away several yards. All Pale with Yand MS showing. Black Pom. subsides now, quickly.

Now there is chaos. A series of reactions which I cannot catch. Turn around to see 2 Cargo inds. almost in contact. One above the other. Facing same direction. Both with arms spread ("Spread"). Sharply contrasted in black and white. The upper ind. is generally darker than the lower. Spread is pure and "typical". 2. Lower ind. has arms almost white with much more scattered black patches. Upper ind. probably has modified 2 or PH pattern (see below) on back. Lower ind. probably has whiter, although perhaps equally mottled, back. The two upper darts down to the corner, apparently trying to bite it. Then the reverse occurs. Immediately the 2 inds separate with puffs of ink ("Ink").

This could have been a cop. attempt by the two members of a pair, or, perhaps more probably, a fight between members of different pairs.

A few seconds later, same area, see 2 pairs not far apart. Once, an ind. of one pair approaches another. The approached ind. immediately does Spread with 2 on arms and a PH type pattern on back. The approacher retreats. Approached goes back into more ORD blue color and stops Spread. Then the whole process is repeated. Then the 2 pairs

Cafh., June 12, 1941, VII

(21)

separate

Observed nursing. Twins, medium dorsum DF before nursing

One, a medium dorsum CWL before nursing. With little or no color change except. Was this intended? I rather think so.

Note. DF may be an exaggeration of a normal "pre-sequence" int. now. Upper pair sometimes lifted slightly above and apart from other before apparently intentionally gel at ask upon you.

One large ad. turns almost completely white, retaining only a black blotch toward the front of the mantle.

"Pie" see below

Swims near other larger in normal way. Apparently provokes spread, with Z on arms and PH-type pattern on back, by one of the kids. it passes.

Later, one member of a pair turns whitish all over. Apparently provokes spread, with Z on arms and PH-type pattern on back, by its partner.

COMMENT: Obviously I am having trouble in distinguishing some of the color patterns. Two major difficulties. (1) Pale-Pastel (2) Z-PH

Cephl., June 12, 1971, VIII

(22) (22)

(1) I really don't know if Pale (and WS) and [illegible] are closely related or not. Possibly all the bulbous, gutted eyes of the species are the light-day — night to provide contrast with the generally rotten dark ORS. Compare vocalization vs. silence in Cephl.

(2) I am no longer sure that there are only 2 conversional Z on back. Perhaps they cannot become more intense than OH on the back. If so, perhaps one also should distinguish only 2 displays of this type. A. "True" OH. Mottling of back only, without spread or conspicuous change in color or pattern of arms and tentacles. B. "Complex" Z. Spread with Z on arms and tentacles, and OH-type mottling on back.

NOTE: Several times today, medium-size adults suddenly below me in the course of our mutual maneuvering in ORD with Y and WS. And also, when they were closest, DM. DM usually symmetrical.

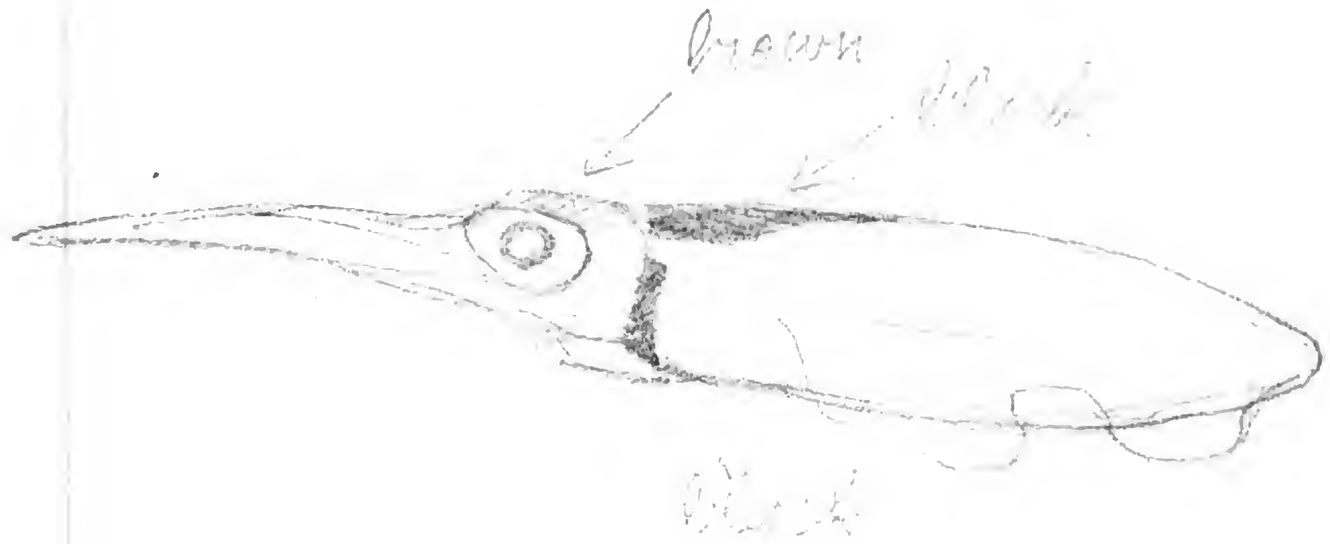
Starting observations again slightly before 1:00 pm. Weather now sunny. Go to same place as this morning. Group still there. Now includes at least 42 individuals. All categories. Small, medium, large. Plus a considerable no. of intermediates. (But intermediates are still less abundant than "typical" categories.)

When we first arrive, there are many "courting pairs" of large inds. One is started by a member of a pair suddenly turning Pastel while swimming after its partner. The latter responds by becoming "pied" ("Pie"). Largely silver with a few dark markings.

Ceph., June 12, 1974, II

(23)

(23)



Who Pie appears to have been an evaporation of ORL. The first unidentified moves to ORD with WS (and probably Y) as soon as the Pie, while still continuing to follow.

Approximately 15 min. or so. Pie joined other courting parties. One ind. (♀?) in Pie followed or attended by 4 others (♂'s?) in ORD with WS (and Y?) or in OH (OH of black, no sign of Z on arms or tentacles). The followers or attendants pass back and forth beside or around the Pie ind., the presumed ♀, perhaps trying to get under her. Sometimes there is considerable "rocking" by some or all members of the party. Brief alternations of forward scurrying and backward surrounding.

This may or may not be ritualized per se.

One dispute (?) between 2 attendants. One ind. suddenly spreads, with Z pattern on arms and tentacles and Pie pattern on back. This seems to repell the other attendant.

None of the courting parties is seen to do anything more. The impression is that courting must be a lengthy process in this species.

Cepb., June 12, 1971, X

(24)

The medium eyes of the main mass do Cou-
ently E from time to time. One or more also does evo-
Curls.

NOTE. There is a consistency dark in contrast
of stripe Colour-fur in spread 2-Pt couples

Are eyes a consistent
nuisance in using dark for
threat and light for escape, appease-
ment and seduction? If so, why?

A half hour later, everything is very quiet.
Counting is almost stopped.

All the animals seem to be getting used to my pre-
sence. All are in ORD. Rather dark ORD. No trace of
WS or Y. (Notice that ocelli on back may be more white
than blue, at least in main lights.)

They also have begun to "scatter" a little. At
least their lines are less regular than earlier. See next page

I eventually stop observing ca 2:30-3:00 pm.
Simply because everything is too dull. We go off to
look for more suitable areas. Without success.

Cyst. June 12, 1941, XI.

(25) (25)

"Dispersed" groupings

June 13, 1971
San Blas

Going to work on plane. Things spotted at 11:10 a few minutes before 7:00 a.m. Cloudy. [illegible] Light at dawn.

At first found nothing at all. Spotted first one here. Why? This is the only side of the bay. It daylight was the lee. Do birds spend perhaps? Can't all perhaps expect so, considering their feeding habits. So I also goes off to the other side to look. Without finding anything there either.

In the meantime, a "single" pair showed up here ca. 7:40 a.m. Most peculiar. One is very large, one is only medium (altho perhaps large for an ind. of this category). Greater difference in size than I have seen in any other pair. When first seen, both inds. are swimming around in the calmer, in and near coral reef. In a sort of pale (light) ORD. The medium ind. does definite DM in this pale ORD when it first notices me. Then it does a long E, with a rather darker ORD and WS.

Continue swimming. Varying in color. All combinations of ORD & WS (mud and D and Pastel. Little or no fluttering. The medium follows the large more frequently than the reverse. Once medium does another DM in ORD with WS. Occasional "passes" with gentle marking by both inds. "Forward up phase" of neck may be

real P. large and Pale more Pastel than medium.

Dorsal fin and more large terms completely ORD. Flukes of two Pastel and medium. Hudson also in ORD all US completely stationary and [illegible] swashing large. The medium gets [illegible] F. [illegible] approaches and just slaps in the [illegible] large and finally moves over the medium. Medium turns Pastel or some Pastel squids off [illegible] Hudson [illegible]. Abruptly [illegible] and [illegible] back into ORD. The medium remains in ORD throughout. Medium F for minutes while swimmer forward after large!!!

A few minutes later, Aurelio and boat come back. Both squid dart off backward. Large in Pale-Pastel. With DM. Hudson in ORD with WS and DM.

8:00 a.m. Indians tell us that squid are now in very shallow water near shore of Island. Is this where they sleep at night? We go to see, but can't find any animals. (Possible explanation: Jose, our guide, says that the squid come into the shore when tide is high, not otherwise).

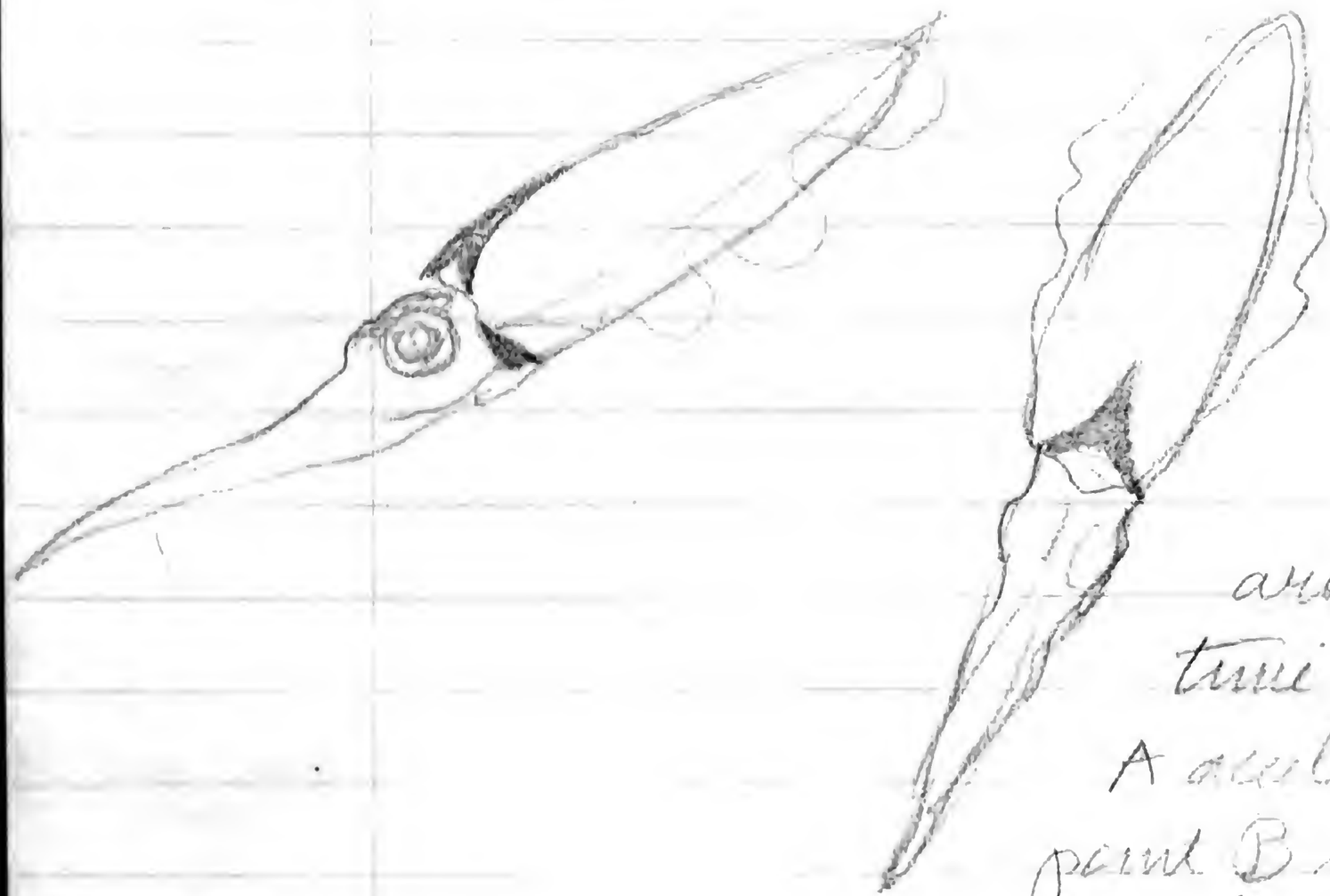
Go back to the deeper Turtle Grass-Reef area. Find group of 7 large squid about 20 yds away from where animals were seen yesterday and earlier today. Apparently 3 pairs and 2 "loners".

Watch one pair. One wid., B, is slightly larger than the other, A. I should suppose that B is ♀, A ♂? A suddenly turns real Pastel, starts to swim after B with extreme

Cephs., June 13, 1971, III

(28)

Flutter B turns Pie and swims away. Both [illegible] jerky, backward B's Pie is [illegible] Sometimes [illegible] exaggerated. Sometimes little more than roll [illegible] Pie (on ORD).



Extreme Pie

The 2 animals swim around like this for some time. Everyone in a whole A accelerates. At which point B shoots upward. A shoots after "her", underneath and behind (Both inds. still swimming backward)

NOTE: Background of Pie is brilliant silver, iridescent with pink and gold, perhaps other, reflections. General effect is quite different from extreme Partial and Pale, which are opaque, "powdery".

B eventually goes back to ORD or something similar. Then a 3rd ind., C, joins group. C gets between A and B. Approaches B in Partial with Flutter. B goes Pie again. Then there is a lot of rapid swimming. I get confused. A certainly approaches C and gives Spread with Z (Z certainly extends to back as well as arms and tentacles). Then I think that A and C exchange places. All

3 [illegible] slowly. Around and around me Cephalopod B has been swimming as a small coral reef around which [illegible] (in the shelter!) B drops in left front of A & behind B, C, but the distance between us is [illegible] from 1 to 3'.

B seems to be in non-ambivalent colors some RL ⇄ Pie. Some ORD with WS. Some yellowish semi PH. C usually in rather dark ORD with WS. A in a variety of colors. Often in semi-PH. Yellowish brown with only scattered or fine dark mottling. Often changing into a yellowish form of Pastel (Yellowish Pastel more hostile than "pure" Pastel? A presumably is reacting to both B and C.) Very occasionally, A "reverts" to ORD with WS.

Every once in a while A shoots backward toward B. In Pastel - Yellow Pastel. As usual, she "responds by shooting upward. "He" follows behind from below, sometimes telling his back toward her when and if "he" catches up. A's swimming during accelerations may be fluttering. When "he" is in Yellow Pastel, there may be a dark streak along "his" side, well below the fin. This dark streak ("Bottom Streak") may be an indication of ambivalence. It probably is absent in "pure" Pastel.

This sort of behavior continues for 5-10 mins. Then I have to interrupt observations.

20 mins. later, find same 9 larvae in same place.

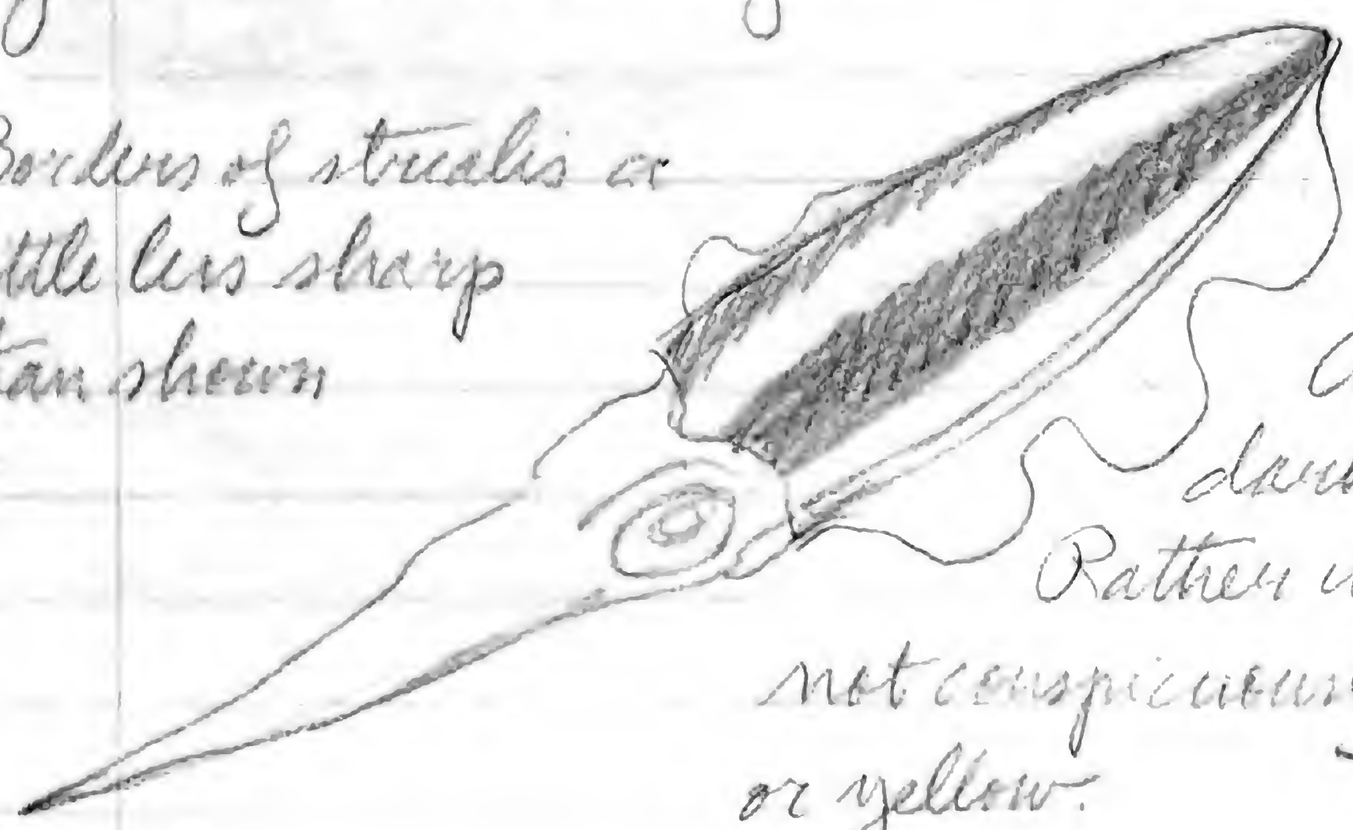
Ceph., June 13, 1971, V.

Some inds P in ORD type.

Some RL lu, one on both mandibles of sexual pairs. In ORD, with or without WS. Have any Y.

ABC two apparently all were. Not doing much. All more or less ORD.

Then one ind. of type, presumed B, turns the shoots off. Followed by presumed A and C, and also 2-3 neighbors. Apparently an "expanded" counting post. All inds. move in same direction, girls close together, but F and some followers backward, other followers forward. All followers in PH and/or ORD-type patterns. One shoots female, makes usual upward "pass" at B. Showing bulb (presumably by tilting). In a pattern which I have been describing as ORD with extreme WS, but which may have a slightly different significance. ORD-type brown concentrated in 2 broad streaks, on either side of median light streak and above fins.



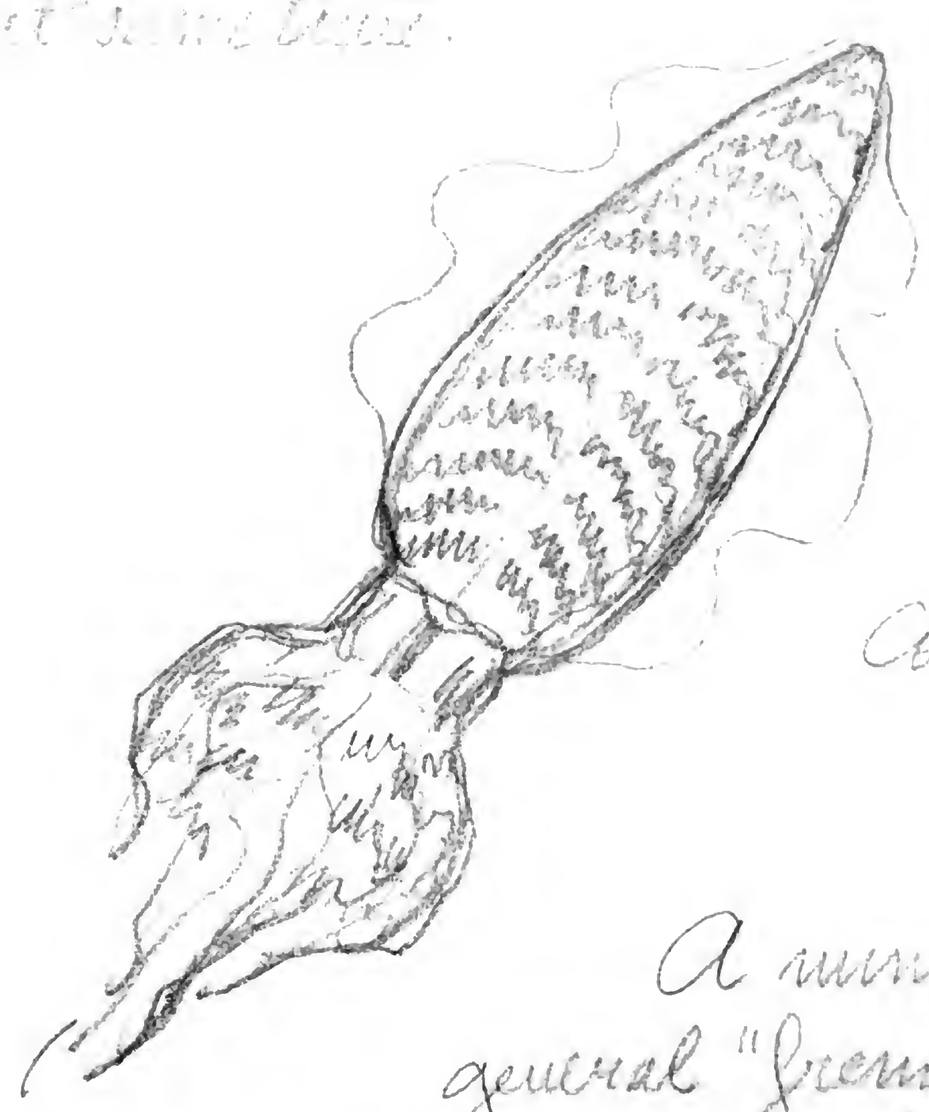
Borders of streaks or little less sharp than shown

Call this "Double Streak"

All areas below dark streaks are light. Rather undistinguished: not conspicuous white, silvery, or yellow.

Cephs., June 13, 1941, VI.

At [illegible] performance, there is a hostile encounter [illegible] followers spread with complete [illegible] gone [illegible] completely tilted toward approaching [illegible].



Lateral stripes black-ish. Crowded quite close together. I am not sure if there is (are) median stripe(s) or not. Could be black and/or white.

A minute or so later, the general "frenzy" stops. Leaving A-B-C as before. Swimming slowly back and forth, backward and forward. B definitely controls movement of trio as a whole. B in ORD with frequent RL, occasionally developing into semi-Pie. A in relatively yellow or rich brown ORD (semi-PH?). C in dull dark ORD. (I notice that A and C have rows of larger light spots on fins than does B. Is this significant?)

There has been no trace of E or P, much less courtship, in the counting of A-B-C this morning.

Then A swims backward toward C, gets very close. The whole rear half of the body of A turns silvery (!), as in Pie, but with a conspicuous, sharp, black line just at base of fins. I shall call this "fin stripe" ("FS").

(I know that I have seen FS before, but I can't remember where or when or in what circumstances or combinations.)

Then everyone relaxes. Everything goes on as before.

A-B-C together as usual. B suddenly goes Pa. A makes a pass at "hole" in Double Attack, after Big Pa. Then all relax again.

We try to collect B, but mess. All the seals become numerous. Stop observations ca 10:45 am.

NOTE: Arcadio saw a group of 14 sea lions near Achutupo (Dog's Island) while I was observing group here at Nuatupo. Distance between two groups approximately 175 yards. Is this typical?

Start observation same place Nuatupo ca 1:00 pm. Find group of at least 32 seals. Most mature. Also at least 2 pups large. And apparently A-B-C.

We shoot at B. Miss (again). B squirts ink and darts away. Ink coagulates in water. In rather different blue "veils". Remains intact for 3 mins. Is more definitely a decoy.

Watch another semi-detached pair. One turns off does extreme E, shoots off, disappears. Other follows.

Watch still another pair. Target of the two leading the other. Target presumably ♀. In PH, then ORD with WS. Partner always in ORD-WS at first. Then turns Pastel on longitudinal part of body away from presumed ♀.

During the next half hour, we shoot at least 3

Cph., June 13, 1971, Sun

(33)

turtle at present is Green, very tame. Small, probably Ogs. Ist. Wrapped all the animals are very agile. Lots of Cuttles are still hanging around. I saw just a few Ulua & further interesting that they are constantly solitary.

Lep. dimentata 2 or 3

July 24, 1971
Sun Clas

Working at Pinnacles, the same area as last month. Start around (7.30 but) have a lot of trouble with equipment and don't really get going until a 10.00 a.m. Partly overcast. Some wind. Which increases steadily as the morning wears on.

Find squids almost immediately. Over turtle grass near reef. In approx. 8 ft of water, 2-3 feet above bottom. (This is exactly the site favored last month.) Usual species. But not many individuals.

First see group of 3 large. One does extreme E, in Oct or 84 when it first sees me. Relaxes almost immediately. Then see 2 more large a few yards away. (Note: There are a lot of fish around, some moderately large. They are ignored by the squids, and vice versa.)

The members of the group of 3 are "courting": Swimming back and forth. Perhaps some rocking. Occasional sudden "passes" by one or more of the males. Also,

one ind. (always the same?) sometimes leaves the pack and approaches the other group of 2.

Inds. which are approached are [illegible] or are "passed" at — and there is [illegible] ind. in each "sub-group", the sub-group of 2 and the sub-group of 3 — usually go PH. Often [illegible] one, an ind. in either PH also does not [illegible]

Sometimes when an ind. of a sub-group approaches an ind. of the other, there is some PH displayed with a "semi-spread" of arms.

Tips of arms kept near together
No Dance real Z

Many, perhaps all, of these PH's are accompanied by dark or black stripe along base of fin. This "fin stripe" may be typical of PH.

Sometimes an ind. making a rapid pass (within its own sub-group?) starts out light colored (presumably Partial) and then turns PH at the climax.

Inds. which are not being active at the time are in Ord, with more or less WS. Also / when close to me.

I think that there is considerable variation, from time to time, in the size and/or brilliance of the ocelli in ORD. Why?

When the 3 inds. of the "counting" party disappear.

A few minutes later find group of 5. Again? Perhaps same as before. Actually divided into sub-groups of 2 and 3. All fairly active. Lots of display. But all very superficial. Finally Pulsing & jerky, as level out. (Also number of flashes [illegible]) Some P in and possibly with VS. Some pulses P. Traces of Pastel on Pale. Outer OH. Some sprouts, complete and incomplete. One fish in Pale by an approached individual. One actually gets attack (Return when?) with little or no display.

Then DLT a few minutes breather. Return, ca. 10:10 a.m. Find group of 4 same general area. 2 pairs? All in ORD with VS. One ind. of one presumed pair approaches ind. of other in slight OH. Then goes back. 2 inds. approach me. In Ord with VS and extreme Y. Occasional traces of P. Then drift off.

Nothing of interest happens for a long time. Only a few very low-intensity indications of P and E.

Then all the animals shoot off when a school of large fishes approaches. Come back again, all at the same time. They certainly appear to be moving as a unit, but they still show traces of a 2-2 division within the group. Note: I am recognizing sub-groups simply by spatial arrangement. Thus, for instance, these animals tend to arrange themselves comme ça:

Cephl. July 24, 1971, IV

All are calm now.

Then they close up and swim in a fairly tight formation for a few minutes. Three in front swimming forward in Ordinate WS. The one in back swims backward in PH.

Then there are some passes among the individuals of some pairs. Once an approached ind. does extend spread arms and the arms are white but the rest of the body is Orange or PH!!!

Now a fifth ind. shows up. From body there is some Pie-mg in the group.

Is Pie hostile?

Now I see that there are 7 inds. around. Divided more or less 2-2-3-2. (Meaning thinks that there may have been an eighth in the area, but I didn't count it.)

Watch one "pair". One repeatedly swims backward toward the other. Starts approach with RL, changing to Pie as distance between inds. decreases. Approaches meets by RL. Both approaches and approached show traces of P. Some "rocking". A third ind. seems to show interest, but doesn't join in the game.

COMMENTS:

It is possible that many of my earlier interpretations of social encounters were mistaken. Some or many of the encounters which I called "courting" may have been purely hostile. (Perhaps all the encounters without Pastel??)

Pie may be purely hostile and related to DM (my Octopus mulgaris). But I must state that I have not seen

and DM: many dense (i.e. 2 black spots) this morning.
The actual attractiveness of the animals here is certain
to appear more from what it was last month. Only large
4 ft. Dorsals are present and all the black spots polygamous
[illegible] (i.e. [illegible] large males were seen last month.
A similar has happened to all the males >>>>)

NOTE: Not only are there more females here now than
last month, but they are more gilvous. Is this related
to the apparent disappearance of the males?

After lunch Arcadio goes to look around some
adjacent areas. Arrives at [illegible] and some other parts of Hualtapa
Islands, 1 or 2 groups. First 2 large, and then 5-6
large. Hundred yards apart at an interval of ½ hour
(i.e. more probably 1 group than 2) I go down to look
at the 5-6. All in dark Ord-PH. 3 in extreme Cural.
2 in extreme E. All with some WS. Two of the males in
Cural have white stripes that are particularly broad but
also interrupted, sort of a series of blotches

NOTE: Arcadio says that he saw some squalls
yesterday near an island called Halunga. So they still
exist after all.

ADDITION: The 5-6 larges here now are almost
directly under the Jetty. Are they using it for protection?

Later this afternoon we go out to the Molandes Keys.
Look around the island of Bogpulcy ca. 4:00-4:30 pm.
Without seeing any squid. Then Arcadio takes a look
at several adjacent islands. Again no squid. And then

Cephs. July 24, 1971, II.

(30)

Once again without [illegible]

Arcadio says that [illegible] lot of [illegible] predators feels here than in the Sin On Cays. Barracuda in the turtle grass, lurkers and [illegible] in the coral reefs. It occurs to me that Sepioteuthis may [illegible] simply because they are preyed upon by snappers and groupers. (They may be particularly vulnerable because of their own hunting methods.)

July 25 1971
San Blas

Looking around the same area and adjacent islands (Hollandes Cays) this morning. On both extensive areas of turtle grass and superb coral reef. Many fish. But absolutely no signs of squid!

Of course, we may have overlooked some as most squid can be no more than relatively rare here. Is this typical of the area? And/or of the time of year?

NOTE: Arcadio has never seen anything except Sepioteuthis on this coast. And only one other species (of another genus) on the Pacific coast. Has [illegible] quite well with the opinions expressed in my recent paper.

But why don't cephalopods diversify more in inshore habitats???

ADDITION: The weather this morning was comparatively cool, windy, overcast, with occasional rain.

[illegible] number in others. It was [illegible] to be clear [illegible]

[illegible] Lots of [illegible] except for [illegible] area [illegible] (?). Also many [illegible] coral areas, also shallow [illegible] large [illegible] many [illegible]. Also [illegible] a single cephalopod. [illegible] Days. Also some [illegible] open. Also saw a single [illegible] sea turtle grass near the reef. About 50 [illegible] the island called "Acluitupo" last month is something else again; our guide considers it to be just a separate part of Ihatuge or "Ihatuge pequeño"). We also found cephalopod ink in shallow and [illegible] water off Aiguilitupo.

Perhaps the typical habitat of Sepioteuthis here is calm water 2–8 ft deep, over turtle grass, near a reef for protection from currents? And against predators? Areas with comparatively few fish (Cause or effect?) Can be either clear or murky.

July 26, 1971
Jack Blas

Cephl., July 26, 1971, I

This morning we start out to look at the Pentapo where I visited last night & where we saw the squid the day before yesterday. [illegible] Cloudy & windy. Water murky. Not much [illegible] than I have ever seen here. Other [illegible] Lots of small to medium fish in [illegible] which the squid seem to [illegible] squid. And [illegible] for 35-40 mins.)

So we go around to other sides of [illegible] large squid hit mostly the old wreck and Pentapo [illegible]. This is the [illegible] side now. This is a [illegible] sand bottom with scattered patches of [illegible] (Caprinetes) [illegible] of turtle grass. Water about [illegible] 4-10 ft above bottom.

It is beginning to look as if the squid at Cuta have to have moderately clear water. (Which might be expected in view of their feeding habits.) When water becomes rough, they move into areas of weaker currents and/or take "shelter" (retreat into holes and crevices.)

The 4 large squid are obviously associating as a group but also divided into pairs. Members of a pair usually 1-4 ft apart from one another, 4 10 ft from the other pair.

Both mds. of first pair seen in Oval Pen eye gets WS. This denotes white [illegible] along of whole side of the body, away from both me and the wall. I think that

[illegible] or relative of "real" [illegible] and shrug I shall call it LP [illegible] But same individual does [illegible] few minutes later. Then there [illegible] on left side then on right side. [illegible] when I was quite [illegible] adjacent, may have been relaxed, and [illegible] toward me.

A few minutes later, same individual does another LP combined with extreme E. While swimming forward and after [illegible] swimming forward. Both swimming [illegible] Box and Flex. LP disappears. Then [illegible] slowly backward, maintaining relaxing gestures. Then retreat again. Swim forward. Rear end, the one who did E with LP before, now does E without LP. Then both relax.

As usual, it is difficult to determine whom this display is designed to impress. Of course, I am hanging in the neighborhood. There are fish around. And the other pair is not far off. (Actually, I suppose that the other pair is the most significant factor. See above below.)

Now there is a dull period. Only some traces of PLay, some or all of the 4 mds. Then one or more mds. does more LP from time to time, while just swimming around in an apparently aimless manner.

Then one of the pairs disappears from my sight. The remaining pair, which is almost certainly the one

Cephs. July 26, 1971, III

that engaged in LP-E displays earlier, now at [illegible]
2 wids swing 1½ - 2½ [illegible] front and [illegible]
side of the other, Both swing [illegible] P [illegible] wid [illegible] P
with E. Note. all this E is [illegible]
Then drops E, LP continues. Then [illegible]
Displays wid. relaxes, Both [illegible]
arising relative positions. Then [illegible]
at first. Then both shoot back and [illegible]
rate. Both P with [illegible] Then [illegible] P
at first both in Ord with WS. Then [illegible]
Double Struck. Most of the P's now [illegible]

Then both wids relax, drift apart

Then P suddenly extends of the wids. Then P pulls wings together again, both pairs are present. Not very close together. Both of nearest pair are in Ord with WS.

One wid. of further pair is in extreme E, then extreme Ord, then extreme E again. Dark (Ord except PH — WS?) throughout. Then relaxes. 2 pairs drift together again all in Ord with WS and Y (to me?)

All swim gently back and forth. Arms slanted upward while going forward, downward while going

backward [illegible] – the last letter slant should be con-
siderably longer. The indents are not real indications
of letters. O or E, P and E might well have been done
[illegible] patterns.

One 2d. has OH when read. Its letter pat-
terns too close.

Now I see the [illegible] around. The
neck-line is also long. The ends more or less close together
or near.

One indent has [illegible] Neighbor shows
longer slant P than EM. Neighbor indents first and
couldn't be E from [illegible] to longer letters also.

Now I see ends with Ord. Some with more or less
conjoined WS, some without. One or more assumes E from
time to time.

There are no numerous here, although plenty of other
larger fish. He squirts [illegible] no attempt to feed.

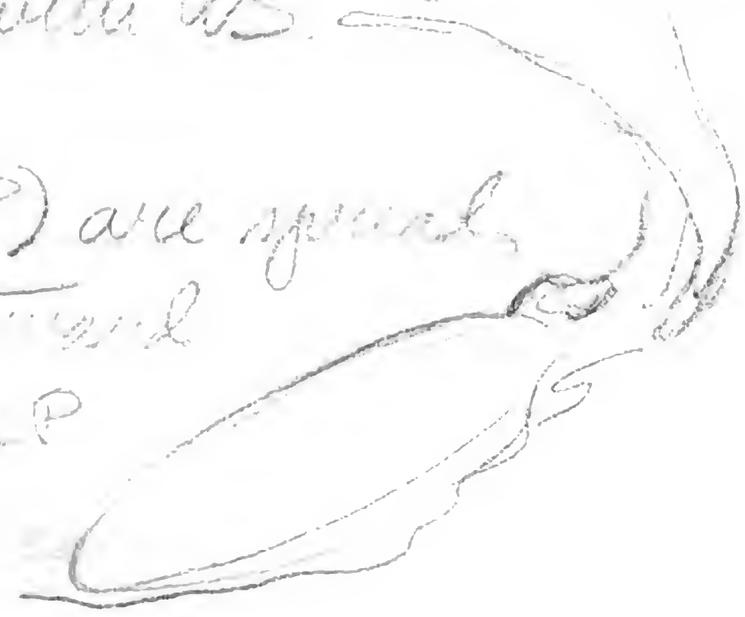
The pattern seen in Shadow has dwindled to all
outward view, although pressure, not in real fact, I
can't tell if the new arrival, the fifth ind., is associating with
one or both pairs, or not discriminating between the two.

Some P lay, some or all inds. Not very excited or
exciting. One ind. alternates E and extreme P (or P–
and). Front in Ord. Then in Ord and/or PH with broken
but broad WS.

Then I take a break. Come back 10 mins. later.
No squirt around. Obvious, because there is a bar-

Cph., July 26, 1971. V.

[illegible] away. [illegible] disappear. The aquilegia [illegible] 2 paws again. Prominent some [illegible] as before. [illegible] seen [illegible] Jetting day before yesterday. [illegible] one [illegible] in Ord with us.



arms (tentacles?) are spread. One end dashes forward. Latter retreats in LP

Spikes [illegible] in V. [illegible] until the [illegible]

COMMENT: I think that the breeding season is quite over now. If so, all the displays seen today and the day before yesterday must be (pseudo) hostile. Or is there "friendly" motivation in this sense?

Minor points:

Obviously LP, Pie, and DM are closely related. What is the difference among them? LP presumably is low-intensity. But cannot be a simple low intensity version of Pie. What is the qualitative difference? LP flutter more aggressive ??? (NOTE: My impression is that almost all the displays observed today were intraspecific. But it would be difficult to prove.)

NOTE: I am quite willing to believe that there was a lot of RL this morning. Probably often as preliminary as LP. But I was rather too far out to be able to see it.

ADDITION: Water here is medium-fairly clear.

[illegible] to Malumega. One of the more [illegible] [illegible] III. [illegible] [illegible] [illegible]

at Pulaski this afternoon. It was lying on a couch about an end of turtle grass, 3 ft deep. Did not urge it out of the couch. It sits in bottom of [illegible] curled around body. Generally pale yellow all over head and body. Legs mottled [illegible] (purple). Some dark brown stripes on [illegible] related to PH.

8-8-1941
[illegible]

Working at Pulaski again this morning. Start out 9:00 a.m. [illegible]

Find squid in middle. Group of 11 inds. in 3 ft of water right beside dock. Water is clear and slightly murky. Bottom mixed mud, sand and [illegible] grass. Large areas of turtle grass nearby. All the inds. are more or less large. 3 perhaps larger than the others. All in ORD with more or less WS.

One ind. does Pie bluff as group starts to retreat before me. Then they pause. Again our ind. does Pie as group starts to retreat again. Pie is obviously an alarm pattern, probably quite low intensity. Group is not very frightened, retreating only slowly.

Then the group approaches me. Add 1 to Ord WS as they do so.

Then group gradually drifts off. I follow. Curious

Cph., July 27, 1971, II

[illegible] reconforming the retreat, [illegible] Our attitude [illegible] Now [illegible] Nels. [illegible] Then [illegible] Now the people at Assignment.

All [illegible] behind front face. Nelson [illegible] the largest in the group) slapping [illegible] Not aggressive. Seem that there is another group of 17 [illegible] approaching from behind. All [illegible] long medium approaching in [illegible] with Dol. And obviously threat. The group of 11 [illegible] away. Leaving the group of 17 medium in possession of the field!!!

This was obviously a boundary dispute. And it proves that the groups are territorial in the strictest sense of the word.

Why are these particular groups segregated in size (age) class?

The group of 17 we have been watching seems to be E (previously to me). All in Ord, with no or slight US throughout.

Now State a bank. A half hour later find group of 11 large again. Almost same place as before, but in slightly deeper water over turtle grass. All very quiet and placid. Stop observations.

At 11.15 a.m., we can see, from the ship, that this

group of 11 has grown to include at least 14 [illegible]
And at least 2 of the "new" members are [illegible]
Does this mean that the original 11 and 14 groups [illegible]
alerted??? Yes, in the left [illegible] groups [illegible]
in the middle of the day and then [illegible] groups in the late afternoon or evening [illegible]
Any earlier observations could be [illegible] by the [illegible] others. And it would or might help to explain the age segregation observed earlier this [illegible]
the territorial dispute observed was neither [illegible]
Quite unnoticeable but not, perhaps, what one would have expected.)

Now we see that there is another (third) group of large squid only 15-20 yards away (on the west side of the 11-17 group opposite the area of the 14 group). There are at least six inds. in this third group.

Group territories here would seem to be <u>narrow</u>. The territory of the 11-17 group may be <u>no more than 200 ft</u> across near the beach.

Population density here is enormously high. Due to lots of food from outboards? Or to heavy fishing of predator fishes by the natives?

COMMENTS: There are no visible signs of pair or small family units in any of the groups observed here. Why? Anyway, it indicates that the animals seen near Tinatupo this trip, dull as they were, were (still) in partly reproductive mood (doubtless declining).

[illegible] is a seasonal breeder

NOTE: [illegible] are many individuals in this area [illegible] Alamejitos.

Additional observations at a long interval. Squid [illegible] and white its arms. [illegible] Once the writhing was accompanied by a [illegible] flash of pale

In the afternoon, after [illegible] looking for squid was apparently [illegible]

Personnel Arcadio sees a single squid apparently feeding by [illegible] than a school of sardines

But then we can't find any more individuals here, nor in extensive turtle grass beds around a nearby sandbar, nor around Wishwala. Rather surprising, as it is fairly calm.

2:30 p.m. Islamujer Arcadio finds squid in area occupied by "third" group this morning. Now 12 large and medium uids in one cluster. Plus four small uids, 7-10 yards away.

July 28, 1971
San Blas

6:30 a.m. Squid already in "third group" area (seen from boat). At least 10 uids. Of different sizes

NOTE: There are quite a lot of needle fish around.

Aqua July 28, 1971, II

According to Nicole the [illegible] as these squids I thought [illegible] them and the squids

Start out 8:10 am [illegible] squids in vicinity now [illegible] consists of 12 mother [illegible] rather large small squids One day [illegible] ing. Then I do Pic with mediate E. [illegible] Pics with and without E's. Also second E's with Pic, in Ord with (intervals) [illegible] involved

The Jetty water starts out [illegible] Squid apparently probably [illegible] then do seem to be small deep (calm) water [illegible] most of the Jetty neighborhood appear to be [illegible] unconcerned — this is bad news

Go over to group III area. Find group of 5 mds. Four are medium — the fifth is small-medium. All quite close together. Probably about 40 ft away from group I at the moment. Very placid. The water [illegible] loaded with jellyfish. So I get out post haste. It is quite possible that there are more squid in this Group III area. But, if so, they are in separate groups or sub-groups)

8:30 Back to Group I area. Group of 18 is still around. Behaving as before, with even less display. Then a group of sardines appears, swimming near surface. All the squid point at them (this is [illegible]

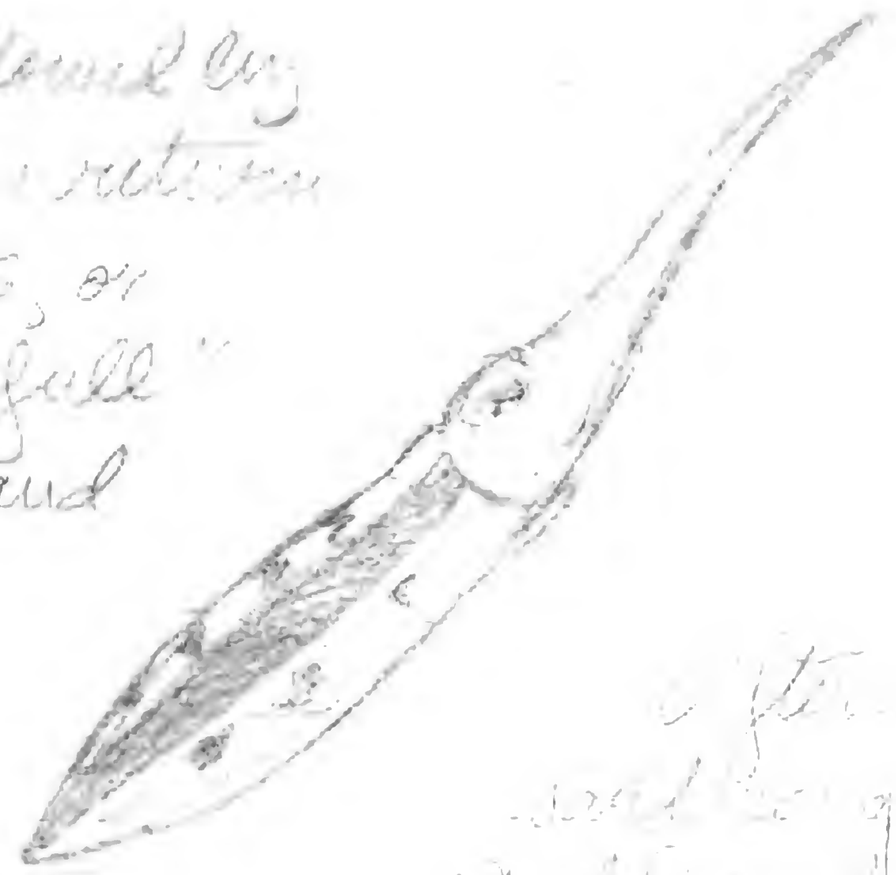
Cap., July 28, 1971 III

(51)

[illegible] Then swim away. Back [illegible] Not [illegible] [illegible] [illegible]

Cph. July 28, 1971 II

This may be followed by elongation and return to Ord with WS, or by a return to "full" Double Streak and another stroke.



[illegible] and [illegible] that there are more spread around than earlier. At first it is difficult to distinguish several groupings among the animals. All were on less in a continuous line. But they gradually sort themselves out into 2 groups or sub-groups about 10 ft apart. One cluster is composed of the 12 large inds. who have been in this area all morning. The other includes 7 mediums. This is obviously the group II of yesterday. Apparently they followed the sat. Ord into the Group I area. And I suppose that all the Double Streak and Mottled Double Streak displays during feeding were actually indications of intra-specific hostility. Nothing to do with feeding per se. (Note: the aggressive Streak display certainly more performed by inds. of both groups or sub-groups. And I might add that the mediums of the 7 group are rather large as mediums go. There seem to be more intermediates between "typical" age classes everywhere here now than last month.)

Both I and II clusters remain fairly calm after

[illegible] groups, those which are [illegible] in Osel [illegible] with some US on all apparent [illegible] [illegible] Should go [illegible]

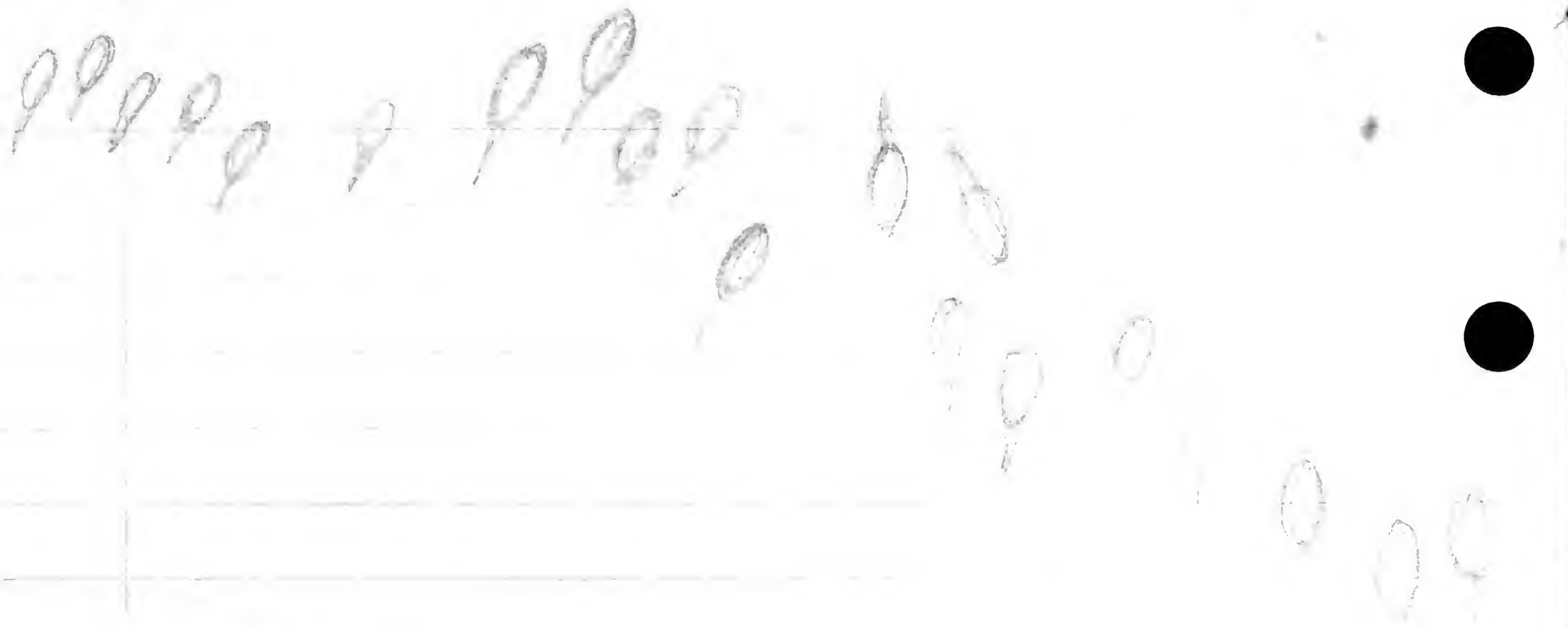
Now [illegible] Travelling fairly at the surface [illegible] long time. They and the Spermaceti [illegible] on surface.

[illegible] must also be important [illegible]

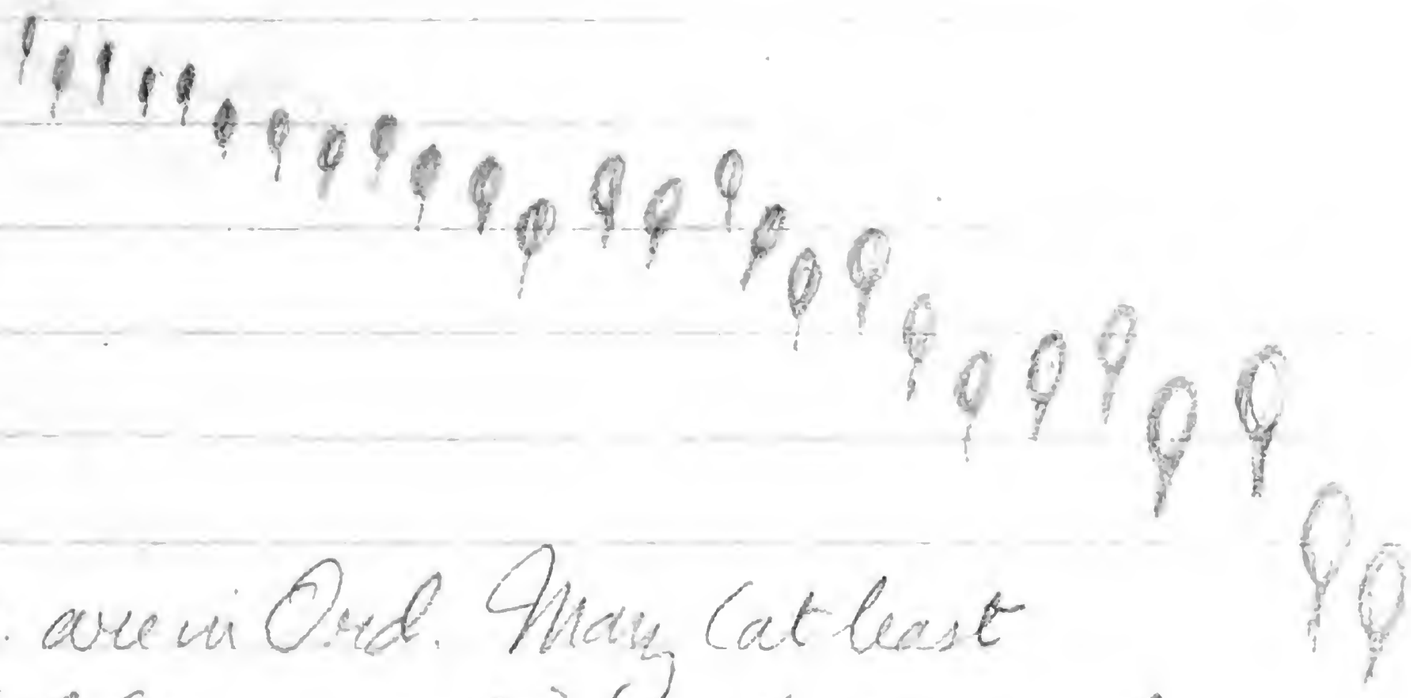
10.00 am. Nothing from Nip. Have large or [illegible] in group III area. Then Arnedo [illegible] large group (22?) of small or medium small wds. coming into area (from other side of island?) Some of the newcomers Anil. Apparently without color change. Then all join up, apparently peacefully. This you would appear to have been entirely "voluntary", quite apart from feeding.

10:10 Go surrounding in Group I area. Anil squid in almost exactly same area as before. Group of mediums and group of large. Now more or less joined together in single line. Mediums still 7. Large have now increased to 14 wds. All very placid. No display. No feeding. Distribution more or less common:

Cepb. July 28, 1971, II



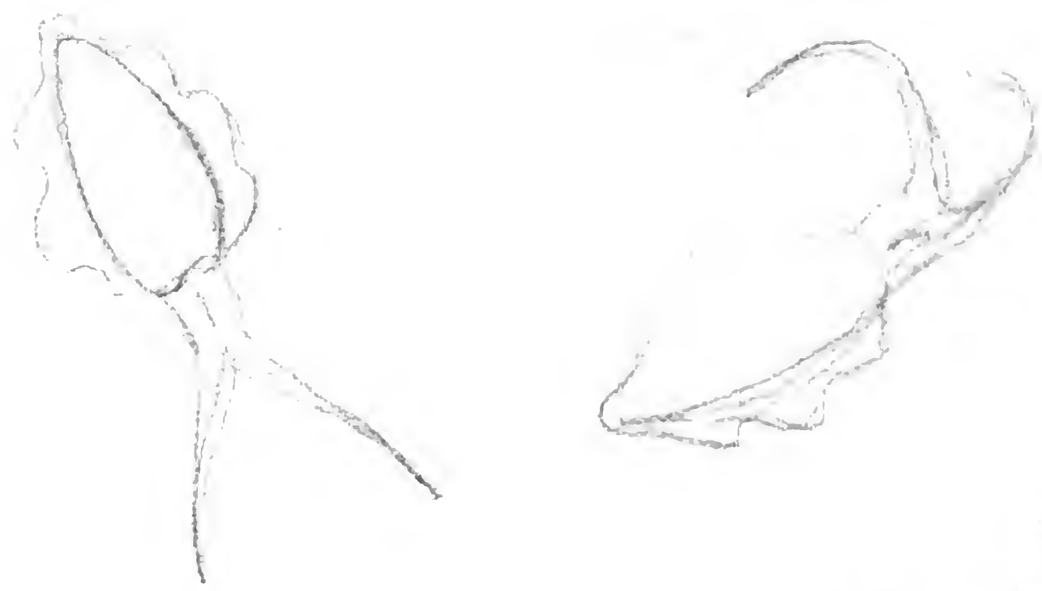
Then I go over to Group III over, 20 ft away. Group there seems to be about 25 birds, 4 more or less medium, grading down quite nicely (and smoothly) to 2 or 3 inch. which are as tiny as any I have ever seen. The presence of such small birds, more so evidence against a definite breeding season, or perhaps suggests that different populations have different breeding seasons. The group is sloping out in a line, going from largest to smallest. (This is another rather common arrangement.)



All the inds. are in Ord. May (at least of the relatively larger inds.) with some ind. SWS and/or Y. No other display, as long as I stay some considerable distance away. But then, as I come closer,

Cephl., July 28, 1971, VII

4 of the [illegible] seem to display to me the closest approximation to Two-Fins Display. One as Cl. Cont. attempts to Curl & V. In the latter, the arms curl [illegible] & [illegible] intertwine hanging down. The [illegible] can be seen from [illegible] the arms at certain positions although not fully the dominant. Or it can be combined with Curl



V is obviously lower intensity than Curl. Done more frequently. Initial response frequency of Curl increases as I get closer. (Note: these very young inds. seem almost, although obviously not absolutely fearless. The smallest actually lunged, with V and Curl, as if it were about to attack me.) One of the smalls also did Curl without V once or twice, but "pure" Curls were certainly relatively rare. All the V's and Curls were done in quite ordinary (Ord.?) color patterns. (This may not be very significant. All smalls seem to have many fewer color changes, or perform them much less frequently, than larger inds. (Perhaps the local smalls have no color changes at all???)

V would seem to be an essentially, although not exclusively, infantile pattern

Cepb. July 28, 19[illegible], II

Possible correction. [illegible] gather that some of the smalls do [illegible] Cuvis with V, when the first year [illegible] morning.

NOTE. Some of the Indians on this [illegible] they distinguish 2 kinds of "squid" [illegible] sollita." This is the common [illegible] Sepioteuthis. The other is [illegible] It is supposed to be [illegible] the Sepioteuthis may [illegible] caught around a sandbank and/or [illegible] and Olga are looking for it now.) The name for the Cuvi octopus is "Bibire Nitlunali".

Arnadio and Olga are back. Arnadio saw and cored without bottle glass. All the squids were medium and a pacific-type. [illegible] Sepioteuthis. Plus one octopus.

Go to group I area again 11 a.m. [illegible] for a while, without seeing a thing. Squid quite [illegible] absent. Then come across a group of 9 small-medium mds (i.e. definitely not Group I or II). But right in middle of Group I area. One md. in E. All the others in B. One darts up to grab a small fish. All on Ord, with or without WS, throughout. Then a mixed school of medium-sized fish dashes off in panic. Squid follows, apparently also in panic. And then all go into full Double Stunk (dark streak below fins) [illegible]

Ceph., July 28, 1971, IX (57)

Page 111

Some strange aberrant reaction of the two groups to the Ord regulations. Do the regulations affect the different species??? Which is which?

According to Group III, you find 17 very small to medium bumps. This is an indication that the 9 ends up in Group I as a "split off" from the group of 20 seen in III earlier. Presumably the 7 moved into the I and "because" the I and II groups have gone off on a quite long time bump.

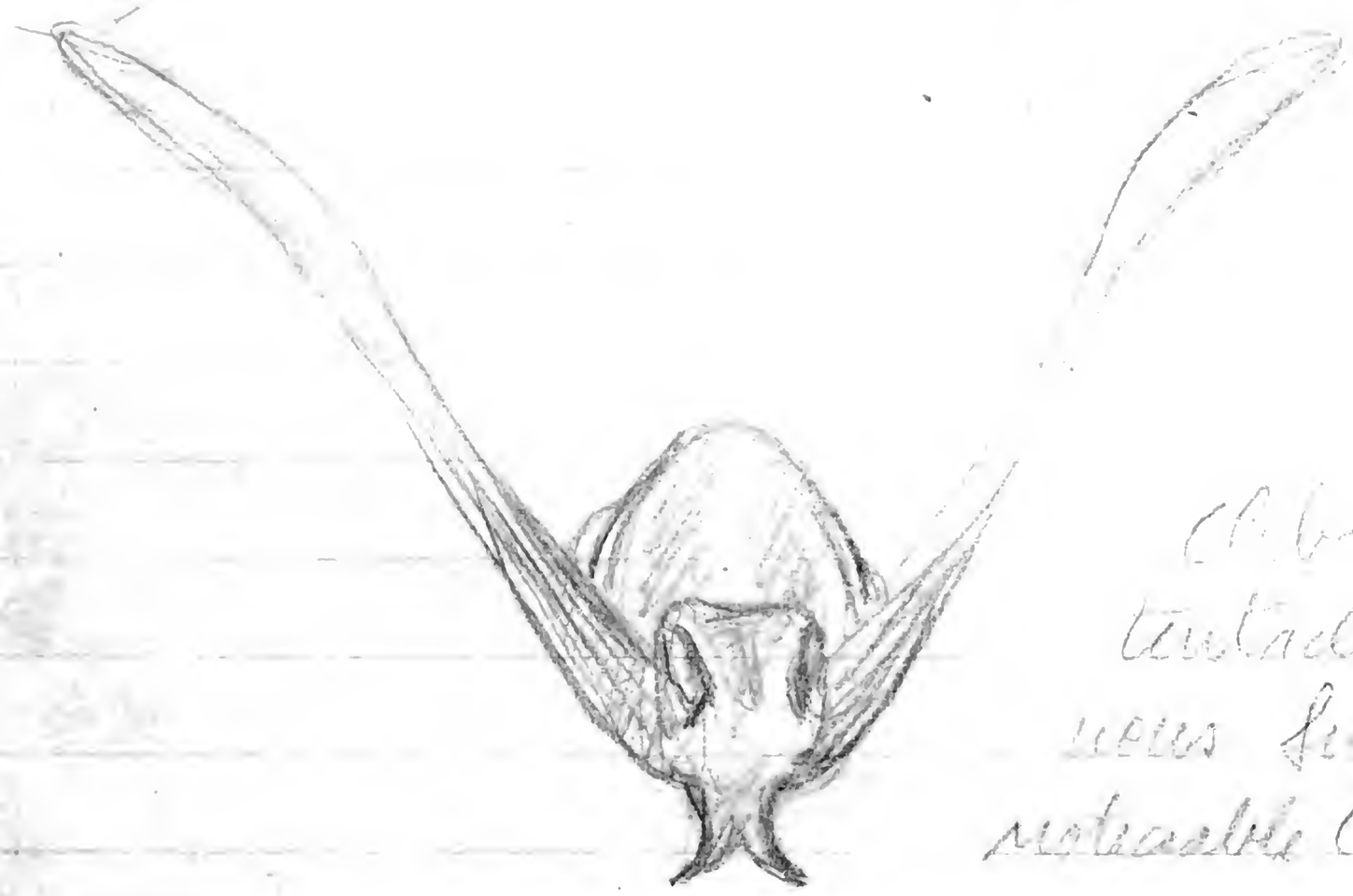
In the 20, with the species that to "recur" in the same general spatial arrangements, rather than maintaining their constants.

All the 17 display when I get close in more or less Ord with WS. Then change into a more peculiar color action, rather difficult to describe or decipher. Broad WS on top. Then a band of pinkish white. Then 2 dark streaks on top. Color of top dark streaks is either Ord or Ord-PH. Then also are broad dark streaks just below pinks. Bottom generally white or whitish. But with thin, sharp, dark streak down center in some (but probably not all) cases. These center belly streaks probably do not extend the whole length of the body. The whole thing, at its most elaborate, might be described as a "quintuple streak". (Obviously snails can manage some color changes.) All ends in P when this color change first

Cyl. July 22, 1871, X

58

sepals. Then several, including both the smaller sepals, several a few cm longer, adopt extreme V's. Some have forward. But most are spread upright. Corona



Cl. bulbosa Spa to Cl. [illegible] quite exceptionally feathers bundle noticeable Cyl. [illegible]

II

Indexed for displays
copulation

November 20, 1991
San Blas

Nothing near our bay "Lolo" (Islands) Leaving at 8 [illegible] (Nothing) 12:15 pm [illegible] Water [illegible] Immediately clear.

Seven second [illegible] Great [illegible] of Pelicans, several small [illegible] of Turtle Grass. Anchor 1:30 pm. [illegible] a single squid. Then [illegible] left and [illegible] offshore. Turtle grass [illegible] squid right near boat. A few feet below surface under approximately 20 ft deep. Appear with tentacles. One in Oval. One white with a couple of black blobs (Pic?) One does extreme V when swimmer approaches. Then squirts ink when we try to catch it in dip net.

NOTE: Boat was anchored in exactly same place on October 18th (Pete Glynn trip). At that time, Sucho counted over 65 squid near the boat! Apparently all sizes.

P.M. In the afternoon, we go exploring around three adjacent islands. Again a variety of habitats, including Turtle Grass. And again no squid visible!

There would appear to have been a major change here since October. Why???

ADDITION: We did see one Octopus late this

Cephl., Nov. 20, 1971, II

(60)

afternoon. Undulatt. long. Above. In 20-25 ft of water. Hiding under coral. Yellow-brown. Flare on each tentacle. Mottled sand color. Body pattern not (obscured) by Black Dermal flesh. Knots of (sumus) attached to another petal of coral. Sillight transverse pattern. Very, reminiscent of Dorid flavescens. S. Sepioteuthis (Roughly) comment.

Goes back to sandy bottom in position hiding again

NOTES: Last night, the other people on the boat were trying to catch organisms at a light. They caught one Sepioteuthis with hook and line. Size surfed. Ca 7:30-8:00 p.m. They also saw a small school of apparently narrower squid. Doryteuthis?

Tonight we tried lights again. Ca. 7:00 p.m. Immediately a large school of squids appears. Several types. Presumably Doryteuthis again. Group includes approximately 35 inds. Circling very rapidly. All inds. incredibly close together. (Apparently but presumably not actually frequently touching.) In what looks like equivalent of Dorid with small but extensive

Cpt. Nov. 20, 1971, III

(61)

[illegible]

[illegible] (Seattle) [illegible] light from a single object [illegible] Alan the surface [illegible] 20 feet below.

Continue [illegible] for 5-10 minutes. Then apparently [illegible] blast [illegible]. Decide to remain [illegible]. Then disappear. [illegible] lights off.

COMMENT: As far as we could tell, these vessels did not [illegible] with the possible exception one sub may have struck at an "anchorage". All vessels seemed [illegible] all [illegible] of the time. But if there was a strike, it was forward.

About 20 mins. later, we turned the lights on again. A group of approx. 11 squids of similar type appeared within a few seconds. These are called squids, slip in later. Then 4-5 "strike" almost simultaneously. Decided to fish surfacing at surface. And Wayne catches one in dip net!!! We put it in a pail immediately.

Discharges lots of ink in repeated bursts. Usual form ("dummy squids"). But dark red in color.

Taking a good look at the animal, it does appear to be Dorytenthis-like in shape. Small triangular fins at tail. Ca 6-8" in length.

Obviously very disturbed. Alternating perio

Capt., Nov. 20, 1971, IV

(60)

Resting on the bottom with forward rises to the top. And shoots of bumping into sides.

Rises may be accompanied by some sort of very extreme "E". Perhaps only most noticeable.

When resting on bottom, arms and legs sometimes spread in "semi V".

At least once "semi-V", accompanied by "Devil Tail" (by 1 or 2 pairs of arms!).

Resting on the bottom. It would also adopt something like PH. Four transverse bands across pale background.

Like this WS.

Rising to the top, the animal becomes generally dark "granular" reddish, at least on the top of the head and mantle (perhaps all over). For all I know, this might be Ord.

The species also has midsummer yellow. Golden not blue-ish.

We turn out the lights while taking care of the capture. Put them on again after a few minutes. Large group comes back, but disappears after a few minutes. Lights out again.

Capt. Nov. 20, 1971, V. (63)

Ca. 8:15 pm. Flashes for fourth time. Can see Bruce's lights. On surface. Turtle on the right. [illegible] on Bruce's. Back. Continued with definite PH. Two or three [illegible] stages.

Ca. 9:30 pm. A single Bioluminescence type appears near lights. Seems to appear to have a flash duration very with very congestion.

November 21, 1971
San Blas

Going to work at Nalusiga today. Start out at 8:15 a.m. Sky clear and sunny. Strong wind. Choppy waves. Water rather murky.

Explore areas occupied by groups I, II, and III last trip. Absolutely no signs of squid. In spite of the fact that there are lots of Panchovetas, of 2-4 species.

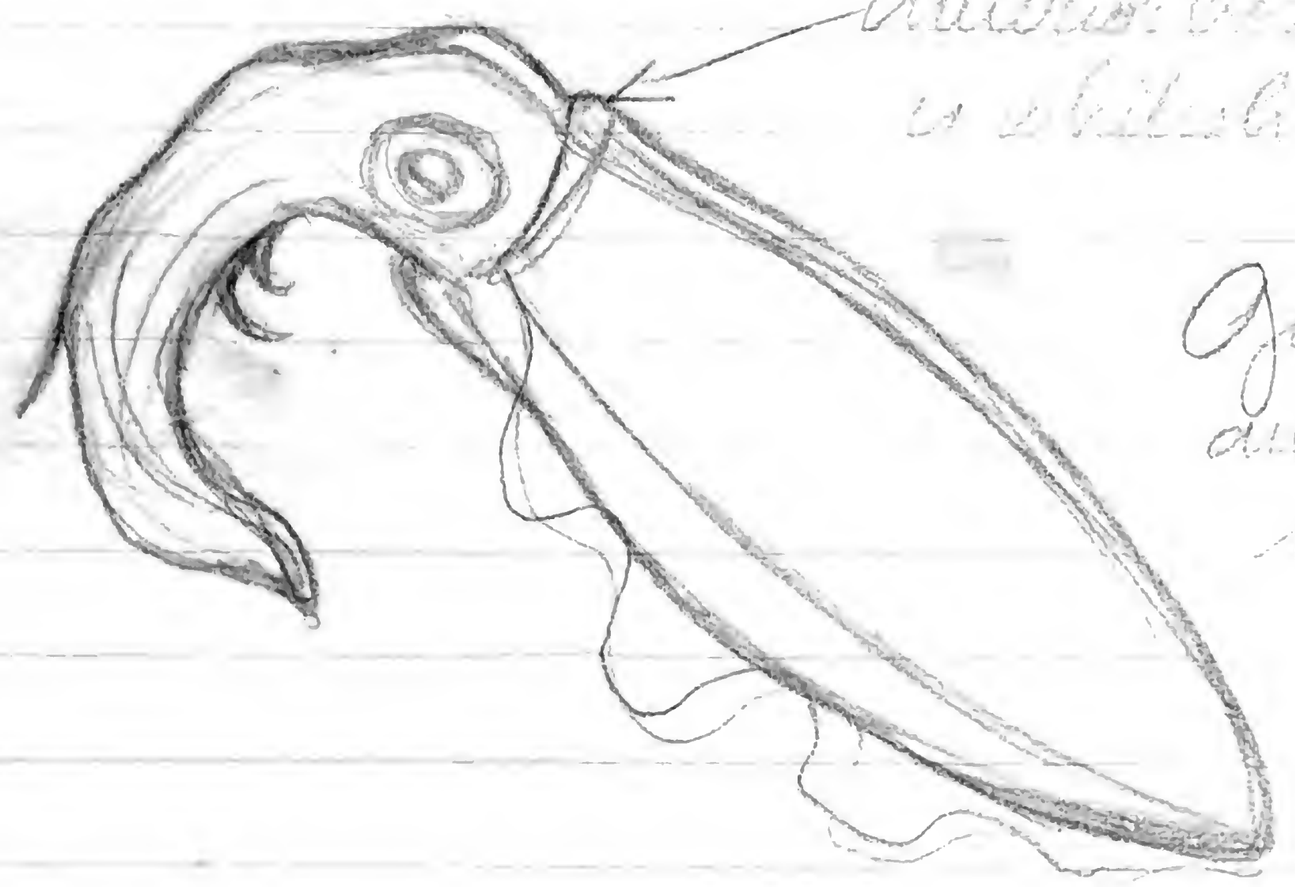
NOTE, This is the windward side at the moment.

Stop observations 8:50 a.m., when Arcadio arrives with the news that he has found squid on the leeward side a mile. Large. In a ft. water. Over coral. I go to see them. Arrive 9:00 a.m. Find three large. In area of low Turtle

Green near bottom of patch, could see Hatch [illegible]
8 ft deep, bottom 2-3 ft below bottom. All in [illegible]
[illegible] and more or less [illegible].

They retreat, slowly, [illegible]
One ind. lost trace of E during school. He [illegible]
When animals change direction. Come [illegible]
One ind. (same ind.?) does extreme [illegible] changing
approach again without change of [illegible]. Note:
Approach is all swimming head [illegible]
three inds. do extreme E, still [illegible] to
me. All three pursuing back [illegible]
When nounces E, still no change in color.

Good view of E



9:08 a.m. All squid leave when school large
fish appears. I find them again a few minutes later. Now
swimming over almost pure Turtle Grass in water 6-20 ft

Dive [illegible] 12 ft above bottom. Still on [illegible] & I. See the back stage of the U.C.S. theater. [illegible] Good [illegible] Very [illegible] to me or to any thing else.

Our boats are returning, a common fine as it [illegible] the dark [illegible] Got one large [illegible] fun all day. Clean up. [illegible] aquarium [illegible] PB towards the pub. Got home at [illegible] to bed.

Later in the morning we go for [illegible] around seven small islands [illegible] Yolung and Pro Tao. Still no squid.

COMMENT. The population of squids would appear to be greatly reduced. And in completely non-reproductive condition. Was there a major die off after breeding in the Spring - early Summer? Are newly-hatched young pelagic now? Quite probably yes.

While in the patrolling, Wayne and Mike went "deep diving" on a reef a few hundred yards off Mulanoga. See one large [illegible] 15 ft down. Hiding in Stag Horn coral. Aspiranetta mimicking Stag Horn. Head up. In something like Double Strude. With tips of arms and tentacles lighter than most of rest of animal.

Cayh. Nov. 21, 1971, IV

Nile Moses annual. Moses 1: Gaulter Hog Nose. Moses returns to feed. Does distinguish between flowers & definite preference for fruit shrub. Bees are not stuck to particular orchids 2:5 [illegible] incubators.

NOTE: Arcadia [illegible] say that the squirrel tried to come [illegible] p.m. Obviously something [illegible] were here all day [illegible]!

But certainly there has been no squirrel visible around dusk 1:30-3:30 p.m. today.

On other matters, Louis, Simms arrived in the Group I-II-III area 3:30-4:00 p.m. Jacques arrived in the same area 4:05-4:25 p.m. No squirrel [illegible]

This is all the more significant because 1) the weather has been calm since around noon and 2) the whole area is lower with small holes [illegible] fly which could be caught by the smallest of the showed lepidopterus.

ADDITION: Wayne saw a large lepidopterus, definitely single, swimming around offshore, [illegible] not far from where "Hog Nose" mimic was seen earlier. This occurred ca 4:15 p.m. Around 10 ft down in 15 ft of water.

November 22, 1971
San Blas

Visited Isla Pajaros (Bird Isl. or Nuatipo, [illegible]). Water very calm. Water some cubic number.

7:45 a.m. One squid seen [illegible] ([illegible] and [illegible]). Boat is anchored in small channel. At 20 ft depth. Then there was a single squid (same size?) a hundred yards away, 8:00 a.m. In deeper water (perhaps 5 ft above bottom in 25 ft of water), edge of shallow grass area.

There do seem to be a lot of single squid around now!

Then I go to look at areas near Nuatipo where we have seen squid before. 8:05 – 9:05 a.m. Definitely not a single squid present.

Later in the morning, we go prospecting around other sides of Nuatipo.

11:00 a.m. Finally success. Find one squid. Definitely legitimate. In area of patchy coral of a great variety of species interspersed with expanses white sand. Water varying 20-30 ft deep. The first squid seen (and its companion seen later – see below) tend to stick close to the bottom, from a few inches to 5 ft above bottom.

Arcadio is the first of us to see the first squid. The squid is apparently alone at the time. In a patch of

Form 8

Capt. Nov. 22, 1971, I.

Stag Horn. Body horizontal. Not seen anything of it by Night, ritualized. In the [illegible] 9 feet to the area, the Squid has moved around a coral head. [illegible] it is sitting, head up, extend P. & [illegible] U and probably some Y. Billows inside. Moves on to a coral or low the CRD of head. The tentacles look inward. Then it advances, forward. Retreat T, still in ORD with WS & Y. The arms are relaxed, hanging against bottom during advance in E.

Then the animal "sits" on a nearby coral head again. Again body, nearly vertical, head up, arms extended in extreme P (perhaps P-Cent.) Probably no change in color. Only peculiar thing is that tips of 3 or 4 arms are separated. Pattern flower like. Top & from above.

Then my own observations are interrupted as my face mask fills. Wayne takes up note-taking.

The animal moves from coral head to coral head. Often changing colors during moves. Once in some sort of a Double flicker pattern. Once or more in pale [illegible]. One with extreme DM. Goes into extreme CM, with vertical head-up at one or more coral heads.

Then I resume observations.

The animal flees from an isolated coral head across a very wide expanse of white sand to a

Capt. Nov. 22, 1971, III.

(69)

[illegible] Quite a few very pale white or tiny DM dots [illegible] the whole area. Occasionally [illegible] Dominant. Darkness [illegible] again, [illegible] ORD, [illegible] Area [illegible] E. Now [illegible] ORDs [illegible] [illegible]

Then [illegible] Also large. Both in [illegible] N. [illegible] OH. For 1-2 seconds. Then [illegible] ORD. [illegible] signal [illegible] between the 2 [illegible] to form a real [illegible] [illegible] for several [illegible]

Both [illegible] medial lead-up P [illegible]. Also [illegible] as a whole P [illegible] defense-[illegible] [illegible] examples of spreading arm tips in P.

Color in P is always more or less ORD-WS-Y. Sometimes [illegible] or back of mantle are particularly prominent. [illegible] and [illegible] are slightly higher than upper [illegible]. Sometimes not.

One ind. [illegible] to return E, still in ORD-WS-Y while advancing toward me.

NOTE: All observations this trip would seem to confirm hypothesis that E contains appreciable - although not necessarily dominant attack component.

Then there is more movement. Both animals retreat over coral. In ORD+WS+Y with DM.

Then one takes off over white sand again. Apparen

It not frightened Jim [illegible] DM. He [illegible] with [illegible] behind for a couple of minutes [illegible]

COMMENTS:

(1) Pots [illegible] and small [illegible] [illegible] this would seem to have changed since Jim's

(2) Only large and [illegible] now?

(3) Most subs. in deeper water now?

(4) Only in pairs, twos, and other [illegible] small groups now.

(5) Range are much less confusing to Jim than now than earlier. Often even could [illegible] [illegible] now.

(6) Range (at least) are shy-er now than earlier. Often trying to be [illegible] (probably small, medium head-up Pneumatics - could and often [illegible]). Perhaps a sheer consequence of [illegible] ???

Various people swim around the [illegible] at various times this afternoon. Without seeing any trace of any squid.

Try lights at night. 8:30 p.m. A single Dorytenthis type shows up. With "PL" circles around several times; then disappears.

NOTE: Just to be clear .... All references to "squid" text count, without qualification, throughout these notes, refer to Loligo teuthis — nothing else.

ADDITION: (7) "Tentacles" of single large and pairs of larger may be relatively large now? The prey seen

they swept over a horizontal expanse of at least 100 yds.

Tony Lopez
Nov 22, 1971
San Blas

Starting at 9:00 AM (end of Tuesday's) Capt. 8:15 AM. We left Cabo San Blas, over the reef, left and turn to port, then get to open water. Pass numerous forts of Jackie Gray Reef (shallow water) and some very large coral reefs. Continue about 1 mile. Until 10:00 AM. Without seeing a single squid.

COMMENT: It is possible that the presence of a group of 6 large animals at Melinaga now could be correlated with a superabundance of food in the area (outhouses, garbage, etc.) This might suggest that the movements and dispersion of large squid at other islands is a consequence of scarcity of food. But I doubt it. Squid fishes seem to be abundant everywhere. Perhaps more abundant, on the average, now than in July.

But do squid feed less in the breeding season, even before spawning, than during the non-breeding season?

In the afternoon, we move on to the Holandes Keys. Anchor boat in center of lagoon between Calubir (Cabos Cayos map), Puntupo, Pometupo, and Morotupo.

Go touring around several of the islands.

1:25 pm. Not far from Calubir. Wayne sees sun

the large squid. In border area 2 ft deep with [illegible] Green to one side and scattered [illegible] to the other. [illegible] squid immediately shoots off and is [illegible] through large expanse (100 yds or more) of [illegible] deep. According to Wayne, it also [illegible] Wayne III — [illegible] perhaps even V (rec!) — during escape.

Come back to boat. Cut in [illegible] squids!!! Ca. 3:00-3:45 pm. All quite close to boat [illegible] hundred m approximately 40 ft of water) But [illegible] in slightly different ways in slightly different areas at different times.

A. Afterwards just drifting on the surface [illegible] singles. Pairs. Once, according to Tasha, group of 8-10. Each individual separated by 2-3-4-or more feet from each other. Sometimes only 2-3 ft below surface. For [illegible] lower (out of sight). I swam after single. In more or less ORD with WS, probably Y. Apparently not quite disturbed. But as I came closer, it gradually went lower and lower. Going low would seem to be an escape reaction.

B. Then a group (varying from 4 to 10) showed up (re-appears?) near another chain of boat. All clustered close around chain. Usually with tail-ends toward chain, heads and arms pointing outward. Quite near surface at first. In more or less ORD with WS. A broad transverse band of dark, almost untanned, rich reddish brown, across top of head. Probably combined with at least traces of Y. Back of head apparently semi-separated from dark of back by

light transverse stripe (four bands of mottle white?)
(I forgot to say I learned that OK tail is my approaching light is OP [illegible] as well I can see that [illegible] light, [illegible] dark longitudinal stripe [illegible] Bottom [illegible] probably dark with some yellow [illegible]. Yellow at gradually along edge [illegible], but [illegible] most [illegible] on each tentacle. Difficult to know [illegible] ORD-WS at the same time. (I don't know other [illegible])

Then I saw them [illegible] all about backward and downward. I've only [illegible] to [illegible] do so. Due Via quite convulsive. The other is bizarre

Presumably just an aberration?

All cuts disappear out of sight in a few seconds.

Then I back off. In a few minutes the group reappears. Now hang another chain much lower in water (15-20 ft down). Not displaying. Tail-ends usually pointed toward chain as before. ORD-WS, probably Y. Can't tell if they have usually dark transverse bar on head or not.

Then I swim further away and go back on board ship. Almost immediately, the little squid move higher on the chain. Obviously less afraid now. I can see their color better. Most usually ORD + WS, with dark bar across

head and Y. One or more squids turns pale over all over, with no further display.

COMMENT: It would appear that the species are semi-pelagic in fall, disperse at sea during the year. Presumably not Pleuroleucal. During winter scattered. But gravid ♀ "hide" at sea on rocks, substrate or attachment area. Are they now in the area approaching the stage (as they were here?) In case, their ecology would appear to be quite different from that of the large squids here.

Which sexes spawn? gravid females

Why do squids seem to group which include large and medium during the breeding season?

What has happened to the medium now? (Perhaps the large seen in July have died, while the medium seen in July have become large. But not less likely applied to the small of July?

NOTES: The small seen today spent some time drifting. And some of them escaped in the direction of the current (which is quite strong today). But they also are quite capable of swimming strongly against the current.

Once, the small squid scattered when an out-board motor started 20-30 ft away. Caution, here???

Do they have any sort of internal swimming mechanism?

Although all the little squid seen this afternoon

Dive Nov. 23, 1991, V

(42)

[illegible] (a matter of a few minutes) [illegible] were not [illegible]
[illegible] from [illegible] [illegible]
All small [illegible] [illegible]
A single large [illegible] Dorabella-type appeared
at [illegible] [illegible] [illegible]

Dive Nov 24 1991
San Blas

Starting out [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
long [illegible] [illegible]. No visible squid.

INSERTION. All the natives we have met, at all islands, say that squid are difficult to find now.

Anchor, boats Flamen Group on reef. We find [illegible] large octopus in mouth, nothing in stomach.

Then afternoon, we go to Cerro Yolutipo. Drag around island. See squid almost immediately, 1:15 pm. In approximately 4-5 ft of rather dirty water. Mixed sand, gravel, and coral, near Turtle Grass. A group. Two pairs of large, extending over 10-12 ft. 1-2 ft above bottom. Not greatly excited by our appearance. In ORD-WS-Y. No other display at first. Then one ind. does E as it passes by me. Quite extreme. Notice that arms and tentacles go Pale, but not the head or body.

Cephs., Nov. 24, 1971, II

Top of head & curve of rostral gutter mouth

Just one pair disappeared. Now [illegible] can't find them again. Not [illegible] on [illegible] side of [illegible].

NOTE: There are lots of [illegible] floating around here. Ignore and are ignored by squid.

COMMENT: It would appear to be true that groups (of small groups) of large squid (adult) occur around deep submarine islands. Presumably a food factor involved.

Arcadio 254467 after p 76

Jan 30, 1972
San Blas point, opposite playita point on the Mainland (San Blas)
Encountered group of thirty IND of all sizes with a rather high incidence of juveniles. Bottom was sandy & grassy with spare coral becoming thick in deeper water. I noticed several isolated INDS and a couple of trios far from the main group. I covered an area of about 200 yds. I noticed no feeding behavior but the stray squids seemed quite excited. The main group was relaxed.
Nalunega Jan 30 1972
fifteen or so individuals grouped near dock on west side, some stray individuals not far from group. Group was not well formed, but was ragged (no social order) Both stray individuals and group seemed quite excited. There were several predators in the area but I saw no attacks
Jan 29-30 Poveniz ("no squid)
" " " Pico fo ("no squid)

SEE ARCADIO'S NOTES ON VISIT
A FEW WEEKS AGO

February 16, 1972
San Blas

Starting work at Helenga 12:30 pm.
Cloudy, light wind, fair visibility

Go over area of Groups I, II, and III. Then move south 2 miles and around another area a trace of squid. Go along west side of island. Again no luck. Wander south along east side. He doesn't see any squid either. We continue until 2:00 pm, then give up.

NOTE: Fish seem to be conspicuously absent out here now. Immense schools of "anchovetas" of all sizes. Plus many large predators (barracudas, etc.). Have the latter eaten or chased away the squids?

Go on to another area. Mainland coast, inside San Blas Point, south of Pico Teo. Area where Arcadio saw lots of squid a few weeks ago.

2:15 - 3:15. Swim over wide area. Stretches of Turtle Grass, expanses of Staghorn Coral, lots of mixed coral, sponge, etc., on sand bottom. Still no squid. (Not many large predators either!)

3:30 - 3:55. Arcadio tries another area, slightly further down along mainland coast. Again without success.

What is happening.

February 14 1970
Sea Bee

Stop briefly at Habuna on way to [illegible] morning. Talk to local people [illegible] agree that squid are rare now. One [illegible] saw four individuals three days ago. A [illegible] to have seen three individuals early [illegible] year seems rather vague.

We also pick up a helper at Habuna. [illegible] Question him rather closely. He states that squid are not more abundant, on the average, in some seasons than in others. But that they are exceedingly variable in the short term. Here one day, gone tomorrow. This seems very improbable, or at least insufficient as a general explanation. (Possible confusion with daytime?)

Then we go on to Tenon Keys. Travel down Hiatapo. Sunny, little wind. Quite water 9:40 a.m. Clear. Start at first site, place where I first saw squid here months ago.

9:50 a.m. See two large inds. 2 ft above bottom in 10 ft of water. Border of rue sand. Twitch fins. Apparently again tend to stick close together (2" to 3" apart). One slightly larger than the other. Larger = ♀? Smaller = ♂?

Both one in "Ord" (see below) with WS and Y when I first see them. Then one or both go(es) into mem

inter. PH. Notice that cluster of arms has conspicuous lightstreak down center (viewed from above) in "Ord". Relevant also PH

Skin now illumination proceeds in "Ord" and bugs PH's dorsal E and/or P's, both sexes, in both "Ord" and PH. Also a few, occasional, bug subjects by one or both sexes, always accompanied by bug Males.

On the whole, these particular individuals do not seem to be nervous.

NOTE: Now are 3 broad dark bars on the hairy blueing PH's of at least one of these inds. separated from dark "cap". "Cap", in turn, contrasts with arms which are generally light (yellowish?) in PH.

One ind. does extreme E in PH.

The larger of the two inds, the presumed ♀, Males somewhat more frequently than its companion.

E's and P's continue off and on.

Notice that smaller ind., presumed ♂, is generally quite dark, including belly, during both E's and P's. This may be an extreme version of ordin. ♂ Ord, or perhaps a separately ritualized type of elaboration ("Dark").

The smaller ind. also stays closer to me than the larger ind. Further evidence that dark is intimidating, light an indication of escape.

Smaller ind. has injured arm. Should be easily

recognizable.

Smaller mid. does another, in Ord. or Var. Dark.

Both mids. tend to stay [illegible] cular rounded coral head [illegible] more often than not.

One "routes" its area. Approaches [illegible] Ord. clearing? Neither seems to pay attention to [illegible] the numerous small fish in the area. Just hungry.

Both mids. drift off a few yards away. Then drift back some Probing. Also some forward "Pass." All very low intensity. Then one buffs PH. A few Pant. moves.

10:00 a.m. Arcadio calls me to say that he has found a group of aound 100 ft away. I go over to see them. 5 mids. On outer edge of small reef here. (Have been seen earlier this morning — and most of the mids. seen here on previous visits were on outer edge.) Three of the mids. certainly large. Two are medium or medium-large. All 2 ft up in 10 ft water. They all give the usual hostile reactions (E, P, PH, etc.) to me.

Then one mid. definitely goes Pastel. (Arcadio tells me that we may have seen Pastel, with "Pass", earlier.)

Return to "normal" coloration. Then all turn Pale and shoot away, backwards, into area of deeper water. Disappear from my sight.

Go back to first pali area. 10:10 a.m. Both mids.

still the behavior before Pete of P & E. Quite [illegible] but not [illegible] at any given time. So little [illegible] of [illegible].

Then I go back to Pete and find appearances still are [illegible] behavior [illegible].

Shoot to Kill

A few minutes later the [illegible] to say that the two from Egypt again. Some people [illegible] then [illegible] first side and in [illegible]. 2 ft up in 20 ft of water. Rumor says that they were all dead when he first saw them. Then perhaps some indications of "courtship" (rubbing and [illegible])

Back into the area. Find that inds are located above base sand dotted with many lumps of coral, sponge, etc. Little or no visible Turtle Grass. Meets in Ord with WS and Y. Some P, Curl, E. I does R2 during slight retreat. Then I see that there are only 4 inds. present. Has the initiator of the "courting party" gone?

In any case, it looks very much as if we are seeing the first "adumbrations" of the breeding season !!!

Go back to see pair again. Still there. Extreme E's by both inds. in dark coloration. The presumed ♀ has a prominent WS. The presumed ♂ has little or nothing in the way of WS. (If there is a "Dark" separate from "Ord", this is it.)

NOTE: I think that the behavior of this pair sup

posts the hypothesis — which I probably made earlier — that E is less escape-oh and/or more aggressive than ♂.

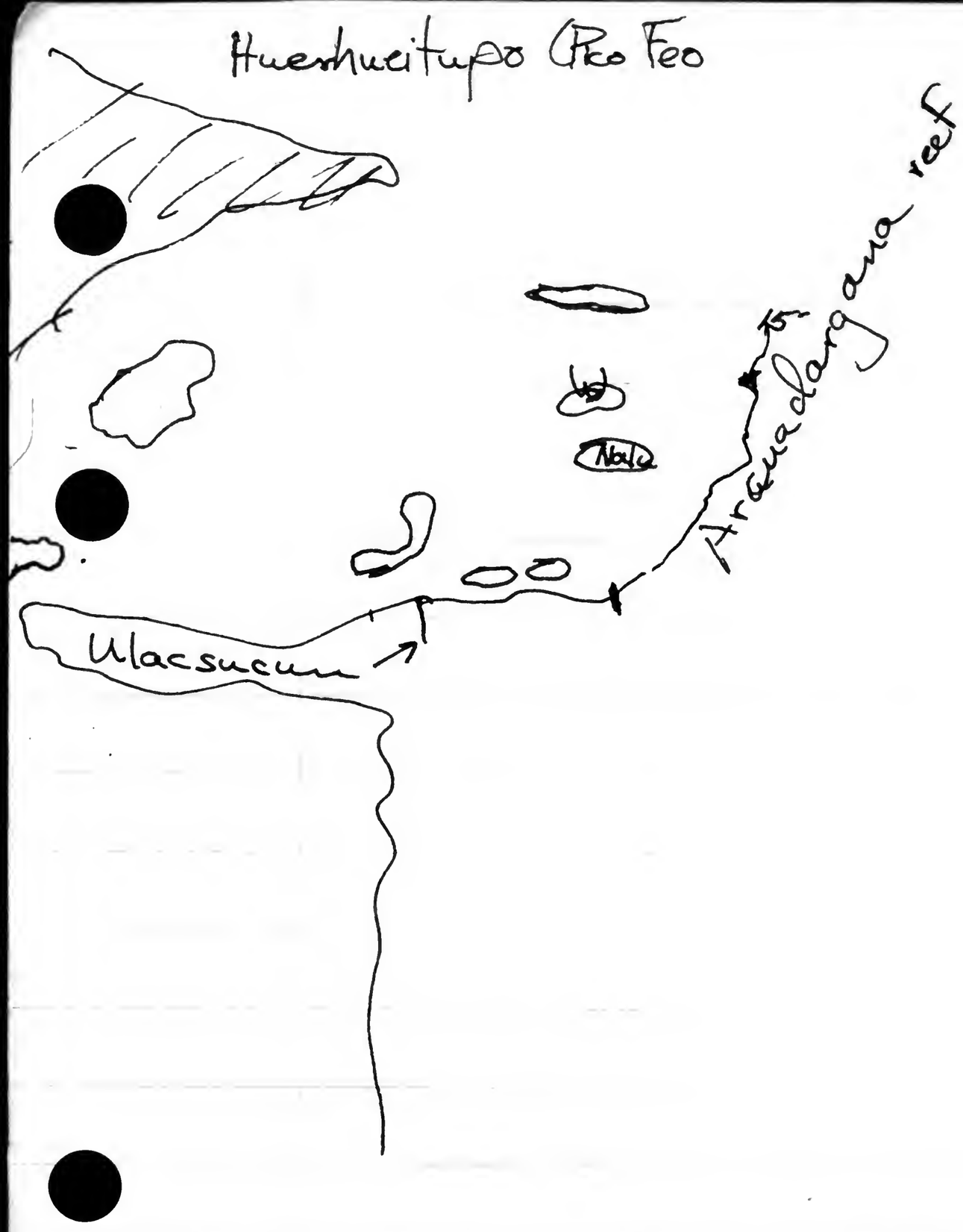
Stop observation at approx. 10:45

GENERAL DISCUSSION: There is a peculiar problem connected with sex and social behavior in this species. Species tends to be divided into pairs and groups. Pairs are apparently long sustained. But social sexual behavior seems to be more characteristic of groups than of pairs. Why? I can see advantages to sex in groups, big gang-bangs. But why, relatively, are pairs of gang bangs are adequate?

Back in water 11:05 am. Water has suddenly become much murkier than earlier. Group seems to have gone

But pairs still here. Exactly same place as before 1-2 ft up in 10 ft of water, over dark patch, 4 ft. from coral head. Presumed male does prolonged E near the Presumed ♀ does prolonged P a little farther away. Both in "Dark" or "dark Orb", belly dark, with some WS (and Y ??)

Sudden big panic. Both males dart away a foot or so. Return immediately. Presumed ♂ does not change color. Presumed ♀ does. Cls she collapses. But not in sequence. First goes into PH. PH with DM! (But I think that the DM may have appeared a fraction of a second after the barring of the back and other characters of typical PH). Then "she" goes pale. (DM perhaps disap-


Huerhueitupo (Pico Feo
Arquadangana reef
Ulacsucum

passing a fraction of a second after typical PH characters) Allows Aqua Hill back to Ord at "dark Ord" again. Yellow and blue-green reaction to outward water starting 200 yds away.

Stop 11:20 a.m.

Arcadio gets into water as I come out. Can't find group either. But Leo finds group in same place (they are calm). Sees a few traces of what he thinks may be "counting" (backing up prominent g. Hill PL. No response by groupers.

He thinks making nervous noises. No reaction

Work stops 11:45 a.m.

This afternoon going to work on "outer" reef. Start 3:00 p.m. Reefs just off tip of San Blas Point. Swim around for some considerable time, both over reefs and very large beds of Turtle Grass in adjacent areas. No squid!

4:00 p.m. Go further inside Point, along coast of mainland. Area where Arcadio saw squid a few weeks ago. And where Arquimedes saw 4 kids (3 large and 1 smaller) only yesterday (sic!?). Again nothing. NOTE: this general region is called "Macsucum" — see accompanying sketch by Jim Porter. Again nothing.

Stop 5:00 p.m.

February 18, 1972
San Elo

Going to work on Hastings medians. Arrive 8:05 a.m. Cloudy, windy, cool. Nothing to see.

The group seen yesterday ("Group A") turned around when we first look for them. Further to the west seen yesterday ("Pair A") at 8:15 a.m.

A minute or so later a single wid shows up more or less large. Definitely alone. Swimming forward, with arms tucked under his body (presumably E — to us? — rather than a mechanical "subject"). 2 ft up in 10-12 ft. of water. Swims right through Pair A area, proceeds straight ahead, passes Group A area and continues for some yards farther. Not over seagrass. In more or less ordinary Ord throughout. Then suddenly turns around and shoots backward. Joins 3 other wids. All more or less large. In ordinary Ord. No "greeting" as far as I can tell.

The 4 wids. drift off in general direction of Group A area. Gradually accelerate. Go down into deep water. Arnaldo sees one near bottom; the other 3 seem to have disappeared (temporarily).

Then we see another group of 4 wids some 20-30 ft. away. All approximately same size (perhaps medium-large, perhaps young adult or sub-adult — as might perhaps be expected at this time of the year?)

3-4 ft up in 10-12 ft water, over mixed coral and grass. Swimming well close together (1" - 3' apart). Flutter in ordinary fashion, some WE (and Y?). The ind. farthest from me does PH from time to time. None of the inds. display Fin Whip. Several inds. show traces of Rubber coloring. Other spots darkened. Three inds. (incl. the 2 who do FL, but not the one who does PH) show traces of Pastel. Acquire a general purplish or purplish "bloom" (partly powder, partly iridescent) "superimposed" upon Gold (at least upper parts). The total effect is darker than an extreme, really pale "true" (?) Pastel. One of the inds., the one nearest to me, acquires this "semi-Pastel" more frequently than do the others. Several times, this ind. swims forward, slowly, away from the rest of the group, gradually assuming semi-Pastel as it does so. Then shoots rapidly backward toward group in "fully developed" semi-Pastel. No flutter during this shoot. Only responses by other inds. are erasive movements and at least one brief PH.

I shall call this second group "B".

Get out of the water 8:35 a.m. Arcadio stays 10 minutes more. He sees Group B joined by more individuals. Quite probably all or most of group A. Then all go off into deeper water (again).

Is this morning's "gradual assemblage" typical of the species? I rather think so.

NOTE: The Onds seen today were quite conspicuously different from the "Darks" seen yesterday. Hot as dark on back. And quite light below.

Go back into water 9:10. And all Hell breaks loose!

Go to Pair A area. No squid 9.15. Then see 1 large. Being photographed by Arcadio. Later observations (see below) indicate that this is adult ♀. Call her "Female B". She is 1½ ft up in 10 ft. of water. In PH with DM. Otherwise not very obviously disturbed. (Can color change be a substitute for more overt actions?) Suddenly she swings around (arms going under into E-type position), then immediately goes pale (probably nitralized Pale, but very extreme, silver, all over). And does extreme V of elaborate form.

Obviously arms too long! But general effect not bad.

Cph., Feb. 16, 1972, IV. (88)

[illegible] some calcification. Smallest arms stretched [illegible]. Also [illegible] may be a single or two Ovoids in app. [illegible] Pelvis later, & scattered [illegible] from Ovoids to direction abt [illegible], but slightly smaller than the other and. Cephalic ☿ ("☿ B") — see below. (NOTE: I can tell that this pair B is different from pair A. The ♀ of pair B has arms on her. The ☿ of pair B does not have visible large arms like the ☿ of pair A.)

♀ B initiates V-Pelvic as ☿ B gets closer. Goes into PH or Ord-PH in ordinary posture ☿ B approaches at normal speed. He is in Ord or Ord-semi-Post el. Joins ♀. Both swim together, facing in same direction. About 6" apart. ♀ now in PH most of the time. PH of a definite type. Barring not conspicuous. More or less dispersed mottling on back. Rather light in tone, as PH's go. No DM. Her fins are speckled along the edges, quite clear, transparent, medially. ☿ in definite Pastel. Not extreme. A "trace" of Ord, probably also WS (probably not Y?), underneath the Pastel. Both inds. do a little Rocking. But not much. When not Rocking, the animals just swim, backward, back and forth. No fluttering. ☿ often "bent" toward ♀. See drawing next page. When ☿ approaches particularly closely, the ♀ tends to spread her arms. Rather conspicuously "broadside." With conspicuous PH pattern on some or all arms, but no real Z

Cephs.; Feb. 18, 1972, V.

"Bending"

Then we get copulations and copulation attempts.

① ♂ suddenly darts into ♀. Forward. Strikes at her head area (base of arms?) with 1 or 2 arms (not tentacles). He is still in his usual Pastel as he does this. She darts away, backward, immediately. Some color change as she goes. Think some complicated combination of PH and Pale (possibly other elements), but I don't follow the sequence well. Then the 2 inds. separate (each going away). ♂ reverts to Ord.

② Then the 2 inds. come together again. Swim side by side. Little or no Rocking. ♀ in PH as earlier (mottled, bordered fins). ♂ in Pastel as before ("over" trace of Ord). Bends from time to time. Suddenly, he strikes again, with one or two arms (2 more probable?) This time the ♀ does not flee or change color (at least not much). Copulation obviously successful. ♂ goes about 10 ft away immediately after cop. Changes back to ordinary Ord as he goes. The ♀ sits in PH or PH-Ord. After a few seconds, she uses all her small arms, but not her tentacles, to "tattoo" her frontal area. Obviously,

rearranging spermatophores on frontal gland.

(3) Then ♂ comes back. Assumes Partl as before. Whole process repeated as before. Only difference is that ♂ doesn't do much re-arranging. Is this ani getting better with practice?

Then I leave. Get out of water 9:35 a.m.

NOTE: All of these 3 copulations occurred during a space of approximately 5 minutes!

Ani stays in water after I leave. Rediscovers pair after 10-15 mins. Sees 2 more copulations. Then he also leaves water.

NOTE: In all 5 cops., the ♂ appeared to attach, or try to attach, spermatophores to frontal gland rather than inserting them within mantle cavity. Is this "normal"? Are mantle-cavity-insertions artefacts of captivity? Due to shortage of space and/or bad training?

I go back into water 10:05 a.m. Go straight to pair B area. Animals not there. But we find them a few seconds later in deeper water a few (20) yards away. Pair B now associated with 4 other inds. Group A? 2-4 ft up in 15-20 ft water over scattered coral and bare sand bottom. The six inds. seem to have formed a "courting party"!!!!!!

Social organization of group obviously complex. ♀ + ♂B at one end. Followed by another ♂, presumably another ♂ ("B"). Another 2 more, presumably. Ord ♀, are showing very mild traces of sex at the other end (Rocking, some RL). ♂A and Tawallit of group) doesn't pay much obvious attention to others, but does do E in Dark to me (not sexual yet?).

♂ + ♀ B doing a lot of Rocking now in these circumstances. ♂ is in Ord most of time. All pair-on spent. ♀ repeatedly RL and Pu (sometimes ev time). Presumably repellent. Repelling either ♂B and/or ♂B. B just tags along behind B's. In Ord all the time. Every once in a while, ♂B drifts or darts back toward ♂B. Assumes PH as he does so. B always retreats immediately. Then ♂B rejoins ♀ and resumes Ord.

COMMENT: It would appear that the most spectacular "courting parties" are "post-hoc" rather than "pre-hoc" (note that displays of pair B today, while they were alone, were not very exaggerated — much less extreme than some I saw last June). "Courting parties" may develop when already fertilized, at least partly satisfied, ♀'s rejoin groups. Presumably pairs separate from groups in order to achieve successful copulations and/or do not go to groups until successful copulations have been achieved.

What is the sex ratio in this species? Are ♂'s

more abundant than ♀'s. On simply active sexually over longer periods of time? On what?

I get back out of water by 10:15. Arnadio stays in a half hour longer. Continues photographing Hotices that seem to vary gradually, dies down.

NOTE! Some of the obvious, hostile PH's (to us) this morning were accompanied by light streak down center of arms. But probably not! The PH's of the GB alarm sound encounters. Light streak on "cit. mov." of Pole?

Going back to same place this afternoon.

Arrive 3:00 p.m. Clear. Cool. Warm. Water fair, clear.

Find group of 6 large inds. more or less where B's seen last this morning. 1-2 ft up in 20 ft of water. Bottom mixed sand and clumps of coral. One does extreme E. Another does extreme P. All in Ord with WS (Y?). Light streak down center of arms.

Probably 4 inds of "group A-B (including ♂ B), plus B pair.

4 inds. move off. Presumed B pair remain. Ord, WS, Y. Do some E's. Then move off into still deeper water.

I go to A pair area 3:15. No squid.

Go back to group area. Find 4 inds. 3:25. 20-30 ft. down. Perhaps pair B plus ♂ B plus a friend (probably another ♂) swimming around in Ord & WS. One ind, possibly B ♂, does LP (!). White

side of body directed toward other presumed ♂'s.
Then ♀ goes exploring over a large area of jungle grass in fairly shallow water. Nothing.
Go back to A-B group area. 3:40 pm 4 inds. back behaving rather as before. Find more or less semi-apart. Other 2 in low tide "courting pairs". ♀ does some Rocking, some escaping with OL and Pic. Otherwise animals in ordinary Ord well, WS.
Why does a ♂ stay with a ♀ after copulation? Does he help in defense of her, or in search for food?
These 4 continue for some time. Then the second detached ind. also starts to follow ♀. She "escapes", alternating Pic with Ord + RL. Then the animals appear to become more excited. One ♂ starts to follow the ♀ particularly closely. He assumes Partial Cul atural, dark, like Pattis scutellus mentum). ♀ assumes "mottled" PH coloration. ♂ "bounds" while swimming beside ♀. Then starts to make "copulatory forward rushes". Obviously unsuccessful. He always stops short. (Presumably stops in response to some information from ♀, but I can't see that she signals in any ritualized way.) The second ♂ follows behind usually in PH. Sometimes spreads arms. Z on arms while back remains PH. Or assumes Z on one side of body (with and without spread) while retaining PH on other side. The Z side is always the one facing first ♂ and ♀. The third following ♂

is much less active.

Squeeze left at 3:55 p.m.

Attempt gets set some minutes later. Tells me that there was "another" group of 3 inds. quite close (Cam III 10 ft.) from the 4 inds. I was watching. Rather smaller on the average. Apparently 1 ♀ and 2 ♂'s. Some very low-contrast "courting" some RL's.

The smallest ♂ of the group of 4 sometimes darted out to join group of 3 temporarily.

Obviously the situation is fluid!

COMMENT: Why have we not seen any baby squid this trip. Are they all in deeper water? Or are there no babies at this time of the year?

February 22, 1972
San Blas

Start out at Pico Teo (Don MacPhail saw squid here yesterday or the day before.) 9:15 a.m. Cloud y. Very windy. Swim all around the island. Through a considerable variety of habitats (Turtle Grass, smallish patches of coral, etc., huge expanses of discarded coconut shells), areas of fairly clear water as well as extremely murky ones. Without seeing a single Sepioteuthis. Come out of water 10:30 a.m.

Go to Uratupo in the afternoon. Still extremely

Cephi, Feb. 22, 1972, II

(1)

windy. Start out in usual area. Sea is moderate now. Water fairly clear but very agitated. Visit all A and B areas. Continue swimming until 2:00 p.m. No squid (quite definite)

Then go to leeward side of same island for min 2:20 - 2:40 p.m. Water is so full of sediment that we can't see anything at all.

On way back, stop at Nalunega. Water is pure pea soup!

COMMENT: Presumably all or most of the squids retire into deeper waters under the conditions which prevailed today. This may help to explain why the main part of the breeding season comes after the dry season (if this is indeed the case).

February 23, 1972
San Blas

Try leeward side of Pico Teo this morning. Some cloud. Still extremely windy. Start 7:50 a.m. Water is not quite as murky as might be expected.

8:00 a.m. Arcadio sees single baby squid. 3 ft up in 4 ft of water over Turtle Grass near large coral. Disappears immediately. But this does seem to indicate that there is some breeding all year round.

I continue swimming until 8:30 a.m., without seeing anything of interest. Arcadio swims all around the

island, until 9:00 a.m., without seeing any squid at all.
Start again 11:00 a.m. Sand bank in area known as Illaskuan south of Pico Tea. Enormous bed of Turtle Grass, some being coral reef but now fish in the grass itself, but lots around the coral. 11:35 Area of grass. See single squid (medium? large?) just on bottom, in 15 ft water. Darts under sunken log. Disappears. (NOTE. I thought that this animal was drag-ging something long (a fish?) and white (ventral and below. It could have been an egg mass. But I could be — probably was in fact — mistaken.) Continue swimming until 12:30, with quite negative results.

Try Haluruga in the afternoon. 3:00 p.m. Wind still strong but perhaps a little weaker than earlier. Group I-II area(s) too murky to be feasible. So we start group III area and swim around island. I get 3/4 of the way. Arcadio completes the circuit. Pass through all sorts of habitats, Turtle Grass, Eel Grass, Coral Reefs, mixed sand & coral, etc. 4-20 ft of water. Considerable current in some places; much less in others. The area, at this depth, looks ideal for squid (and we have seen many here before) — but we did not find any this afternoon. It must be the wind!

NOTE; Talking to more of the natives of Haluruga this afternoon. Including Carlos, who seems reliable. He says that he saw a group of approximately 100 squid near San Blas Point. Inds. of all sizes. This tallies

Ceph., Feb. 23, 1972, III

(98)

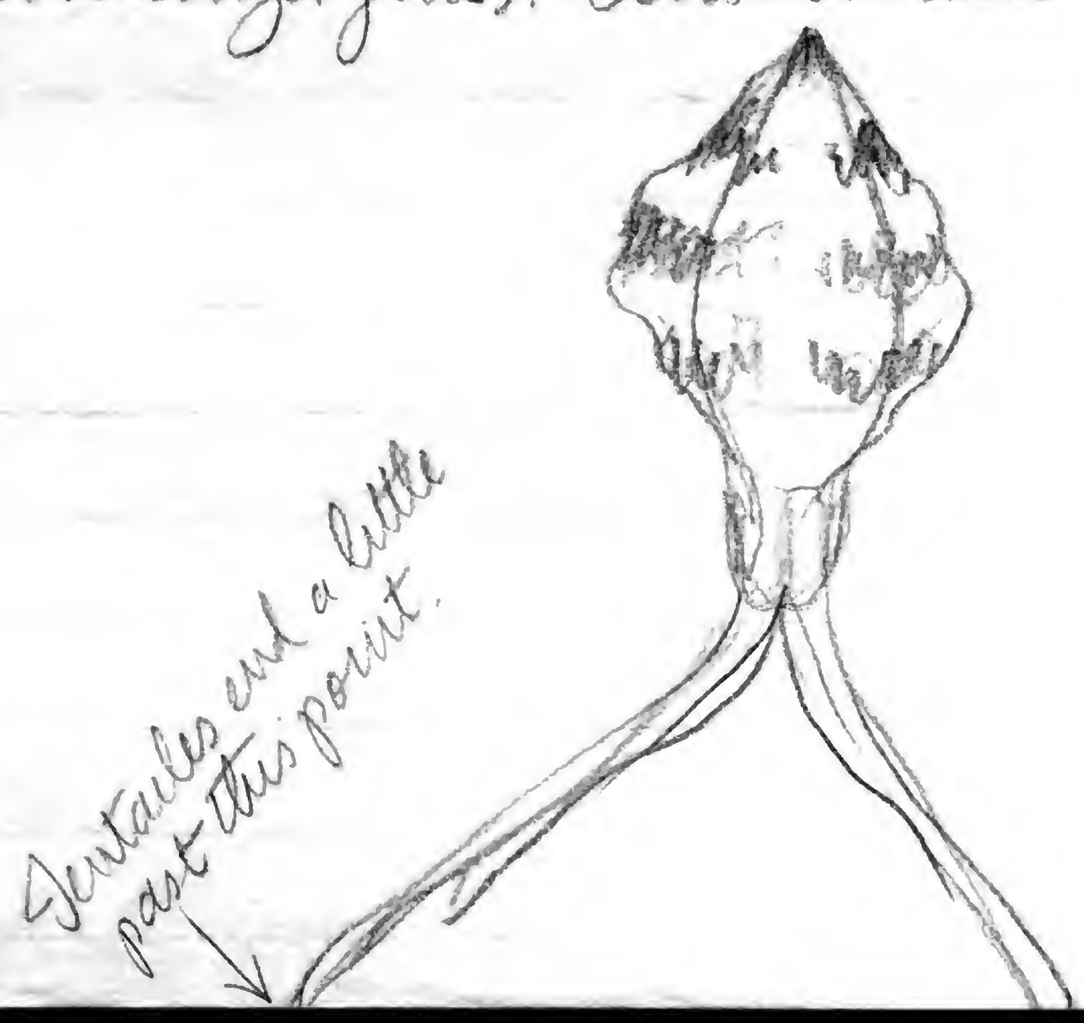
with Arcadio's account. There really must have been large groups only a few weeks ago.

Does the species have two breeding seasons each year. Or was the local population "misled" by the peculiar nature of the dry season this year (even, during all of December, rather wet in January) to start to breed prematurely, only to have to regress later on?

February 24, 1972
San Blas

Wake up this morning to find that the weather has not changed

8:05 a.m. Pico Teo. sitting on porch. See a single baby squid (not quite as small as some) in shallow water right beside house and island (visible nearby, near barrier). In semi-PH (3 interrupted bars on body, apparently extending to and through fins). Also extreme V



Cayh. Feb. 24, 1972, II

Presumably these apparently single baby squid are being swept along by winds and currents more often than not. But they do seem with certainty went again at the current for at least 4-5 ft.

Five minutes later, see another (?) baby squid in same general area. Same size. Same PH and V. (Notice that PH is accompanied by extreme, extremely, visible-eut, Y). This vid. is about 1" down in 1-1½' water. Drifting or swimming in same general direction as current.

COMMENTS: Arcadio makes the interesting suggestion that these baby squids are mimicking bits of Sargassum. The resemblance is certainly close!

Which may be correlated with another peculiar feature. There would appear to be a fairly rigid ecological separation between smalls and medium-larges now. The latter probably have retreated to deeper waters. Some or all of the former are near the surface. Are babies always, at other times of the year, more likely to remain not far from the surface than some mature individuals?

If so, it might be a simple consequence of their mimicry. (One of two types of mimicry in different classes of the species. Eg "adults" on Staghorn Coral in November.)

Go exploring later in the morning. Weather still unchanged

Arrive at Aruman Islands 9.35 a.m. Harangjo

Chico Waterlilies soup. Sent [illegible] scouting around for some time. We don't even bother to get out to the water.

Go on to Navarro Grove Dive site.

Then go on to some islands to the north in Robeson group. First Hunutupo. Water [illegible] lots of Turtle Grass; also small coral heads [illegible] including needlefish, but no squid 10:15–10:35.

Go on to Ailitupo. Again beautiful scenes of habitats. Again no squid 11:10–11:25 p.m.

This afternoon we decide to look for Sargassum (pursuing the idea of infantile nurseries).

Follow one long drift line, starting from Pomeroon reef, almost to Halimeda. Extending over fairly deep water (Turtle Grass on bottom, when we can see it). Composed of floating Eel Grass leaves, Turtle Grass leaves, and lots of Sargassum floats (very few whole plants or substantial fractions thereof). See one school of small fishes. Nothing else. Give up 3:30 p.m.

Then Arcadio explores a solid mass of floating vegetation, largely Sargassum (largely semi-intact plants), more or less "hung up" before sandbank-coral reef in front of Pomeroon (lee side). Lots of fish. No squid visible. But when he sticks spear-gun up into mass, he provokes release of a puff of ink. Dark (i.e. not Doryteuthis is; either Sepioteuthis or, possibly, pelagic baby octopus). So there's something around in this environment after all.

Stop work ca. 4:20 p.m.

NOTE: Jim Porter says that Sargassum grows, roots, on the outer reef here.

February 25, 1972
San Blas

It is a little less windy today than during the last few days. But still far from flat calm. Going to work at usual place this p.m. Get into water 8:45 a.m. Some sun. Water fairly clear. Lots of fish. No squid anywhere. Leave water at 9:25 a.m.

Then Ayala & I swim around the southern boat channel, which is deep and shallow water, all around Matupo pequeño (called Achutupo in some of my earlier notes), and also around a large part of Matupo itself (including the whole of the lee side). Until 10:25 a.m. Again no squid.

Then I go back into water in usual AB area. Until 11 a.m. Still no squid.

I think that it is safe to say that the squid simply are not here this morning! Evidence quite definite.

ADDITION: While I was swimming the second time this morning, I followed a drift line of nearly complete for some considerable distance without seeing any bubbles.

NOTE: The small swirlines near the surface here seem to be more dispersed than usual. Is this because the squid are absent now?

Cgh. Feb. 25, 1942, II

This afternoon we work along the [illegible] San Blas Point. Beginning at a place called [illegible] Carlos saw ± 100 [illegible] 2:15 p.m. [illegible] moderately clear calm. No squid [illegible] point (Cuvane). Part [illegible] until 3:00 p.m. Still without seeing anything [illegible] to us. Then Cuadro [illegible] further, until 3:30 Not a sign of squid. I think that we can safely say that squid are not here now either!

Was there a big die-off last week or [illegible] months, after breeding?

Possibly so. But it cannot have been complete. For we return to Helungan after the afternoon's work, to find that one of the little boys on the deck has just caught a Sepioteuthis, large (!), and cut it up for bait. He says that this ind. was one of [illegible] years.

Caught near inshore (3-4 ft water?) [illegible] Group II area.

So the whole situation is just as complicated as I thought it was!

III.

Indexed for display
" " courtship and copulation

March 22, 1972
San Blas

[illegible] Dolphin [illegible] Club Gatorbeg was rough
and windy [illegible] Also [illegible] was [illegible] Sundays
life & [illegible] [illegible] squid [illegible] 26 [illegible]
at Group I [illegible] Area [illegible] day before.

Get into water 7.55 & swim around Group I
II area & [illegible] Quite [illegible] squid
stop [illegible] [illegible] Go to Group III
area [illegible] squid there either

Is Pete [illegible] in the morning?

Get into water again 8:25 am. Group I & II area
still no squid by 8:40. Go over to III area. No squid by
8.55 am

Aurelio has himself towed around island 8:10 –
8:25, again without seeing anything of interest

Then one of the villagers calls me. He has found two
squid in extreme II area in shallow water. I get running
over and plunge in. Squid still there. Two medium,
one considerable larger than the other. Quite close together
Perhaps 6-8" apart. 1 ft up in 3 ft water, over miscellaneous
rubbish near TG.

Both reels in extreme & when I see them. Alternating Quadruple streak with Quintuple streak, i.e.
bells, stripe coming and going.

Coph., March 22, 197[redacted], [redacted]

Then the smaller and stage 2 female dashes in and mugs in P. Goes into a very yellow-green Ord (with WS and probable Y) that I can't generally tell from one related to OH, but I couldn't detect any OH bits, and nothing on the back (of course, the animals were far away, and then I couldn't see the back at all on stage 2 females)

The larger and stage 2 male dashes in and charges into steady quintuple threat.

NOTE: I didn't see either individual make any attempt to feed while in streaks, but they might well have done so before I arrived.

Then the larger and does exactly the same while retaining quintuple threat for next page. Holds this for a couple of minutes.

Then suddenly shoots backward a foot or so in extreme E, in Ord, WS, Y, and DM. The smaller and also shoots backward at same time. I think in "yellow Ord" with WS and Y, nothing else; but I am not sure about this.)

Then the two begin a sort of hesitation dance, obviously directed toward me. Advances and retreats. Advances usually longer than retreats. They are obviously trying to edge around me, to go on somewhere else. Some P's and E's by both. E's are more frequent and longer sustained by the larger of the 2 males, who is also the one that advances most vigorously and stays closest to me. The larger ind. is in Ord-WS-Y throughout

V + Quintuple Hook
(NOTE 9 tentacles arrangement of hook and light on tentacles is correct. It was however, conceivably have been reversed.)

At least one arm underneath in V with the tentacles.

Smaller arms point downward in "pseudo-hook" effect. Sometimes they are dark. At other times light.

Fins not conspicuously colored. In normal movement throughout.

Eye quite visible from this point of view.

Cpla., March 22, 1972, IV

The smaller returns were seen at the "yellow-Red" site. Finally the short-legs are all disappear 9:25 A.M.

I think that this series of longlegs confirms my earlier conclusions and hypothesis: P = V and P-streak patterns are all hostile. P is also given a higher V higher intensity than P (with escape flight, can go around ant ????) E contains relatively few P (and V ?), panels also higher intensity than P on the average (although lower intensity than V ?).

10:30 a.m. Arcadio has just gone for a leg line across some outlying banks and reefs. No squid.

Go into Inter again 10:55. Search all the high I-II-III areas. No squid (NOTE: it is low tide now. Area where inds. seen earlier this morning is very shallow indeed now. Do squid come near shoreline only at high tide? If so, why?)

Then we go on to Matupo.

Start usual area 1:35 p.m. No squid in any of the A or B sites. I also patrol a stretch of shallow shoreline; Arcadio and I explore other reefs; Arcadio inspects another stretch of shallows; and Arcadio has himself towed around most of the whole island, all without seeing a single squid. Stop 3:30 p.m.

NOTE: Most of Arcadio's tows here at Matupo this afternoon and some of the tows at Nalumaga this morning were deep. They indicate that the squid are not now in moderately deep water near the

particular shoals. I'd say probably, had drifted after the last "flush" of spawning.

After lunch go into the Lava Islands. Anchor off beach, which I'd like to call Sealed "Harbor" in honor of (p. 37). Arrive 4:45 p.m. Sea squal immediate!

Group of 9 smalls now close to boat. Smooth at surface, some swellish motions, but (probably) not as quite as small as the tiniest) have seen elsewhere at other times. Definitely "playful". Swimming 1-2 ft down in 30 ft depth, curious, channel. When first seen mids. are rather scattered (disturbed?). They don't come any after a few minutes.

But then they come back almost immediately. Now quite tightly integrated. Mids 6"-1' apart. All in and some with us, some without. (I presume that all or most also have Y, but I can't see it.) No trace of V. All mids. are facing toward the boat. (Facing toward is obviously defensive.)

Bottom here is sand and TG.

NOTE: There is no floating Sargassum or other weed here now.

After approx. 5 mins., all these smalls swim away, left to right. Swim past the anchor rope (white cable now, instead of metal chain) without stopping or showing interest in it.

We get into the water and try to find them

The subs were heading in the general direction of "Heulman" when they disappeared for us some 10 kts way to the ESE. Surface up 5:15 p.m.

Running light this evening. Pages a a 130

No cephalopods show up by 6:00 p.m.

Thursday, 1972
Sun Cles

Working same place (Solar) this morning. Sunny Windy. (Will they come again?)

Begin 7:40 a.m. Moslar goes on shallow lagoon Bay several islands, through a variety of habitats, mostly on the sides. No squid by 9:05 a.m.

We go back to the "Jetty". We haven't seen any squid here either.

So I go into water 9:10 a.m. Swim to nearest island. Follow anchor cable. No squid "attached" to it. Swim around and near shore for some considerable time. Mostly extensive TG (scattered thin, sand visible almost everywhere) with many Diadema, few fish, some areas with scattered coral heads, sponges, etc. Still no squid.

Then, 9:35 a.m., come across a group. 5+ All small (or perhaps, in some cases, small-medium) 1-2 ft down in 8 ft water. Area of pure TG and abundant Diadema. I think that this may be the first time I have seen Sepioteuthis in an area so rich in Diad

March 23 1972
Salar (San Blas)

Deep exploratory dive at 1 p.m. Dive down to about 160 ft on windward side of island along fringing reef. Side of reef is steep & cliffline solid coral with a lot of caves, patches of Gorgonians & Hydroids. Coral reef ends at about 140 ft. into sandy sedimented bottom that slopes deeper. encountered some small fish but no potential predators except for one nurse shark of about four feet resting inside of cave. No Squids. Dive lasted about 45 minutes & covered of about 150 yds. Visibility was about 100 ft. (very clear)

March 24 1972
Ogopukip (San Blas)

Shallow Tow on windward area of island. Sandy & TG Through length of island, then coral reef from northeastern end of island and

extending about 200 yds. Towed along windward edge, Then turned at end of reef and went along its lee side. At about 100 yds from turning point I spotted 14 mature INDS and. 10 ft from surface, bottom was 30 ft down and solid coral sloping down into deeper water. Group seemed to be travelling in opposite direction from current, mantle end first & in a sort of wedge formation with the larger ones in the lead. Some INDS flushing pale on and off as they went. Upon noticing me they broke formation to face me and retreated about 6 ft all paling. Then stopped and ORD with P & some PH & a couple PM over ORD & PH. as I approached them. Some social order but in general the formation was ragged throughout my observations. Group seemed relaxed but curious and a little wary of my presence. I was able to come very close to them while snorkeling, but since they were a little too deep I donned a scuba. From then on they became hard to approach. The

group became quite excited and attracted at the sight of my bubbles but impressions to me were I exhaled into my mouth-piece without releasing bubbles & they did not come close.) After a while they allowed us to come closer but would bolt and retreat whenever I exhaled. The group was formed by two very large individuals, eleven medium large and one medium small which could always be found at the opposite end or near the opposite end from the two large INDS. The two large INDS seemed to be the same two that we had encountered 1½ hours earlier and about 300 yds away in the shallows by the windward side of the island. There was some countershaft but of a very low intensity. Some RL over ORD with P & PH with posteling from the largest of the two. Some rocking back and forth. During photographing session the main group deserted the two large INDS or viceversa but remained about 40 - 50 ft away and did not respond

until I left the area, length of observation about 30 minutes between 12 and 12:30 pm. They moved on or seemed to go I left the area. I went back later on with Dr Moynihan but failed to see any. Visibility was about 50-60 ft. I made a shallow tow around Island and in outer area visibility was less than 40 ft. I felt several warm water pockets especially on southwest end of Island (extreme lee) visibility there was poor (due to high salinity?) also on the shallow sandy & TG area on windward side of Island

ans. Seller's opinion that the true specimens almost never reach the surface.) Ocean about 100 ft from beach - i.e. about 1/3 of the way from the ship. Quite possibly larger than average squid by quite a bit. Estimated approximately 1 ft apart. All with a more or less Ord (can't tell with certainty and/or I forget). Shot away and disappeared almost immediately. (NOTE: There was no drift in this area at the time. Of course, baby squid can "swim" forward without actually overcoming current.)

Stop observation 9:45 a.m. Return back to ship. Still no squid by another mile.

In the meantime Arcadio has been deep towing without success, and he gets back to "Jettys" 10:00 a.m. Finds groups of 6, all more or less small, some yards behind ship. Same group? Disappear immediately.

The young squid here seem to be definitely shy now.

They may well have a daily rhythm of movement. In shallows at night. In deeper water during the middle of the day. But almost always near surface in all areas.

Misc. Arcadio has been talking to Carlos, our local guide from Haluniga. Carlos says that there are times when there are only small squid around. Confirms "big bang die off" hypothesis. He also says that the squid are being fished very intensively at Haluniga (for bait). There used to be much larger groups a few years ago.

We prepare two "decoys": Floats with line

chains, dangling frayed ropes and attached buoys. Put one out in deep water (30 ft) near ship. Go then in shallow water (4-5 ft) near shore. No bites. Then attach anything. Back aboard for lunch 12:20 pm

Start full dive at 3:30. Go to small bay a short about 1/2 mile away. Entrance shallow. Go to it with and without Dialma. Also see and photograph and scattered among TG. Water very clear. All very peaceful. No squid. Leave 1:30

Then next around other islands: "Cayo Jago" (?) "Hausui" (?). Arrecife does shallow-water work then. Nothing of interest. Go on to Nuevo 2:10 p.m. Nothing (no squid, no fish, no creature) at shallow water dive. So I swim out to "Jettys" and deep water dive. Nothing there either. Swim back to shore. Arrecife has been exploring shallows. Nothing. Stop about 2:30

NOTE: We have been having trouble with "deep" water float. Rope and/or chain get caught in coral heads so float is sometimes stuck in no more than 10 ft. of water. And freeing it entails a lot of movement. The movements may have frightened things off.

Go out to check this float again 4:30 p.m. Nothing there. Then swim in to check shallow water float. No squid on the way in. Nothing but one fish hanging about the float. I swim around general area. No squid.

Obviously the small squid here are not very abundant. Probably they also are extremely mobile (as might be expected)

March 24 1972
San Blas

Start at approx 10 (Arcadio's lake) 10:00 noon
very long. Ends 11:45 approx 75 min

Swim out to reef flat. Down into shallows
with flat. Dive down to bottom of the flat shelf

Both are colour, however, Arcadio finds a group
of 40 plus! (prob 60 here) Cycle round slop. 20 ft
under Pedro (Arcadio) leaves group and
pursues single 3 m 10 ft long, in mid clear surface
group quite well organised at times, inds. 1-4 ft apart
tends to break up when disturbances appear (e.g. when
a Red Snapper swims by, when I join Arcadio). But
then reforms again.

All the inds are certainly young. Some quite small
Some almost small-medium.

The first two inds. seen by Arcadio react to his
approach by V + PH. Then one darts away with puff of
ink. The other swims down and away more slowly. Gradu
ally goes (back) into Ord (+?).

When I arrive, all the inds. are in Ord with W5
and Y. All apparently calm.

Arcadio sees some feeding in group. Inds dart
forward, shoot out tentacles, and grab something. Prey
too small to be identified. But needs some manipulation by
arms before being bitten and swallowed. Inds turn Pale thef-

are shooting forward to catch prey. Then darting off towards Cassiopeia unusually dark Orb.)

While I was resting, the sky lightened, and was marvellous, full of approximately the same sky Cancell weeds, swimming and feeding most of it.

COMMENT. Does this coordination suggest that small squids congregate in large groups on the ocean bottom to sleep at night? And then break up into small groups, to come inshore or rise to near the surface during the daytime? And, if so, is this different from their routine???

NOTE: The Red Snapper which disturbed the group this morning was shot by Arcadio. It did not have any squid in its stomach. Nor did a small Barracuda shot by Arcadio yesterday.

Stop observations 8:00 a.m.

Then go out to Holandes Key. Stop at island called Aguipubi.

Arcadio starts shallow-time 9:38 a.m. Sees small 9:42. In 4 ft of water over pure TG. Gives a shot of Sulk and darts away. I get into water. We swim around for a while, over TG, without seeing anything more. This is windward side. Water only moderately clear.

Then, 10:00 a.m., come across fair large area of mixed bottom sand, TG, miscellaneous corals, sponges, etc. Water 2-3 ft deep. Animals 6"-2' above bottom. Prow often low than high. The 2 reds are <u>everywhere</u>.

Sph March 24, 1972, III

(112)

Prominent Orange Pl. recovered. 'Best yet' seen! Appears a red giant. Our previously, even larger than the other Pleiades' members. Bright Red Orange Giant

Wind first seen, on and off, in Dec. Pl. Steady with Jul (Fig. (see)). Mostly in Oct (probably with NS only, but Y and WS back). Both winds gradually drop out, with Oct. and Both in white light. Both winds accompanied by Northland Ord (with NS and Y). A sort of pale, purplish nimbus of Ord. Oddly unusual, crisp, vibrant (changed?). At first I thought that the pulsations might be an illusion of seeing. But I doubt it. The general lightness of the Ord in these circumstances may have been "seen" simply, a partial attempt to match "background" (the in hole area, shallow with much exposed sand on bottom, is relatively very light).

As they subside, this light Ord is sometimes buffs, interrupted by traces of PH. Once one of the winds does DM in Ord. After a while both winds begin to do bits of E. Quite close to us. At the same time, they stop in creating E's often, very often. Winds to do E's more frequently, and sustain them longer, than P. Once, I notice that the arms are dark in E, while hues are light, whitish. There is little or no trace of P before or between just E's.

Then the animals seem to relax almost completely. Still very close to us (2-3' away). Both in light Ord with prominent ocelli, slight trace of WS and Y.

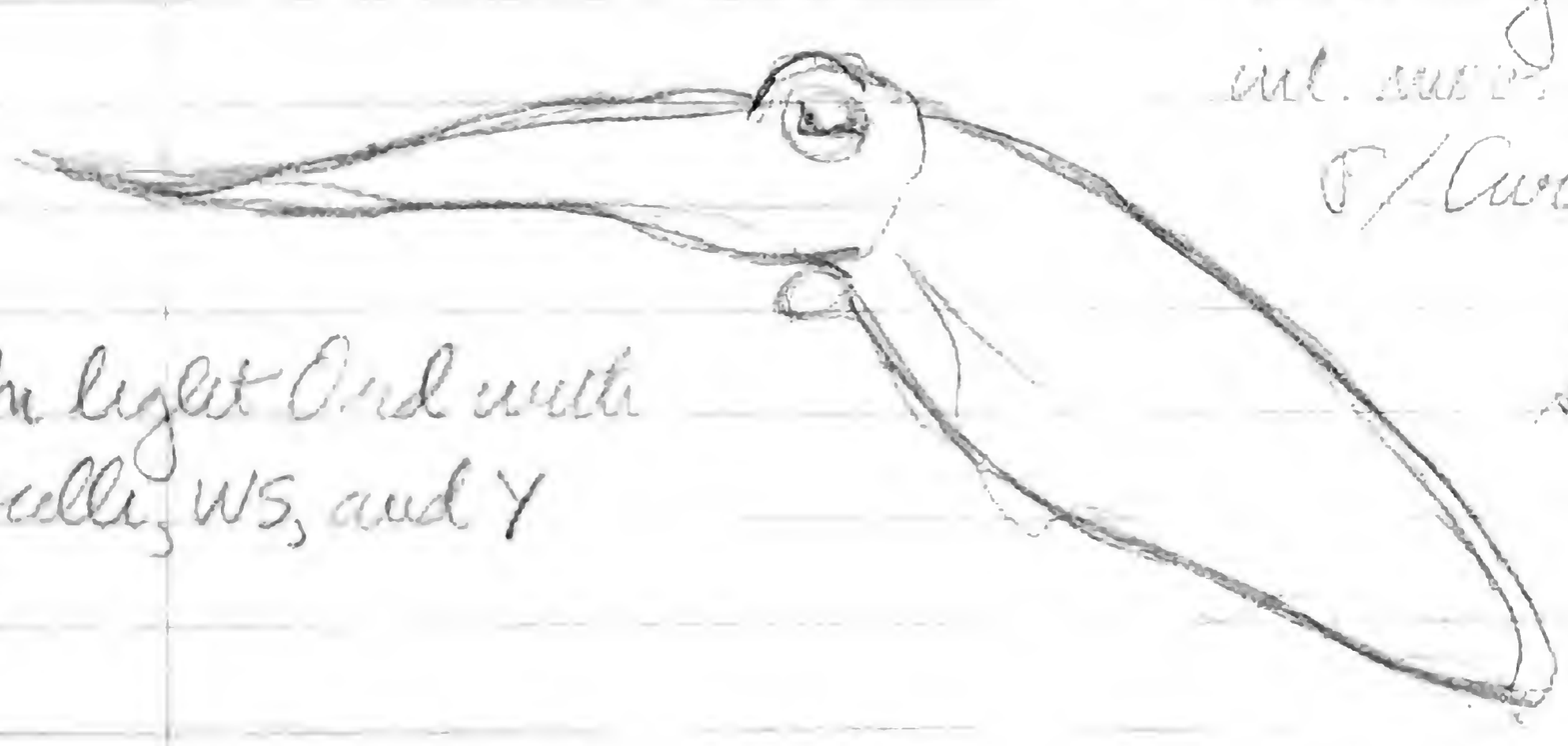
Occasionally they back together

Aph., March 24, 1979, IV

(113)

Then we approach the animals connected to Arcadia photographs. This seems to show it was E. Again approach by ♂ at first in light Ord + then ♂ suddenly turns dark. All seen ♂ Bell. Then ♂ suddenly dark brown – I cannot see SWS but in complete ord.). Then back to light Ord again. Bottinds. complete tel, ignore rather large fish swimming very near by.

While the ♂ is E-ing, the ♀ often runs to get into connec.



This might be an int. mov. of E and/or ♂/Cord.

In light Ord with ocelli, WS, and Y

Sometimes cord used with DT

Bottinds. sometimes "show-back" to us. With and without E or int. mov. of E-P.

Then ♂ suddenly does P and turns very dark again.

This dark must be a display.

Then the ♂ does brief PH when I approach particularly closely (my hand only 1-2' ft away). I believe that the mottling of PH is also visible on the ventral side.

Then a whole series of apparently hostile displays in such proliferation that I get rather confused. Only a few points fairly clear:

A lot of P.
Developing into Ord occasionally
In O'R and Ord PH

Ord-PH

Arms more or less dark and "normal"

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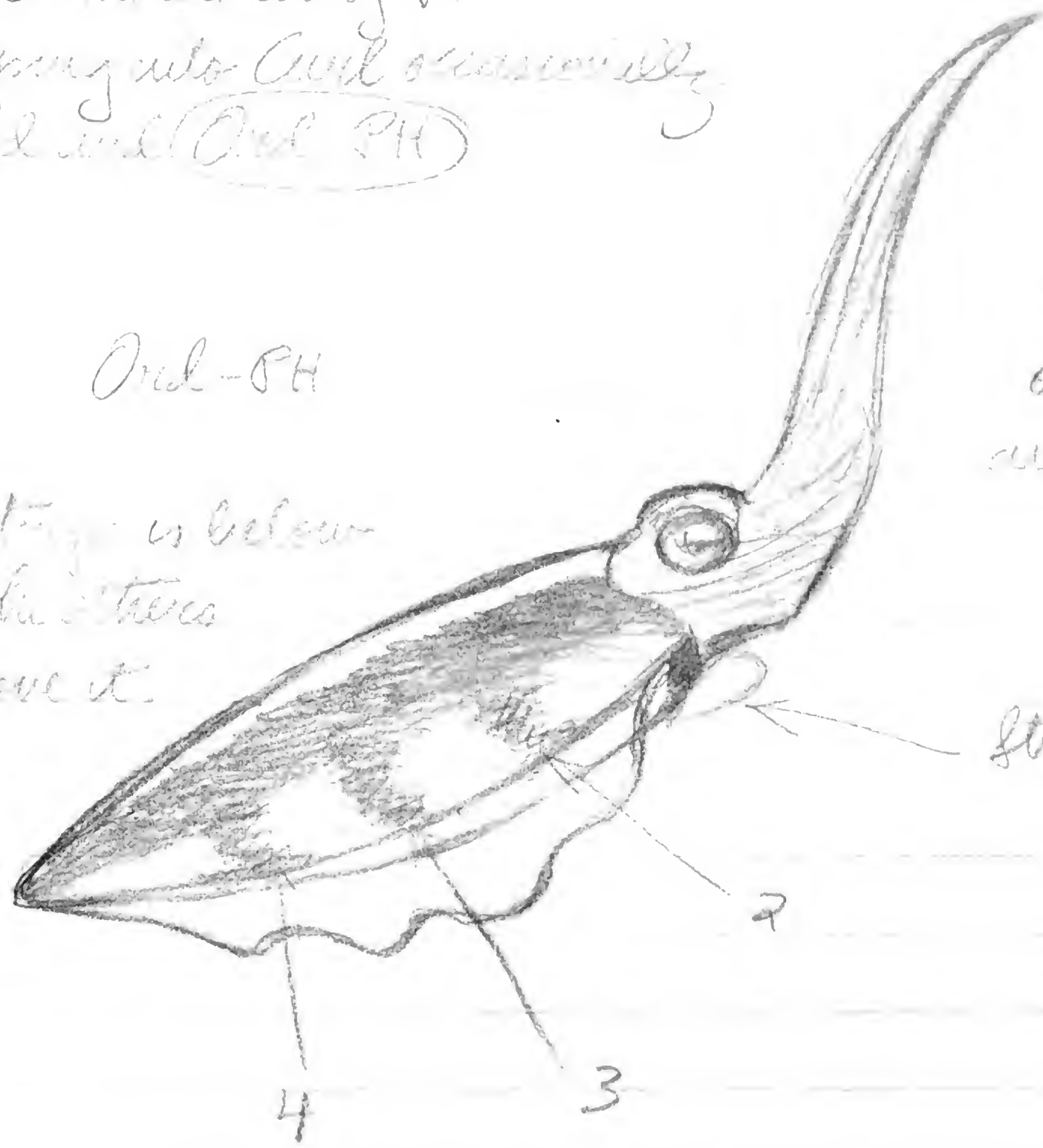


Whenever we approach the annuals, they tend to show DM. Quite extreme. In uninitiated postures, E's, and P's. With Ord and/or PH coloration. It is the ♂ who tends to assume PH. The ♀ hardly varies from light Ord with prominent ocelle.)

Once the ♀ assumes E with arms "splayed". Both this posture and a ♂ Curl are shown on the next page:

Cephs., March 24, 1972, VI

Slightly contracted

The funnel is really quite large, but it seems to be colorless, probably transparent (probably always).

Stop observations 10:20 a.m.

COMMENTS: Why have these large squids survived so long? Why are not, apparently, counting and copulating now? Have they survived simply because they have not copulated.

Adults of this species are much less shy than infants and juveniles. Presumably because they have fewer kinds of predators. They certainly are not much bothered by human beings and most fish. It is only a few things (only Barracuda in my own experience) which really frighten them very strongly

The 3rd of the pair seen this morning contours, displays more fin pattern and contrast, than the 2nd. Why? Was the "dip" in the 2nd Carlos felt slight, more flattened?

While we were observing these lactiges, Carlos saw 2 small ones, maybe 6, a few hundred yards away. They darted off toward shore when alarmed. And when we return to the ship, Judie tells us that he saw 5 small ones nearby. So it would seem that smalls are predominant here as elsewhere now. The pair of larges is exceptional.

Arcadio goes back to photograph this pair again, ca. 11:45 a.m. Finds that they are gone. Goes around to lee side of island. Finds group of 14 in 2 ft water, area of coral. 2 very large, perhaps pair seen earlier, plus 12 medium larges. All inds. quite low. Lots of PH some RL. Perhaps some courting in presumed pair.

The various islands here are certainly out of phase with one another. Why?

SEE ARCADIO'S NOTES.

Working same region this afternoon

Start where Arcadio saw the 14 inds. this morning. Get into water 1:55 p.m. Sunny. Moderate, calm. Area is superb large reef. Swim until 2:20. No squid.

Then Arcadio does shallow two-around island. Until 2:50. No squid.

So I go swimming around ship and out to area where 2 pair was seen this morning. All sorts of habitats. Then walk back to ship along shore. No squid by 3:45 p.m.

Cph., March 24, 1972 VII

(112)

At same time, Orcella [illegible] and Fraser [illegible] again. Still without success.

Obvious, the squid around here are [illegible] now, even in the short term!

NOTE: Orcella might have [illegible] to avoid Nassau Grouper this afternoon. Still in bad sequence to stomach.

March 25, 1972
San Blas

Starting out early this morning. Same place as yesterday. Sunny. Windy. Orcella begins shallow tow 7:10 a.m. Goes past area where large pair first seen yesterday. Then out along reef.

7:40 a.m. Approximate area where group of 14 seen yesterday. Find three large squid. One very large, presumed ♀. Two slightly smaller, presumed ♂♂. When I first see them, they are about 4 ft up in 8 ft of water. Over prime coral reef. Swimming about quite calmly. In O.d., with some W's and Y. The ♀ writhes without color change. Then I notice that there is a definite social structure within the group: ♀ and one ♂ definitely a "pair." The other ♂ is an onlooker, hanger-on, suitor intruder. (I shall call the pair "X", the other ♂ "O".)

The orientation of the animals is characteristic: X's have backs to O ♂ (and vice versa, of course).

Put things still more around to gather (i.e. the X's backward while D goes forward or again vice versa). Flashes appear, — or fading away — must be definite, unusual. (see also below).

Then both X's do the without color change. Perhaps a reaction to approach by Arcadia.

One or both X's may show new but faint slight traces of Pall, continue to time. But, for, the performance is so low-illumed that I can't even be sure that it exists.

8:52 a.m. All three uds. shoot upward toward the surface. The ♀ first. She has DM with her Ord. The two uds. don't change color at all. I can't tell what provokes this movement. But the ♀ leaves DM and all three uds. come down again immediately.

Then the ♂ leaves immediately, the X ♂ starts to display. Turns brilliant silver, along longitudinal side of the body away from the ♀.

NOTE: I think that the fin on the dark side remains essentially colorless, but this will have to be checked again later.

I know that I have seen this pattern before (e.g. p. 16), but I did not realize quite how

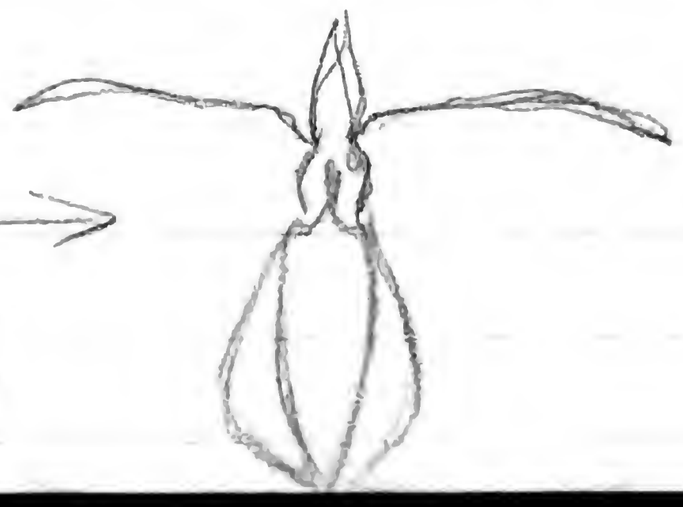
distinctive it is. I originally thought it was light and was Partial. It is not. It is light indigo — like the silver of Pie. The color is particularly light on the eyebrows (or eye protuberances). I label it the pattern "Lateral Silver".

The ♂ assumes Lateral Silver again in Cagour. Always on the side away from ♀. The actual side differs according to the relative positions of the two animals. (The ♂ shows a very strong tendency to stay below and behind ♀, perhaps 1–2 ft away from her. But there are occasional variations. He certainly switches from one side to the other of her. He may even fall behind ♀ or and/or abreast of her when she switches direction. As far as I can tell, she is setting the course.) Once the ♂ does Pin Lateral Silver Between Lateral Silvers, he assumes more or less undistinguished Ords (probably with only slight WS, little or no Y).

Throughout this performance, the ♀ retains the same color pattern. A more or less light Ord with conspicuous ocelli. Probably no Y. And WS reduced to the absolute minimum, perhaps completely suppressed at times.

Then another presumed ♂ (ne) appears. Presumably ♂♂. Comes quite close.

♂ ✗ does extreme but rather peculiar spread with Z on arms but probably not on back. Intruding wit.



Comes in wedgetail! 8:02 a.m.

The X♂ goes back to lateral silver displays as soon as the intruder disappears. One lateral silver is combined with extreme Cpl. Then more lateral silvers without Cpl. Again and again and again. Then more extreme Cpls. Some with lateral silver. Others with undistinguished Cpl (suggests). Also more lateral silvers without Cpl. All buff intervals of normal ammunition Cpl without tail display at all.

When the tail displays disappear the "impress". The ♀ can see the Cpls, but not the lateral silvers. Perhaps these displays help to "warn off" rival males?

The ♀ remains in light Cpl with prominent ocelli almost throughout. Cpl, then, occasionally and briefly does she assume a darker Cpl (where very dark) with more WS. Then display stops fairly abruptly 8:07.

An intruder, presumably ♂, presumably O, (we) appears a few minutes later. The X♂ reacts by another extreme spread with Z on arms but probably not on back. Form of spread is different from that of earlier performance

But apparently equally effective. Intruder leaves at once. (Spread with Z seems to be one of the most rapidly effective displays in the whole repertoire of the species!)

Cephi, March 25 1972 — (121)

♂X goes back to Lateral Silvers. Then stops. The two animals just swim peacefully, side by side. ♂ in usual Ord. ♀ in usual light Ord. (NOTE: The color that period that I have been observing this pair. Usually the two usl. have always swum with Ord. heads pointing in the same direction.)

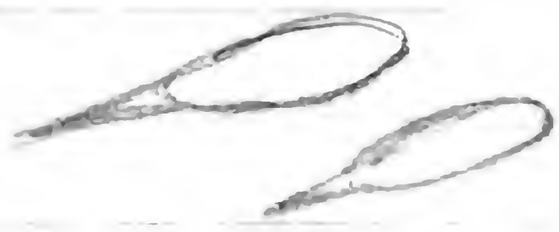
Then ♂X starts Curls again. Both still in Lateral Silvers. Then resumes normal swimming. Both of the inds. are in Ord. without ♀ and with numerous PUS.

Then the ♀ starts RL! Very slight. Both inds. PICK together. Then relax. Then ♂ Curls in Ord. Then does Lateral Silver in normal swimming posture. Relaxes again. Then ♂ writhes without color change. Ord. for a second or so.

NOTE: The Ord. of the ♀ appears to be rather blue (a "powder" blue) than that of the ♂. An effect of sex?

All relaxed 8:15 a.m.

Then ♂ Curls. And there is some more Pecking. At this point, I see that two small-medium inds. have appeared on the scene! These smaller inds have certainly joined the group, but they also keep themselves to themselves within the general social unit. Detailed observation continue.



pp

♀X still swimming by ♂X, does RL with some PH (rec!) on upper part of back. Then both ♂ & ♀ peck together in a blot of foam to be semi-fertile (rec!) ? Then both relax. Gradually drift off.

The small-medium seem to have disappeared by 8:20. They did not flash, while they were around. Just floated in "ordinary," and with some WS and Y.)

The X ind. have non-clear yellow pigmentation. Swimming back to back. But still definitely moving in the same direction. I.E. they are no longer quite as friendly as they were earlier, but they are still acting without aggression. They are not displaying any more, at least for the moment.

Stop observations 8:25 am

COMMENTS. The behavior of the X's this morning is exactly what one would expect of early "courtship." Almost too good to be true. The ♀, in a semi-encouraging color, allows the ♂ to approach and stay with her. At least for an appreciable period of time. He "defends" her against other ♂'s. But nothing more develops.

I would have supposed that this behavior could also be pair-formation. But it may, conceivably, be significant that medium and small-medium also occur in dros, probably with some appreciable frequency. Does pair-formation tend to occur early in life ??

Cepl., March 29, 1972, III

The appearance of the two smaller whales noted late this morning was indicate four larger groups are found as the day draws on.

April 29, 1972
Ron Elias

Arrive Malumega at 7:45 a.m. Cloudy and rather windy.

Find that Arcadio has been watching group of squid near dock and boat. Group III area. Men just seen approximately 9 inds. Ranging from tiny to almost medium. All clustered around pole in a few ft of water, near surface. SEE ARCADIO'S NOTES. Men swam, there are only a few left. All quite close together. All facing outward from pole

All in more or less out stretched with Y and WS. Larger does bring curl when we approach (walking on dock). Eventually, frightened off by canyon coming in.

8:45 a.m. Go into water. Start Group I area. Water very murky. Nothing. Go over to Group III area. Water perhaps a little clearer. Nothing.

Then 8:55, see group of 3 squid. Small (but not tiny) 1-2 ft below surface in water 6-10 ft deep. Above a large group of anchovetas. All three close together, swimming quite rapidly. In more or less ordinary O'd, with

W and Y. One or more dr(s) around V's. Sometimes stay off layered forests a dozen ft. Once with extra one split — something like Nautsan before all V's and V's and well defined (all in a) Animals go out and disappear in lit (to at least 20 ft) Disappear from view.

A few minutes later, Echo sees single small at more or less same place where I first saw first. Near surface, above and down but then goes down, through fish. Went to near back to Group I area. Nothing. to Group II area. Water getting rough. Finally 9:12 found and off II area. In new Vee, near shore turned TO, sands, pits large tree trunks. Miscellaneous garbage. Animals about midway between surface and bottom. Group is very large. 47+ individuals. Ranging from very small (not quite term) through ordinary small to small medium. The mediums number 4-5. All inds. quite close together (2-6" apart). Drawn up in the usual "Lepanto" string or semi circle with the largest inds. at the two ends. All inds in Ord, WS, Y when first seen.

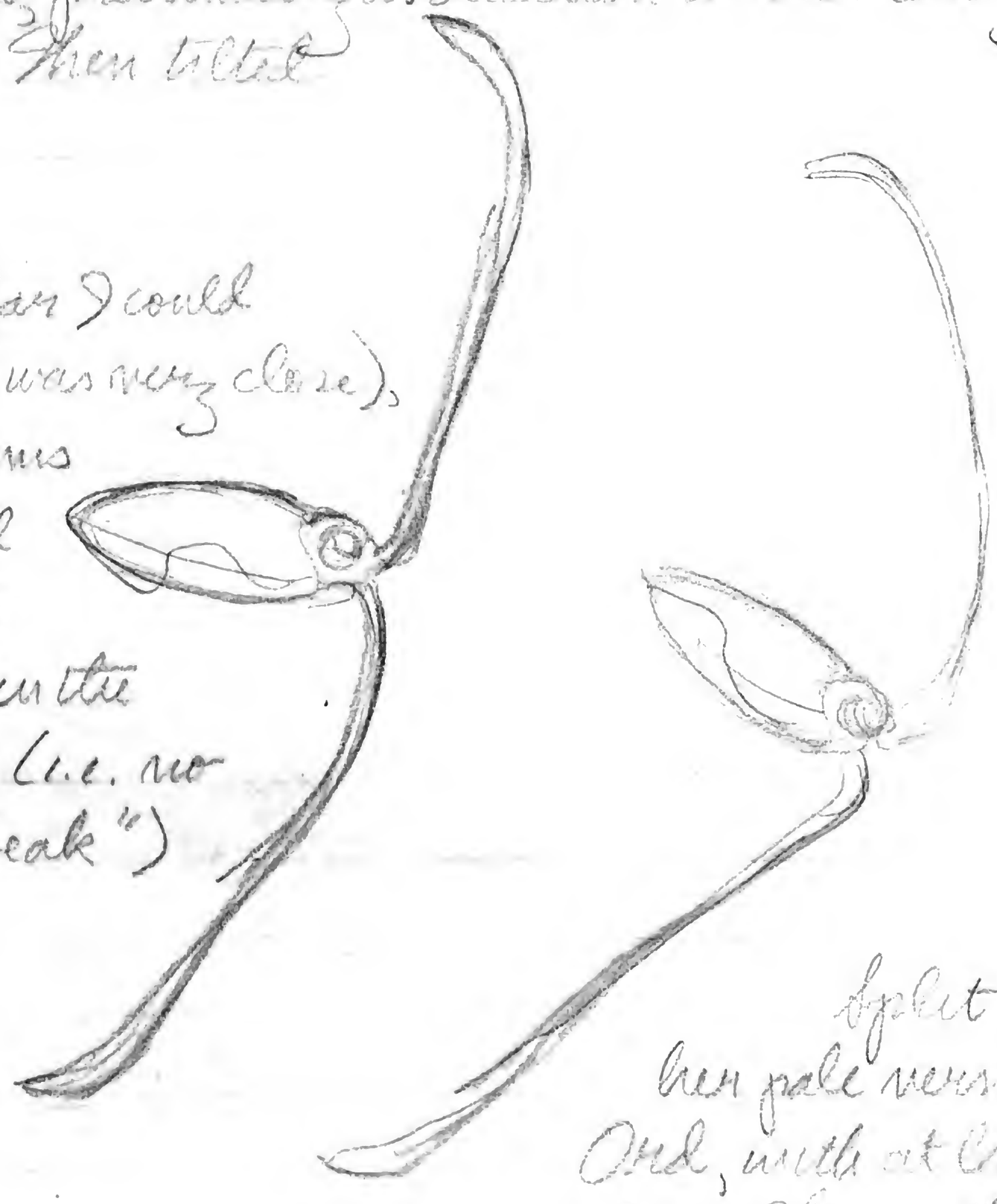
I go on gradually goes on number and more group of squid at far shallow water 1½-2½ ft.

Then some of them begin to display as I drift closer

Aph. Apr 29, 1944 —

Some Quadruple Streaks without nitrolized posterior movements. Some Quadruple Streaks with P. Some Quadruple Streaks with V. Some V's with Ord (& presumably NO & P) All or most V's straight forward

Two of the Larger ones, stone and Little Lee (is this a real "pair"?) gradually drift away. With the time, a nearby smaller one, Dr. Nelson's Ord. Does not enter one split, presumably as reaction to me. Only hangs tail at first. Then latter



Note: As far I could tell (and I was very close), all the arms were involved in the split. Even the short ones (i.e. no "pseudo beak")

Split first in part by pale version of Ord, with at least some WS and Y. Then with PH (mottling very conspicuous on belly).

Then the upper group of arms is gradually lowered to form conventional E. Partly with Ord etc Partly with

Quadruple Pitch.

Can only call one most of these splats were with nose or less above surface of V, but I never saw the arm and just the right angle I can't see this.

All the squid were dusky white I write. Found them again a few groups away, same habitat, 9:22. All in Ord, WE, 1. Form to V, straight-line end. Then retreat. I notice that the oldest is the retreat first (and fastest). Younger ones tend to bring up the rear. All with retreat backward, facing me as they go. (This is characteristic.)

Stop observation 9:30.

Comments. Groups seem to be very highly integrated now. Composed of young, as would be expected. But it was surprising to see a large group in such filthy water.

There seem to be a rather surprisingly large number of intermediates between typical smalls and typical larges around here now. Have "classes" broken down? If so, why?

And why have the locals suddenly begun to do splats? Did I just overlook them before? Or are there "fashions" in display?

Go back into water 11:00 a.m. Patrol all three areas. Visibility even poorer than earlier. Don't see any squid. (Probably really all gone. There has been a lot of disturbance this morning. Lots of cayucos and other swimmers.)

Move on to Marathon in Lemon Keys in the afternoon. Go into water usual spot 2:35 p.m. Clear. Rather calm.

Within a few minutes, come across 8 large squid

In deeper part of "B" area. Left upon arrival by 4 pairs. But one or two of the ♂'s [illegible] around below.

When first seen, all ♂'s in O.C. with more less WS, probably more or less ♀. Then [illegible] Rock. ♀ of this pair does spread in O.C. [illegible] RL. Stops. Then does spread in O.C. again. [illegible] anytime.) Then relaxes. Then a ♂ (the ♂ of this pair, I think) starts to approach other pairs (can't tell if he is aiming for ♀'s or ♂'s or both) [illegible] as he does so. Sometimes finely mottled OH. Sometimes paler more uniform light Ord. with sand-pastel. [illegible] this seems to provoke much response of eventually vigorous "mate". A few minutes later, ♂ & another pair behaves in same way. With equal lack of conspicuous result.

Then there is some (more obvious) "courtship" among at least 2 of the pairs. Probably 3. Perhaps all. Same sequences performed repeatedly. In much the same way by each pair. ♂ approaches ♀. ♀ assumes exaggerated RL or complete Pie. ♂ assumes what looks like Double Streak from above (I can't see the bottom sides of the animals) or a pattern more or less intermediate between darkish Ord. with extreme WS and "Double Streak". Then both birds relax, at least temporarily. All done very fast.

The animals move off 2:48 p.m. I find them again, some yards away, same habitat, a few minutes later. All in Ord. No. 1. Some with WS. Some without. No other

Cpb, Apr. 29, 1972, VI

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compression dives for 15 minutes. I do note however, that 3 or 4 times, Pat & Cpt stroked down the center of the chute on flukes. [illegible] Of course, I have seen it before (as Pat does) but doesn't mean I don't pass it off as [illegible] relative to WS?)

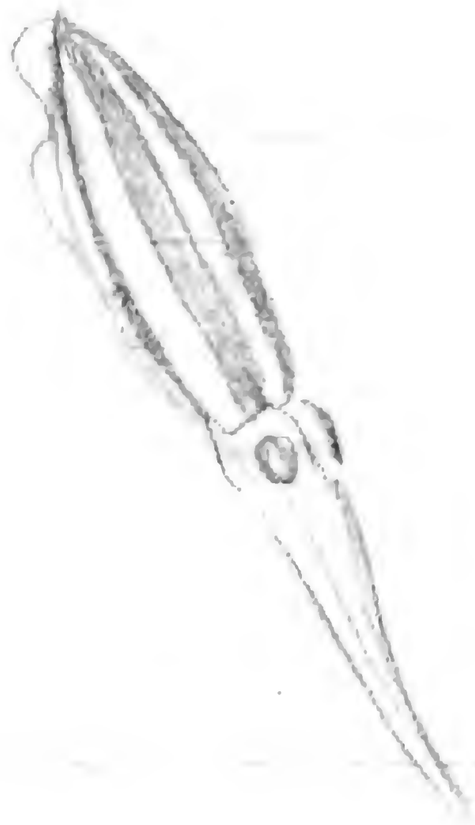
In the I saw 11 to 12 newborns, big or general group. They all appeared to have come from the ref side. A few seconds or minutes later, see 30 newborns approaching from the other side! Coming from deep water. Approximately 10 ft below surface. Groups were cohesive, kids only a few inches apart. All coming with first. (All of the larger are facing toward them head on) There is some but not too much variation in size within this group of 30, small medium to large medium (probably averaging on the smaller side).

This group of 30 "joins" the others (within a few feet). Not much reaction at first. Both mixed and all times in Ord, WS, pauld, Y. Then, suddenly, the ♀ of one of the pairs of larger goes forward and approaches one of the newcomers. In what looks like Partial (sic!!!). She may even touch the newcomer briefly with the tip of a tentacle. (Is "she" really ♀?) think she must be. The rest of her behavior fits.) Then she retreats with RL. Then her mate advances a little, hangs head down in water, facing newcomers, displaying conspicuous streak pattern on upper surface. Certainly double streak on back and either fin stripe or some sort of streak just below

Cephl., Apr. 29, 1972, VII

(20)

fm



I can't see if there are stripes on the arms. Almost would fit the 30 mm. I started to offer backwitted from fish which then rolled along, no signs of fins, but also quite steady. The large fish drift away in angle & don't come back all last to mm.

I think that this must have been a turn-toward encounter between groups or (perhaps more probably — mm. I and II at Pelunga some months ago) sub-groups.

The stroke patterns may be quite effective as threat COMMENT: This species also seems to have a rather unusually large number of threat, or at least repellent, displays. Why? Are they segregated by (prominent, adapted to) particular sexual contents. OR and ♂ lily ♀'s in semi-sexual contents. (Lateral silver lip ♂'s in comparable situations?) Struggles during encounters between groups and sub-groups. Z and probably PH during non-sexual encounters between individuals. (PH also anti-potential-predator.)

Compare use of struggles this afternoon with pp. 51-52 and similar incidents.

Stop my own observations 3:05 p.m., when I can't find any of the squid again.

Cephs., Apr. 29, 1972 VIII

(130)

Arcadio continues longer in deeper water. Sees a group of 9 mudlumps which may be part of the group of 30 inds. Also sees a group of 38 mudlumps which may be different (perhaps better 2 or mudlumps on the average). Abdnt off down on 25-30 ft of water. Somewhat further on, sees just 1 of approximately 50 smalls low in water of similar depth. SEE ARCADIO'S NOTES

There are a lot of fasciculatus around now !!! This may be typical of the beginning of the breeding season and/or the period immediately preceding.

Arcadio goes for lobs at 3:45 pm. Picks up 2 small squid "floating" under Sargassum. Almost certainly not fasciculatus. Rossia? Very young Lolliguncula?

Usually (?) rather dark reddish brown on top (including base of arms). Ridges above eyes a brilliant, shiny, greenish gold.

Pointed "tail". Rounded fins (usually fluttering very rapidly). Broad head. Sub-equal arms and tentacles. Individual chromatophores quite distinct.

Both inds. were kept in bucket for approx. 1/2 hour. Very disturbed. Usually dark with "Y".

Cepla., Apr. 29, 1972, IX.

One shoots ink, immediately turns pale, darts away. Ink is blackish. (NOTE: This may be the species which shot ink when we prodded Sargassum some months ago.) Then returns to "normal" color.

Then both turn transparent and die.

In the meantime, Arcadio, who has been collecting Sargassum to put in bucket, sees single squid of the same type in open water.)

Whatever this species is, it must complete mating and small sepioteuthis.

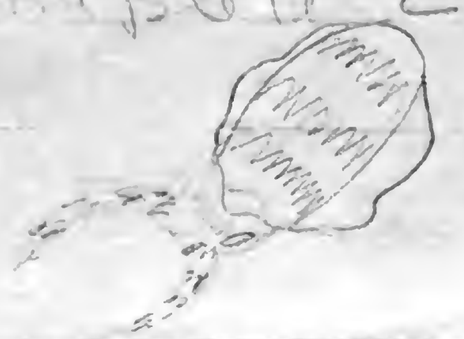
We run a light off the stern for a couple of hours after nightfall. Without success. Apparently no squid.

April 30, 1972
Ann Bess

Working at Nuatupo again this morning. Clear, sunny, calm, water beautifully clear in most places. Start 7:25 a.m. at usual site.

Swim around A and B areas until 7:50 without seeing a single squid. I think that we can say that they definitely are not here now. Then Arcadio and I split up. I go to explore shallows along shoreline. He goes out in to deep in water. I stay in shallows until 8:25. See lots of juvenile anchovetas. Also lots of very tiny, almost larval fishes. But no squid. Most of the smallest fishes are in rather dispersed groups, which suggests that they are not being preyed upon

April 29, 1972
Michigan Lake Erie
[illegible] about 20 ft
[illegible] observed
about [illegible] Then
moved to the pole [illegible]
There were [illegible] different sizes
3 small large 3 small medium
2 small small and 1 small.
The two larger ones [illegible] very close
to the pole and swayed back and
forth with movement of pole
The other three remained at a distance
of about 6½ feet from pole and
floated near surface.
There were small medium and
[illegible] and [illegible] circumference
them. They all turned on their sides
about 3 hours before sighted dark
and sank rapidly close to the bottom.
They did not change color as they started
[illegible] immediately after calming down.
One went with a complete Z pattern
with speed



II April 09 1972

Went back to same place. There are 6 squid (large & small medium) around sand patch ORD no interesting still single, no b and spth with movement of pads.
2 small medium bird [illegible] to back up TETHYS displaying [illegible] ships permanently). Then [illegible] passed TWO small INO (small, med) on motor to Porveur both passed ink black and retreating. No ejection of ink.
There have been a lot of ink puffs in the water all morning. Could it be that they are being predated upon or is there an extreme large population inhabiting the area now? 9:15 AM South East side of Island 6 ft of water over T.G. blotch of ink about 14 inches under surface (no squid)
9:25 AM 3 INO (juvenile) one double striped under mantle & DM with dark tentacles very limp. I notice a fourth & try to get closer to it. It does an E & DS under mantle as he lounges towards me (to scare me off?) then stops turns around and hangs almost vertically very limp, the underside of his mantle to me & DM (I can see it through the mantle) goes ORD turns to me & does E. There were two INO close to the displaying INO

April 29 19[illegible]
Malamala, Sol. Isles

[illegible] in TH and the other Positions [illegible]
and [illegible]
[illegible] the [illegible] with me [illegible],
did not see [illegible] end of dive at 1045 am.
Miatapo 232 pm Start dive in usual
area A water is clear (about 35ft visibility)
no squid on shallows. I head for
deeper water, I spot group of 8 large
ind almost immediately, they are down
very close to the bottom, (coral, sand &
some rubble) they are hard to detect
amidst the coral ORD with us.
I leave Martin with them & go to
survey another area, didn't see any
back to where I first saw them. The
first group is still there plus a group
of juveniles 32-34 ind, Younger group
heads away from older-original group
and goes into deeper water but staying
about 6ft from the surface. They
all follow very disorderly with the
smaller inds on the lead. I loose them
and a few seconds later 9 ind
from that same group pass me

going down the channel between the two Islands towards where the TETHYS is anchored. Moments later a group of 22-20 100 squids passed and right below me close to the bottom (same group?) They look a little bigger. I follow them for a short distance Then I notice a group of 50+ juveniles down below me very close to the bottom in about 25-30 ft of water. ORD with a lot of arm spreading. They are spread all over the bottom and hard if not impossible to count.

Second sea-sled dive: 330 pm around smaller Island (small Miatupo?) I am still trying to familiarize myself with its operation so I concentrate more on getting used to it than making observations Down to about 65 ft over varied bottom, Almost near starting point I run into two very small squids (obviously not Sepio teuthis) about 14 inches from surface under sargassum line, I collect them and brought them back to Ship.

Third sea-sled dive down to about 40 ft for 20 minutes no air puffs & no squids.

was interested, at the moment.) Then go back to neg area and explore A-E area again. Still can't find squid flap observations 2:10 pm.

At a 2-step water level 8:55 lots & medium-sized squids near neg. appear coming from shallows (!). Also 1 medium large and 1 small (not together) along outer edge of neg. SAN.

All this would seem to confirm the hypothesis that large groups of Sepioteuthis come up in the late afternoon or evening, and only (re)appear late the next morning.

9:28 a.m. See group from Jetty. 12 individuals ranging from small to medium (or small-medium). Only 6" down (perhaps less) in water of ca. 10 ft. Bashing in surf? All very close together. No more than 1"-2" apart in some cases, perhaps occasionally touching. All except one moving head forward, approaching boat, at first. Even the exception eventually turns around and conforms. The animals may have been in Ord with WS when first seen. As they get closer, it becomes obvious that they are in a pattern which may be closely related to "typical" Ord (see also below) but still slightly different. Back of body rather light ("pale Ord"). WS (still) present but not very conspicuous because of lack of contrast. The top of the head, on the other hand, is very dark brown or blackish (little or no Y). At one point, an anchovy dashes through the group. At least 2 of the squids react by forward V. Then they gradually drift off again, still staying very close to the surface of the water

Cph., Apr. 30, 1972, Tu.

NOTE. There have been no pelicans here yesterday or today. Presumably breeding elsewhere. This may help to explain why the squid are so abundant. Audubon's Shearwater continue on the surface for minutes on end. Other birds are still some Black Terns around. They may compete with the squids but probably do not prey upon them.

9:40 am. Down and from Settlement of Gorgonians on a squid almost immediately. In channel between Mahupos (or between Mahupos and Celestipo). About 4 ft. up in 8 ft. of water. Area of sandy bottom with several small corals, gorgonians, sponges, etc. No T-. All the inds. might be classified as large, but untanned, at the smaller end of the class. Obviously divided (in space) into 2 trees. Inds. usually 1½ - 4 ft. apart, i.e. not as colonial as younger annuals.

They react to my appearance by doing a few P's. Probably in "ordinary," Ord (+ usual dense ~~Ord~~ P). Then two or three inds. do repeated E's. Some of these in more or less Ord +. But main with some indication of Pale and/or related patterns. This "Paling" can take various forms. Sometimes just general, more or less all over. In which case, seldom or never very extreme. (Pale-Ord) in my conventional terminology. Sometimes concentrated and extreme on arms (usually most extreme near base of arms, I think). Perhaps I should recognize a separate category of "Arm Paling"???

The precise circumstances in which Paling and Arm Paling with E occurred were rather revealing. With both advances toward and retreats from me. But not by

Cpl. Apr 30, 1972, IL

nds who were at Stroon. All this would seem to indicate that E is merely a Palangous to produce when both attached and apparently is an fairly strong (perhaps stronger than in P) contact. A similar pair must be approached in a well Pal + N in Pb.

While some of the nds. are going through these Palangous E resultes, the other (or, bros of the same brer, perhaps nds.) remain essentially unmoved, neither advancing nor retreating, quite close to the surface of pastures. But now dark (nearly red-brown) on top, probably all over. However. I can't see the bellies of these nds. at the time, but I should imagine that they were dark like that of the "mini" described below.) Although the dark coloration of the back is almost uniform, it is possible to detect a trace of a gold stripe along the sides, halfway between fins and center of back, in good strong light. Presumable, indicates expanded below melanophores. Sends a special signal, perhaps not.

These dark nds. are either less excited or less afraid than the Palangous.

Suddenly a 7th nd. appears. Approximately same size as others. Forms through group, not very rapidly. Resembles PH-Z. Spread out of the members of the group as it comes close. Very bif. 7th hangs around for 1-2 minutes. Then drifts off and disappears from view.

Then one of the nds. close to me does first E and then P in dark coloration. Rich dark brown almost all over, including bottom of arms, head, and mantle. After it

been in P for some seconds, I really think it has sucked some in the water until it is heavily fed, a few in Cuvierian tubules (recoiled vorticular) coral head. P is now [illegible] its body semi-neutral. P sometimes lies [illegible] slight curl.

Definitely no Y or WS!!!

Note that arms are spread at base (gaps are visible) but tightly pressed together at tips.

The oral area which are not dark are the eyes, funnel, and fins. Both of the latter are almost transparent and very inconspicuous. The eyes, on the other hand, are bright silver and very conspicuous indeed. So are some of the gaps between arms at the base, at least when the light source is behind them.

It is evident that I must recognize "Dark" as an important (separate) component of the color reaction. What does it mean? Is it purely a sexual signal (and/or "anti-signal")? Is it, like some other patterns, partly or wholly, sometimes or always, cryptic or cryptic??

Why do individual Sepioteuthis sometimes flee

from predators and at other times try to hide? It might, conceivably, be significant that I was floating almost absolutely motionless during this last example of mimicry".

After some considerable time, the "mouse" suddenly shoots away a few yards. With extreme force, turning very Pale all over. Notice that it becomes semi-transparent during Pale, and the blue ocelli on the back relatively conspicuous. I don't know what provoked this sudden movement. Possibly the animal's "mouse" lobe. Possibly it became aware of a cayuco, with motor, passing 20 yds away. In any case, it slowly returns to relaxed pose. At the same time, its companions dull back. Also disturbed by cayuco?

New thought: Is it only isolated inds. (although not all isolated inds.) which attempt to be cryptic?

All the animals are relaxing now. Back into Ord. (sometimes +). Only occasional E's and/or P's, with few or no color changes.

Stop observations 10:05 a.m.

COMMENT: There was absolutely no trace of "courtship" among these 6-7 inds. this morning. Are they still (slightly) too young? Does sex occur only near the shelter of a reef or something comparable?

Continue to work at Malipo this afternoon. Still sunny, but now windy. Low tide. Start 1:10 p.m. Explore usual A-B reef area and environs. Also drift lines. Nothing. Stop observation 1:40.

Comment: The squids would appear to have

Cephs., Apr 30, 1970. VII. (136)

abandoned this E. Bares almost [illegible] smooth and rough water. Subjs gave [illegible] either preferences.

4:58 On Heavy [illegible] Pegasus or Achtiopo. Arcadia [illegible] sizes & large or medium-large squid. S [illegible] section too. 3-4 ft down on approx 1 ft [illegible] bottom with natural coral, rubble etc. Subs in Dark with little or no Y. Some traces of P. Then all turn to Dark. Two do E in Dark. Then no P's [illegible]. Then there are more E's in Dark. S [illegible] or always extends over [illegible] surface. And even the fins are dark, incomplete dark [illegible] gh somewhat lighter than body, [illegible] at edges).

One ind. does brief PA, with DM spot on one side of body only (!), when a medium sized fish passes close by [illegible] overhead.

One ind. shows Arm Pale on Dark as it advances a few feet toward me.

Inds. return more or less Dark for some time. But perhaps starting to relax. At least [illegible] me less continuously (but perhaps Arcadia, also with the [illegible] plung them, in a distraction). In any case, they start to do E's and P's more frequently, still in dark, after a few minutes.

Once they interrupt this behavior by a somewhat surprising maneuver. All shoot backward toward me,

"displayed back". In O.D. with conspicuous WS and Y. Perhaps this is a reaction to some novel Arcadia Inaug case, it is big. After a few seconds, it annuals go back to Dark and E's and P's.

COMMENT: I have no idea what causes provoked all this Dark. Is it possible that Dark is pretty a reaction to strong sunlight? Cutting the water is as clear here today as I have ever seen it.

NOTE: This area is not very far (20-30 yds) from where I saw the group of 6-7 birds this morning. Could it be the same group. The problem is that these 2 show very little sign of pair bond-ing. If they are sub-divided, it is into 4 pairs. No trace of Tiros at the moment.

COMMENT: These animals have shown absolutely no trace of "courtship". It would appear that the local population has not yet advanced very far into the breeding season. Perhaps next month?

Then we go on to Molandes Keys. Ogyuplip Lane place we worked March 24-25.

Go into water 4:10 p.m. Lots of Sargassum around, so we decide to follow duff lines. Water fairly clear, quite calm. We swim around for 10 mins. without seeing anything of interest. Then Arcadio goes for a shallow tow. A long distance along a duff line, past the site where enormous pair seen last month. Then, some yards further on, 4:35, comes across large group 33+. Of these, 11 are medium, or small medium. The re

Aph., Apr. 30, 1942, IX

(3)

numbers range from large numbers to large [illegible] [illegible] [illegible]

When they were swimming together (which was all the time in most cases, pairs spent almost all the time in one case), the movements of copulatory pairs of Cerges showed the following more or less fixed patterns:

Males: Pistol, OH, Ind., Double Hook (or Hook) with Tail Tap (Hook, Tail, Tap or Tail Slap), and almost all possible combinations thereof.

Females: Pistol (or Hook and Pistol), OH, Ind., RL, Pie, and almost all combinations thereof.

Usually a of pairs combination movements very close by, swimming both backward and forward. Usually behind and below ♀ sometimes in front, especially when there is a change of course. Rarely, infrequently, above.

Some or all pairs of Cerges engage in vigorous courting while they are in the middle of the group. But this seldom leads to an actual cop. attempt. Mere Rocking and chasing. And the ♂'s do lots of RL and/or Pie in these circumstances. (NOTE: I did not see a single cop. attempt this afternoon while the ♀ of the pair was in RL or Pie, or even shortly after she had been in either pattern. RL and Pie must be very discouraging!).

The cop. attempts occur within pairs which are on the outskirts of the group at the time. Sometimes only 1-2 ft away from nearest neighbor. Sometimes 4-6 ft away.

Successful cop. attempts take following form: ♂ suddenly shoots forward, head and arms first, and

♂'s tentacles (and arms) to "forehead" ♀. He is in Partial, perhaps mildly dull Partial or Partial-PH at the time. She is in dull Partial or Partial-PH or Partial-Ord. His dashes forward are accompanied by fluttering. (Perhaps he starts to flutter here (before)) NOTE: I was surprised that the color changes accompanying copulation were not more spectacular. Is this typical? Perhaps so. Viz. cop. seen at Nuhly's a couple of months ago. Presumably, the cop. can occur only after the nuds have begun to feel secure with one another. No need for the most extreme color patterns which are signs (comfort or motivational stress.) After the ♂ feels his tentacles at her, and presumably attaches his spermatophore, the ♀ starts to fiddle with her shorter arms, presumably readjusting the packet. Then the two animals resume swimming as before. Often without any great change in color pattern(s).

NOTE: I did not see any paracopulate successfully more than once this afternoon. Probably (?) because I was distracted by trying to follow two, maybe individuals simultaneously.

The apparently unsuccessful cop. attempts were not very different from the successful ones in some aspects of form. Only the ♂ apparently did not make contact. Accelerated toward the ♀, turned his arms toward her, perhaps extended them, but not to their full extent. Certainly some ♂'s made several unsuccessful attempts

within a few seconds or minutes. And one of the successful attempts was made by a male I judged at least two unsuccessful attempts previously.

With one possible exception (see after 2 incidents described below) I saw nothing else on Atlantis or -chance of positions among the cetaceans pens. Our bonds would seem to be strong in this area.

The smaller juvenile did not pay any obvious attention to the sex overtures all around him. Assumed I wondered why the mere tiny. Arcadia however, noted that the larger followed the smaller ones whenever the latter made a marked change of direction. Perhaps the younger ones are acting as "sentinels" (Obviously advantageous to the large. Also to the young. Brock and Riffenburgh's effects. Mis selection.)

Quite a large number of fish of various sizes, including large ones, moved through and around the group of squids almost constantly. The squid ignored them. The squid paid less attention to their neighbors this afternoon than I have ever seen before. Presumably an indication of the intensity of their "preoccupation".

I stop observations 5:00 p.m., to rush back to the Jettys to start writing. Arcadia stays behind to make more observations and to photograph.

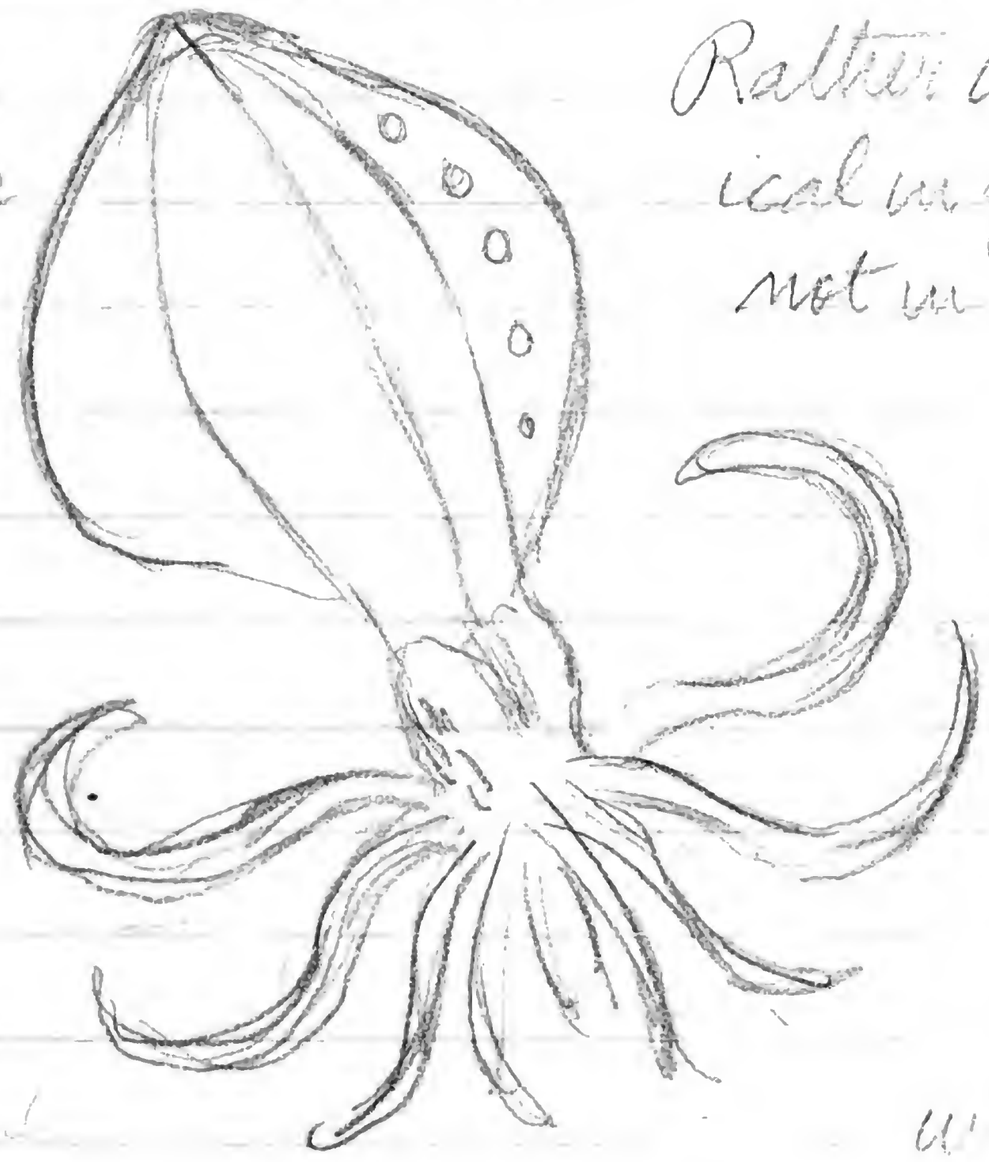
ADDITIONS: The course of events described above was interrupted by two kinds of hostile behavior while I was still in the water:

Once all the inds. with group were to be seen in Ord, WS, Y, and Pale Ann [illegible] and Ord, WS, Y for some [illegible] had done nothing to alarm them

NOTE: None of the inds. in this group were in either P or E this afternoon! Why? Probably because of their preoccupation. They could not have been [illegible] serious attention to us.

There were several peculiar "Z incidents" in the midst of the "cowling"

This appears to be broader than usual (i.e. moved less than usual?)



Rather too symmetrical in general, if not in all details.

The two outer pairs of arms appear to be sub-equal in length. I am not sure which are the real tentacles.

Suddenly one individual was seen hovering close above another. Both in extreme spread as shown above, both facing in same direction. Bottom ind. in extreme

2. All men, both bodies, arms. Bell black markings, separated by extra pulsate (pondel, silver?). Stopped by "Dark Z" on top (unfortunately can't see underside) like conventional Z, but back men keeps much more arms, almost running together on back (and head). Orchids, some type of US Natavil, and lem radiation of white or silver arms. Tens also very dark on the whole. Only a few large light cells, enlarging in line, down center of each fin (again see above). The two cells stayed this way for some seconds. Not moving much, except for some flexing or wiggling of arms. Then stopped spread + Z + Dark Z, darted away, still made as a together, in extreme Pale.

I saw performances of this type at least 4 times. Couldn't see what started them. I figure ind. in Dark Z always smaller than lower ind. in ordinary Z ↗ above ♀. Rape attempts? I think that one presumed ♂ performed in this way with 2 presumed ♀'s in rapid succession, but I may have become confused. All very strange.

ADDITION: After I left, Arcadio saw two more apparently successful copulations. SAN

5:20 p.m. Arcadio coming back to Jetty. We see that there are at least 18 small Sepioteuthis by the ship ladder. Not far below the surface in deep water. Rather scattered (perhaps by approach of motorboat).

Running lights at night. A moderate number of

Cayh., Apr. 30, 1972, [illegible]

(145)

small fish show up. Then 7:55 p.m., a large [illegible] is approx. circling around [illegible] nut [illegible]. Often back to [illegible]. [illegible] Flesh. Also peculiar V-cuts, perhaps [illegible] SAN again.

ADDITION: Another caught a large [illegible] this afternoon, shortly before [illegible] group. [illegible] ach was found to contain a squid. Partly digest[illegible] squid size, and mantle [illegible] slip for [illegible].

[illegible]

Still at Oxyrhinchus Arm, but Weather worsening. Start out 7:38 a.m. Area [illegible] goes on shallow [illegible] Arm. Arrive area of large group (which [illegible] shallow) 7:44.

Group is there (still or again). Fish appear less [illegible]. Difference is due to medium. There are fewer medium [illegible] with the group now than yesterday afternoon (guess). The group is still reforming. With the smaller number, it seems that the larger buds include at least 5 pairs [illegible] or 7 in fact. Buds usually ranging 2-4 ft up in 6-7 ft of water (slope is steep here). Overall variety of bottom. Patches large patches of TG as well as sand, coral, rubble, etc.

When first saw, all or most buds in Ord, WS, Y, and low intensity Pale Arm (i.e. pale streak down center). Obviously slightly disturbed by our approach. But soon we

I

Mustapha Sanchez
April 20 1972

[illegible] Tight with deeper water on left
[illegible] D. [illegible] shallow
[illegible] to be [illegible]
[illegible] left
[illegible] first
OCD with [illegible] go down
to about 5' to bottom. Depth here is about
20-25. They start swimming back and
forth facing me. They are spread about
left and swimming towards and
backwards here [illegible]
and Darry walks to L while swimming
to tentacles first. Large Turn group of blue
[illegible] seems to have moved there away.
They did not seem to like going into deeper
water. Minutes later one [illegible] from small
group PH with US & DM swimming to
tentacles first and curl motions and
[illegible] DM Turns goes deeper and swims
back and forth RL with PH
& DM [illegible] at 30 ft blue [illegible]

area, I don't think it would with deeper. I
I notice a large barracuda in area, at 1
second time I seen this same fish in
the last half hour. I follow the barracuda
trying to scare him away. Then notice
3 very small ink puffs. Probably from
a very small or several very small squids.
8:35 2 puffs of ink one close to surface. Then
down to about 8 ft looks like small squid
again but did not see any.
8:38 one juvenile Lepidotheutis PH & WS does
a split Then starts to retreat from me. It's
about 7 ft from surface with bottom at about
30 ft I follow and goes into open waters
(I can't see bottom) 8:45 still following it
it takes off but I keep up with him. Turns
whitish while moving and goes PH whenever
it stops. Takes off again going whitish
Then starts turning dark as it it where going
to ink. I try to induce him to do so
and I try to come closer, it sounds
and I follow Then surfaces and darts
out of sight. End of dive at 8:48 am.
9:38 am Small Miatufo 7 ft depth 30-40
visibility. Area where I found 2 new specimens
yesterday. no squid
10:18 AM group of eight medium large

III

Mitapo, San Blas
April 30, 1972

about two feet above bottom [illegible] deep
water [illegible]
[illegible] to One RL and to another police
and Double Eagles with [illegible] back and
forth [illegible] All
[illegible] They are all in [illegible]
[illegible] when they [illegible]
bottom [illegible] Suddenly
They all pole [illegible] at right angles
and make a two FOOT dash towards
deep water. Then stop & go back and
everything goes back to normal.
They repeat this again a few minutes later
when a gaichile flying overhead cast
its shadow in their vicinity.
A lot of dolphin are seen to [illegible]
over them and they all have [illegible]
[illegible] & E with a lot of flittering of fins
& cannot see their pattern. Suddenly
[illegible] and go into E with [illegible] flittering
of fins with [illegible] spacing away
from [illegible]. Mitapo 1.07 pm usual
[illegible] Went to deep water [illegible]

IV April 30 1972

[illegible] one long [illegible] along its perimeter
There dark [illegible] shallows [illegible]
equal [illegible] 123 psu [illegible] 20 in
under surface in 20 ft of water [illegible]
survey at 145 psu. Shallow to [illegible] from
study area in [illegible] to [illegible] 4 [illegible]
lots of [illegible] in [illegible]
vicinity of area [illegible]
Turn small specimen spotted [illegible]
Lepidotheutis but [illegible] [illegible] 8 [illegible]
East of [illegible] and found the [illegible]
eight inch [illegible] seen [illegible] Today
Took about 24 shots of TRIX [illegible]
which [illegible] end of line 220 psu
ogopuki (Holanders Rays) 407 psu
Follow line of sargassum for 10 or so
minutes, Then decided to go on [illegible] along
same line no squid near it or under it.
Arrive to S.W. end of island windward side
and run into 35 or so ind from
med small to extra large. The large ones
are courting, not much group order except
for younger members of group, who are
keeping pretty close together and more or less
leading the group from one place to another.
Part of their pre-copulatory display seems
to be a flushing from dark pale to light pale

V

Ogopogo Rip Sanchez
April 30 1972

may possibly, also fluttering as he approached her from his right side and tried to get another leg, I also noted that the female's antennae were twitching at 1 to 1½ minutes. Then it rate Then after copulation or perhaps if it lost interest. One perhaps two successful acts of copulation. Both times male approached female from left side and under pushed with some of its arms into armpit of female. After both attempts I noticed female moving her short arms as if massaging spermatophores

Cephs, May 1, 1972 II

by about 10 to large open bar without "coming up" pairs moving around together. Only [illegible] & Pairs or Trios [illegible] New Penis [illegible] & [illegible] Hotel show [illegible] patterns. Some Dark and [illegible] & [illegible] Tan and Cream [illegible] or Yellow and Red. Also pale & Light Spots. Some bar out ends. These can be perfectly without [illegible] in color of the arms (Maroon, Blue, Red color). Others moderate Blues. With definite Z on arms. Also Dark arm Z can sometimes be seen with Red US on back. These various hatchetty patterns seem to go along by either or both the O and Z of upper. But not to be perfectly known now begining by the O's. The O's are obviously defending the Q's. Did a couple of nice cases of a O suddenly begin out ends and go to another when she is approached from the "fan" side.

Again there is no E or P showing untransparent encounters. Very clean cuted. for skin-color.

The general arrangement of the group as a whole is not very different from yesterday. All inds. usually quite close together, only a few feet (1-4 body lengths) apart. Pairs courting most vigorously tend to be on outskirts; sometimes stray slightly further away, but never more than a couple of yards (this morning). The smaller inds. form a definite subgroup. Sometimes slightly higher in water than all or most of the larges. Sometimes at one end of the group. Group in general sometimes a line, sometimes a cluster. There is constant but not

usually very rapid "milling around." Pale Note. The group as a whole is quite active. Bright in areas in the direction of auditory, receptive light but average for. Who is this one more attractive to the ♂.

Sexual and partial sexual behavior rather [illegible] frequent and for less energetic this [illegible] of [illegible] between Possible dominance relation?

Fish milling around in or near group.

Everything rather quiet 4:58.

See some spreads with three Pale Arm. Out no other color change (neut of body, Ord, WS, Y).

Watching one particular pair. Call them ♀A. On outskirts of group. They seem to be peculiar in one respect. The ♀ is not larger than the presumed ♂ (possibly smaller if anything). Incessant and Rocking together. "♀" does RL in semi-Partl. "♂" in Ord, WS, perhaps Y. Both have slight Pale (center) Arm. "♂" stays behind and below "♀" almost all the time. But, rather surprising, they seem to be showing "control" of direction of movement. Sometimes "♂" follows "♀", but sometimes also the reverse. (This variability may be correlated with the lighting of the sexual dimorphism in size.)

In other pairs, the ♂'s also tend to remain behind and below the ♀'s. With more constant "control" of movement by the ♀'s.

8:04 a.m. Large Barracuda appears 10-15 ft away. All the squid turn Pale and shoot away. (NOTE: "Pal-

ing" may be adaptive in almost all circumstances, against all predators, simply because it does, generally, increase unpredictability. But it can run back almost immediately.

Following what seems to be part of A's courtship regulations, she bites more as before. And the group retains same geographical position in relation to others of the group as before. Does each pair or individual have its preferred "station" within the group? If so, it indicates a very elaborate social structure.

Matching ♀ of another pair, 10, she seems to be in Pie almost all the time.

Another ♀ is in Dark Rose in gorgeous Wrestling. Notice that both her mate and an adjacent pair are also in dark. (WS seems to have disappeared almost or absolutely completely in two of the individuals).

RL and Pie becoming rather more common now (again). The reaction of a ♂ to RL or Pie by his mate is quite characteristic, stereotyped. He assumes Double Streak on back with Fin Stripe on sides. The "WS" with Double Streak is remarkably conspicuous. Relatively broad and very bright silver, much more so than in WS combined with Ord. In one case, at least, there were no stripes on belly in Double Streak - Fin Stripe.

NOTE: The water is really quite murky here now. Lots of sand and mud stirred up by feeding fish, our anchor, etc. Doesn't seem to bother the squid.

COMMENT: The group, and even the constituent pairs, are really quite remarkably sedentary on the whole. No great

"cousing" back and forth over under leg [illegible] seen at Pow-wow (and Heritage?) last year.

Has a ♂ to ♀ (w/ [illegible]) as full [illegible] Obvious, prolonged and direct [illegible] definitely interspecific Venus.

♂ of PA pair mates. [illegible]

Notice that both ♂'s and ♀'s of all [illegible] pairs tend to keep their arms slightly spread at the lower more so than usual, even without color change. This could be an attention movement of female and/or (more probably) an indication of sex, getting ready to treat suit or mount opponent.

8:18. RL's and Pas tangent, very close now. Only 1 ♀ in many contact Pts.

One ♂ does Spread with outside Z on arms, Pt on back. To neighboring ♂ or pair.

Aha! Joint copulation of the day seen by Arcadia. ♂ does rapid fluttering, Pastel flushing, beforehand. Copsuccessful? (NOTE: These birds obviously take some considerable time to "warm up" in the morning. The ♀ may have done RL before (some time before?) the cop. It would be nice to see further sequences of this same sort for confirmation. SAN.

Watching another pair. Perching together, sometimes closely, sometimes rather far (3 ft - 4 ft) apart. ♀ once assumes <u>Extreme Pastel</u> when the distance between the 2 birds is

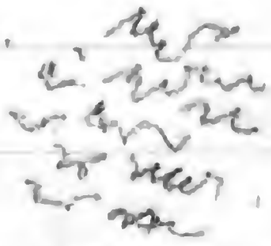
greatest. Then Pic swings closer. Then subsides into Ord, WS.
Hogan loses Double Stack - Jim steps into Ord, WS.

All back equal 2:32

Nothing appears unusual as PA behaving in a way which I would expect to be pre-copulatory (or dem-
onstrates of pecking between copulations). Preening and
Perching together. ♂ with "Bent" arms. ♂ sometimes in
Ord & WS, sometimes
in "Granular PH"
(see below) and/or
intermediate between
PH and Ord & WS.

♀ in intermediate
between Ord & WS and Pastel.
Then the ♀ Wallies conspicuously. ♂ switches from side to
side of her, to protect her from "intruders". Then the ♀ also
Bends, toward her mate. At the same time, she begins to
show trace of RL. All very, very subdued.

Stop my own observations 8:45 a.m.

COMMENT: I am beginning to worry about "PH"
type patterns. "Typical PH" is characterized by bold semi-
stripe-like blotches of relatively large size. But there also are
yellowish patterns with much finer markings.  I have
been assuming that there are intermediates
between typical PH and Ord and/or Pastel.
Is this assumption justified? Or is there a distinctive
"Granular PH"??? Must check.

Arcadio stays behind a few minutes to continue observations of ♀ group. Sees a couple of cop. attempts.

When he returns to Jethro, we see a large und. on group right next to ship. Arcadio notes the little fish, etc.

9AM.

Starting out again 11:15 a.m. [illegible] ♀ pass [illegible] on unchanged. Water still rather rough. [illegible] group above immediately. Still contains 28 und. Still over [illegible] Tom and other bottoms. All und. in Ord, WS, Y, and [illegible] (counter) Arno at first. Some P in Ord +, to us. Pilot [illegible] immediately. Resume "courtship", sex and hostility. [illegible] Pao, Dallas, Ignacio, "PH"s, etc.

One und. does E in Ord + (to us?) Then and then E to (Jacuzzi) fish passing by.

Suddenly there is a burst of quite an water. At same time, whole group darts a few yards sideways. Can't see what provokes this. Animals relax. Then they all shoot out into deeper water, hover about half way up. In Ord, WS, Y. Again a release of ink. Why? Is there a Barracuda around? We can't see it. After a minute or so, the squid relax, drift inshore to previous area, resume "courtship".

11:24. Two cop. attempts. ♂ pass [illegible] around in group. Often near middle, seldom on border, never far out. Going back and forth and Rocking as usual. ♀ in semi-Pastel or Ord-Pastel. ♂ in ambiguous color, sort of intermediate between Ord and (Granular) PH, perhaps with a touch of Pastel thrown in. ♂ makes two forward copulator, "pares"

[illegible] of about one minute. First figure [illegible] fledgling hour-aged. Both go [illegible] [illegible] anything [illegible] centered rows. [illegible] attempts [illegible] (again reduce [illegible] extremes of color range [illegible]) [illegible] soft and [illegible] [illegible] does not do as continuously as [illegible]

Then [illegible] group dents at [illegible] a few yards. Back again almost immediately.

Then there is a Hob burst of "Z" [illegible], more or less like this seen yesterday afternoon 11:30

2 [illegible] [illegible] ↗ Approaches another [illegible], assumes dark Z with extreme spread while the other assumes light, conventional Z, also with extreme spread. (It is impossible to tell which assumes pattern first.) Then the upper animal moves off. Lower goes Pale and Cultra ts. Original "aggressor" moves on to third ind. and repeats performance in same way.

Then I see several more (4-5?) performances of the same type, involving the same or different individuals.

Certain regularities become apparent:

The "aggressive" ind. (I shall call this the "approacher") goes straight to the approached. Always gets <u>above</u> the approached. The two inds. assume their characteristically different Z patterns almost or absolutely simultaneously. The approached usually up ends, tail up, almost immediately,

Cpb, May 1, 1972, TX

(153)

while the approacher remains approximately horizontal. As a result the tails of the two animals meet on different planes with their front ends nearer second in the upper

I get a good view of patterns on undersides. Both have very conspicuous fin stripes. (Are fin stripes characteristic of all Z patterns, or all Z's which extend to the body??) The lower animal, the approached, is light below (just plain light, not silver, or pearly). The upper animal, the approacher, is light below with rather sparse, scattered, small black spots. If there is any difference in the width of the spreads of the two animals, it is the lower, the approached, which has the wider. (I am not sure that the fin coloration of the upper ind., the approacher, is always the same in all circumstances. Always largely dark above. But perhaps not always

marked with prominent light cells as described yesterday. Outreach in Dodo is often hours of concentrated bow land (without prominent cells).

The animals included in these "2 incidents" always stay together for some seconds. Minutes later, the approached always darts away in the direction of the

What is the point of this observation? In one case, an approaching shot has tentacles and arms toward the upper (central) forward border of the mantle of the approached gul as the two animals separated (the lower going forward, the upper backward). Was the extension of the tentacles and arms might be copulatory. If so, these encounters might be "rape"!

Arcadio saw one of these encounters in which both animals may have been males. In all the cases I have seen clearly, the approacher was smaller than the approached. I.E. presumably males attacking females. N'importe.

If rapes do tend to occur as the day wears on, this must be because the ♀'s tend to become satiated.

In one case, I thought that a presumed ♂ who had just attempted a presumed rape upon one presumed ♀ immediately (re) joined another presumed ♀ after the rape, and then swam peacefully with her for some seconds or minutes. Thus, the "rapers" would seem to be mated rather than unmated. Unsatisfied rather than unattached.

(This hypothesis may be supported by other evidence. There does not seem to be a "surplus" of adult ♂'s in

Cephl., May 1, 1972 XI

this group now — in contradistinction to some other groups seen elsewhere at other times. When its solution is not enforced by the supposed rage attempts, the large bull can go with two females.)

In one instance a group which had just been "raged" or attempted, rejected the original mate, and swam in PL with them.

COMMENT: Perhaps the above description is not quite clear. It may be useful to recapitulate in part. The "Type Z individuals" seem to have several diagnostic features: 1. Both Z and Spread patterns are vertical. 2. There is always one ind. above and one ind. below. 3. The upper ind. always assumes a characteristic Dark Z. Note the Z encounters in other circumstances, e.g. between males in courting groups apart from rage, are rather different, perhaps lower intensity. Spread tends to be less. Z may be confused to arms. There is less (perhaps no) tendency for one ind. to position itself immediately above the other.

Perhaps the "quality" of the Z motivation is much the same in all cases. Only the relative or actual strength may differ.

Stop observations 11:40 a.m.

NOTE: The members of this group do not seem to be feeding now. An indication that they probably do die after breeding.

Start out again in afternoon. 3:00 p.m. Weather still the same. Sunny and somewhat rough.

Go to 9 prop area. 9 fish swimming almost mixed with Now approximately 22 nmi. In much the same manner as the fish. All next to our appearance by small Old WS, Y. The fish seem to also have long snouts on them.

Apparently there is still some "courting" in progress. See several pairs. Some circling 9's.

The water is particularly murky now due to extreme of a school of 10 fish feeding on bottom. These have the same gray with yellow streak along sides, yellow tail. According to Arcadio, native Cbe "Bonehead" in shape. But these fish are definitely grazing (while bonehead are supposed to be carnivorous)

The fish are staying close to some of the squids. They seem to be so active and to have roused so much silt that they have split the squid group. Now there are only 13 squid near me. All large or medium large. Not moving much. It appears that they have almost lost interest in sex. All passion spent. Certainly, they are much less active in "courting" now than earlier in the day, or yesterday afternoon for that matter. This is a rather rapid decline!

Squid nearest me does DM with otherwise conventional Ord, WS, Y.

The gray and yellow fish go away several times but keep coming back. They would seem to be definitely associating with the squids. Why? And why do the

squid "allow" it? (The fish are still larger than even the largest squid.) More on tools? Engraving agaths?

Some of the squid do C & ne in O & t. Then one or more of 2 do(es) move RL & Ve.

All quiet again 3:30. Only the usual forms & curious intermediate and outlying individuals. Back to Arch. So go off to look for more. Find group of 12 smaller squid about 20 yds away, rather low in some but deep in water. This is obviously the "other half" of group. All new, plaud. I go back to larger half. This slant off and out like when Arcadio tells (continuing) of spear fish. But they don't go very far.

3:40. The 2 halves of group are still keeping their distance from one another. Is this typical of "afternoon break-ups"? Only very few instances of courting now. Paws still unlike as with, but only occasional Rocking and/or weak RL.

None of the larger pairs any attention to small fish swimming overhead.

Stopping observations 3:50 go on to main island of Macclubes. Arcadio goes for shallow-water fish. 3 small-medium squid in 4 ft of water. I go around, but can't follow them. Then we both lose them. Nothing.

Stop observations for afternoon 4:50.

NOTE: large squid have approximately 17 ocelli on each fin. In a row. Ocelli are largest at center.

Pacific Light at night. Group of 6 separate specimens of light squid, which are into fish by Eugenia Clark, where 3 others have appeared. All these squids have been long and slender, sometimes in Oct, Nov & Nov after new moon. Squid above is of form of "conventional" OH. Dark blotches of these "baby" squids little more than 2 inches long. Dark blotches "extend" onto fins. There are some dark "dashes" down center of back. Rest of body and appendages are h fins is light, orange, lighter than in still OH, but probably rather yellowish in tone. Head is somewhat darker and not blotched.

Blotches are dark reddish

Thus light OH tends to be assumed just as the animals approach the electric light.

They also start to move their arms in remarkable ways at the same time. What look like all sorts of combinations of Curl, V, and Spread (no Z).

I should have supposed that all the light OH, Curl, V, and Spread patterns were purely hostile. But sometimes a squid performing these patterns shoots out its tent acles and catches a sardine, which it then proceeds to eat. The sardines caught have all been swimming near the surf

face at the time.

Very surprisingly, Arredio says that the large be same swimming in open water this morning also feed in the same way, with the same distinctive tilt and [illegible] movements!!!!!

What can be the meaning of this? Do it represent a new form of feeding? Of feeding during the breeding season? Of feeding on certain foods in certain places? Or are all these animals both brightened and slightly irritated in these circumstances? I think the last, but it would be hard to prove.

9:07 p.m. Three larges still at light, still moving and occasionally feeding in the same way.

COMMENT: Looking both at the squid and at my drawing of one on the preceding page, it strikes me that the dark "eye spots" of DM must be related to one of the "bars" of conventional PH.

NOTE: I saw 3 pelicans flying around this island today; but it is still true that they are relatively rare now.

May 2, 1972
San Blas

Still at Ogupuhip. Start work at PA area 8:10 a.m. Sunny and rather calm. Find PA group almost immediately. Now consists of 15 inds. 4 (possibly 5) real larges. The remainder range gradually from large medium down to small medium. Animals approximately 5 ft up in 15 ft of water, ov-

I

Ogopupip, San Blas
May 1 1972

May 1 1972 7:30 AM Two frigate birds
dolphined to other, one with some groups as
yesterday. Some of the smaller squids
are gone, only 28 and left 82 cuttlefish
and 6 very small & very large. Some
predators in vicinity. Shot one snapper
& notice one barracuda & one large grouper
both seemed interested in group. Too we a
lot of grazing fish under the squids
most of the time. Still fighting over right
to copulate with any given female?

Visibility 30-40 ft cloudy and windy. I think I can see the ground in some of the wind but I am not sure. Photographs 12 to 36 end of dive 900.

915 bound under TETHYS. They seem to be attracted by red-shed flashlights. They stay close to it. They are taking the fish scraps thrown over board by Dock who's cleaning snapper I shot earlier. There are a lot of arm displays splits, curls with V, extreme curls of all arms PH pattern's pastel end of dive at 9:38 am 9:50 AM Deep tow with sled. Went for about 1 Km in about 40 ft of water above bottom of reef 6 large squids at about 30 ft. and 300-350 meters from starting pt. End of tow 10:30 AM.

Night Observations: These observations were made on the night of April 30, 1972 Starting at 7:30 pm. A pair of Sepiotenthis appear under the light. They approach the light one behind the other. The first one tentacles forward doing a V with curls, the second one moving in mantle first with its 2 tentacles trailing longer than normal. At 7:44 pm one takes a sardine and the other at 8:20 pm Sometimes when

[illegible]

[illegible] the tips were [illegible]

[illegible]

[illegible] split. First [illegible] attack [illegible]

[illegible] the tentacles forward.

That is, the tentacles [illegible] the squid

used facing the prey before the attack

began. On the second, the squid shot

its tentacles pointing to the prey before

beginning attack. It shot forward and

at the last moment turned around

and grabbed the fish with what seemed

like very little effort. The other pattern

is quite baffling. whitish

with a reddish brown mane bounding

across, no white shark, just some

vestige of Dm. Could it be PH make

artificial light? They seem to work

the mesa-sled for protection. They

always approach the light from the interior

of the sled. Usually, they start close

to the surface and gradually sink as they approach the light. Most feeding frenzies first twice with DM & PH with W.S. and then only like PH with no W.S. It was really a half hearted attempt to protect itself from food. It did not retreat after releasing ink but remained in same place surrounded by the ink cloud snooping like a flamingo. It did [illegible] when the boat moving with [illegible] the [illegible] the squid also not approach the light and lose sight of them. When the boat again moves into deep water, they return to the light and resume preying.

Night observations. May 1, 1972

Probably same two as night before. Tonight they are bolder. They come to the light shortly after we turned it on and all the way on the surface. I jerked one up with a dip net and [illegible] him in a bucket for a while. Ejected some ink and a mucous white substance which remained on surface. I put him back in water and swam away slowly and deliberately preying as if nothing had happened. Tonight they are attacking the fish gathered under the light intermittently. They come into the area and start feeding right away. After a

V

Ogopogo, 1972

May 1 1972

While most of their prey quite the other and they too learn to recognize attack after the pounding. Dark and waits to the light. This went on all the time we had the light on.

on usual nurse bottom. [illegible] appearance by [illegible]
8:00 [illegible] entirely for the [illegible] at
[illegible] gradually [illegible] out of group. I stay.
See one Pu Ord W, Y, and Light Pale centrals.
Have slight [illegible] of Pu reading of with RL.
8:16 Have more Pale + Pu Ord+. All by large. Squid
move to us but not actually very close. Everything very
calm and still on the whole.

Have are still 1 to 3 miscellaneous fish around. Ign
and light squid and vice versa.

Some of the squids are feeding. Much raises an inter
esting question. How do the mediums support themselves when
they are with a "contingent"? They have to eat sometime!

8:28. The group gradually drifts off to an area of
pure TG. When there is a group of gray & yellow-fish grazing
(mc!) as well as other fish.

Squid are straight out in a line now. Catch a glimps
e of more Reading and RL in pan at far end. Difficult to foll-
ow as the group is making water very murky.

Arcadio comes back from exploring distant waters
Saw only 3 squid, 1 large medium, 1 medium, 1 small medium
Minus Oregon. Pu "V" (see below). In PH and Pale. SAN

One of the large in my group does 1/2 DM (one spot)
in Ord, WS, Y, Pale (center) Arm. Then E with full DM in
Ord+. Then E in Ord+ without DM.

Arcadio goes exploring again, into deeper waters. I
go exploring in shallows. 8:40. I find lots of gray & yellow

Cephi, May 2, 1972 III

fish but no squid. Stop observations 9:00. Have go back into shallows 9:10. Still no squid. Arrive back 9:15. Haven't seen anything of interest.

Go back to PA area 9:20. Group now reduced to 11 inds. Several larges gone. Still interested in alarm and defensive reactions. I go away for a minute. Return to find only 3 inds. General break-up. Not quite [illegible] find group of 10 inds (obviously the 11 minus 1). About 2" up in 12-15 ft water in area of pure TG. 9:30. All inds. have cryptic. Both arms and body inclined upward. This is the sort of posture which I have been calling a sort of P (or semi-Cord) in my notes. It may be better to call it "V" from now on. (Meaning the term "P" for upward pointing of the arms while the body remains more or less horizontal.) Most of these inds. in V are in Ord with companions N, but not Y.

And I notice that the underside of the body is medium dark like the back. (This may not be typical of "ordinary" Ord's. Perhaps the pattern should be called as Ord-Dark.) In any case, the net effect is to render the animals very inconspicuous against the "background" of TG.

After some minutes, the animals begin to relax. Bodies become more or less horizontal. See 1 E.

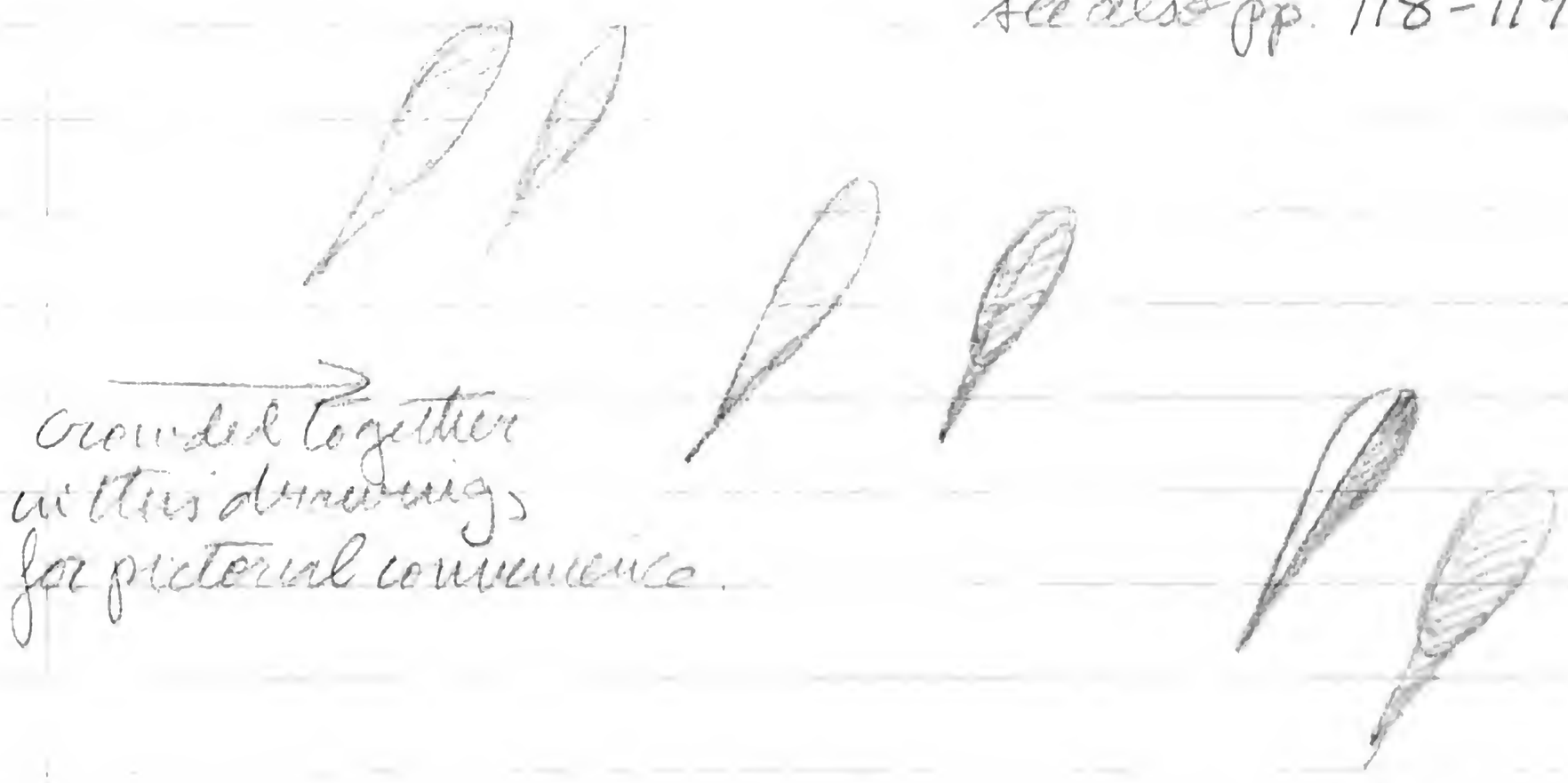
Stop observations 9:35. Start back to Jetty. Arrive in shallow-tow. 9:40. We see three larges in 4 ft of water over curved bottom. They take off, but we follow them.

Catch up to find that the group really includes 10 inds.

All large Rattler fan (2-4 ft) apart from one another, in line. But apparently divided into 3 pairs. Inds of one pair are slightly larger than the others.

When we first catch up with them, they are 2 ft down in 15 ft. of water. Showing some "courtship" behavior. Some Rocking by at least 2 pairs. The ♂ of one pair does lateral silver like ♂ of pair seen near reef in March (i.e. silver half of the body away from his own female but directed toward possible alternate fem.).

See also pp. 118-119, etc.



Then there may be some cop. int. moves, in the most distant pair (largest inds.) Rocking. Perhaps some "bending" of arms. All very difficult to see in distance.

The group gradually drifts in to shallower water. Finally end up low in 8 ft water and stop "courtship". Lots of E and P (apparently to us). Gradually turning into, or regularly cryptic V. Four out of the six inds. are in Dorsk, definitely without WS, Y, or Pale Arm, when in V. 9:50. The larg

at 4; however, in Ord & WS during low ☾

I notice that the eds. are much closer to one another when settled in ☾ than when they were [illegible] in gravel.
But there are still traces of gray segregation.

Then all the animals swim off in Ord & Bach into deeper water. Largest gray remains "cowering" 2-3 ft down in 15-20 ft of water. Pachuca and Pie. I swim up to them. They cupped their tails down toward the bottom in shallower water. In Ord & WS. Some E have one or more eds. (They seem to be quite shy at this stage in their cycle!). Then go off into compact ☾'s, intermingled with some E's in Ord & WS (definitely no Y or Pale Drum). One ed. does ☾ with Sh. ☾ get a nuzzle, good vibrations (underwater). Some dark colors fins and a trace of a center stripe, but all "fuzzy", not very distinctive.)

Stop observations 10:00 a.m.

COMMENTS:

(1) This group of eds. is fairly obviously not part of the ♀A group. It would appear to be in an earlier stage of the breeding cycle. I shall call it ♀B.

(2) The area of ♀B is only 100-150 yds. from area of ♀A. It is remarkable to find two groups so close together and out of phase with one another. This must indicate that their development is not controlled by any single factor of the external environment such as phases of the moon.

(3) Extrapolating from the bits and pieces available now, it may be possible to reconstruct the "normal" development of

Courting behavior in this species

A. Juvs. begin appearing sometimes large groups in mid-day. Inds. in groups, sometimes large groups, under, in both dayas and observations. Still fast, or even ill, inds. may at times have begun to form pairbonds.

B. Inds. pair bond in the morning for the first and/or new pairs bond when the females become adult and come into breeding condition.

C. The final stage in this process of mate-finding or formation is intense "courtship" in semi-open waters. Inds. still tend to be scattered in comparatively small groups. ♂ defends ♀ (Lateral display) and ♀ allows him to do so. But no cop. attempts. Inds. still very shy. Perhaps even more numerous than earlier.

D. Then annuals come inshore. Courtship becomes nearly continuous. Groups become large. (Attraction of juveniles. Also additional adults?) ♂ still defends ♀, but by conventional Z-patterns, etc. Copulations become common. Annuals become bold or tame, tend to ignore potential predators (except such major dangers as Barracuda).

E. Then most of the females become satiated. Still remain in same areas for a day or so. Occasional cops. Rape attempts still not very shy.

F. "Successful" adults move somewhere else. Remainders of "courting" parties (including juveniles) tend to break up. Become shy again.

Cephs, May 2, 1972 VII

G. Egglington, etc. Allen Moore

ADDITION: Also ΦB group may well be the same as the group of 6 which Amedeo and Lyle Pretzyski saw. They also have included the mds, which came to the Cove Φ and left. They may still be feeding occasionally as they move into the bend mg please

2:05 pm. See at least 13 small squid near Tethys. High up in 20 ft of water. Rather scattered. Disappear when I go into water. I cannot follow them.

We go to explore adjacent islands 2:20 p.m. Swim along beautiful coral reef. No squid by 2:45. Then explore large area of TG in shallow water, some mixed bottom near edge of steep slope. No squid by 3:05

Amedeo goes for shallow-tow. Over large area of TG still no squid by 3:20. This species certainly does not like expanses of pure TG.

3:30. See a single small by Tethys. Disappears.

Then we go back to Φ areas. I explore ΦB area until 4:10 pm. Nothing! Are the squid out feeding somewhere else now? At the same time, Amedeo goes to ΦA area. Finds only 5 mds left, medums and small medums. SAN. Deduce Φ group is progressing rapidly!

Run lights at night, but there is so much duff (scum) on the surface of the water that we can't see a damn thing! Then, 7:50 p.m., there is a gap in the scum. See a single large Sepioteuthis which has just caught a large sardine-type. Finds held by arms some considerable time;

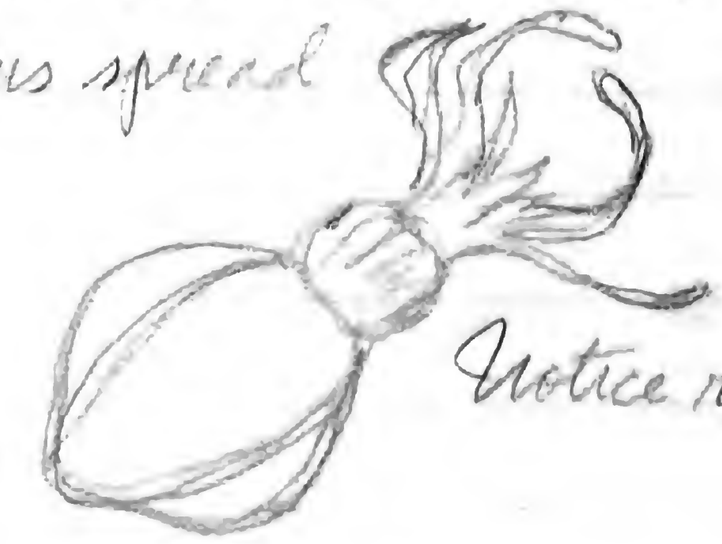
at least several minutes. (The slowness to "swallow" may be characteristic of all Sepioteuthis, perhaps all squid. We only noticed it at night.) The b. b. & the arms which are not engaged in holding the prey are held "spread out" (spread). Body is extremely light for the dark night.

8:45 p.m. Another gap in the sand. A single small Sepioteuthis shows up at light. Pink & very light body color, only marked by a few blotches. Arms not curled (probably in horizontal plane?) As far as I can tell, this ind. does not feed.

COMMENTS:

The very light coloration of both adults and young at the electric lights may be evidence that these animals do tend to adjust their color tone to ambient luminescence. And the frequency of "curling" (s.c.) of the arms apart from actual feeding may support the hypothesis that such movements are social indications of hostility, rather than purely predatory.

8:55. Another small Sepioteuthis shows up. Really very small indeed. Certainly not "larval" but about as tiny as any I have ever seen. Almost entirely colorless in wat or under light. Arms spread. Rather irregularly



Tentacles not expanded full length at this stage.

Notice relatively large head.

apparently not feeding in water. Arcadio lifted up and on put it in bucket. Immediately assumes extreme convoluted PH (3 "bands", extending into fins), and does form and V, V-split, upward V. Toward the end of this V-sense, the PH gradually fades, becomes almost none (Cyd Cave bio). Then we throw him back in water. It swims off.

Are young usually single at night?

9:15 Catch a glimpse of another Tur. Sp. [illegible] a few inches under seam. Color bar, with Cyd.

Where are all these infants coming from? Never saw a place as scum? If they originated nearby, they are good evidence that there are some kids breeding at all times of the year. Do squid have breeding seasons like nurlings?

May 3, 1972
San Blas

Still at Ogrugulip. Notice cormorant perched near ¢B area at dawn. But we still go there. Into water 7:35 a.m. Cloudy, calm, clear. Arcadio sees 9 ft shark (Carcharhinus nelbrecki?) almost immediately. Then a single large squid in 8 ft water more or less edge ¢B area. 7:45 a.m. It disappears and we can't find it again. Then see a medium-sized Barracuda nearby. Inclined against coral head. Hiding from shark? Then we patrol ¢A and ¢B areas several times, without seeing a single squid. (We also inspect drift lines of Sargassum, etc., of which there are a lot after last night, with equal lack of

T

May 2, 1972 Dropped off S.W.
8 AM 15 fd. I need small to med large
go on to look for more.
8:10 AM 3 two 2 med med 1 med small
all in P & large in PH & W.S.
The other pile to the W.S. they are
very close to a dump of aerospace
environs, obviously munitions. I go
on and when I return at 8:23 AM
they are gone.
8:33 Dive down with tank to 40-60 ft
both end of Coral slope, some snappers
and groupers. Shot one. Crawl about
250 ~~yards~~ meters on no no rapids. 9:06 AM
Dive around shallows trying to shoot groupers
no luck. Tow back to TETHYS
6 100 probably same I saw yesterday
under TETHYS It is also very likely that
the couple that have visited the light
in the last two nights are part of the group

May 2, 1972 II Ogopogo

10:08 on first tow. [illegible] ogud 11:15 am and small large [illegible] rubble 20 ft of water [illegible] ogud is about 4 ft [illegible] [illegible] and sort of [illegible] island. no [illegible] either, go completely [illegible] 3 land and about 50 meters [illegible] a lot of groupers fish under them. [illegible] try to shoot one of the groupers but failed the ogud disappears and so do the groupers a few minutes later [illegible] again, Hey and nursing Tiger Tuna and the groupers (yellow and gray) are following behind end of dive 12:20 pm.

2:15 pm Kalubin (West To Ogopogo Rip)
Snorkeling along surface, visibility [illegible] dept 10-12 ft a lot of potential predators coral and sand then becoming steep and deep only coral on East side of island water a little cooler 40-50 ft depth end of dive 2.35 pm

2:40 pm other side of island, coral, sand rubble & TG a lot of groupers slopes to about 40 ft. & followed the fringe of the reef for a while then turned inshore and followed along length of island

[illegible] with [illegible] [illegible] [illegible]

shark went past. we saw [illegible] groupers and two [illegible] in cuttings position next to heads of coral or sponges. Could it be mimicry, to look like the shark? a lot of [illegible] fish but no [illegible] for small pieces of [illegible] go to East side to Wakkubiki, no squid, a lot of predators go also. [illegible] bay from Ogopogip, nothing. [illegible] across bay back to Tetigi, cannot see bottom [illegible] 8 deep water no squid. end of tape

9:07 AM

10:04 swimming to sea along shelf 10:15 AM small wit puff 10:20 AM 15 squid in 30 ft of water, near the bottom 2 small 5 med and 8 large no action, a little low intensity [illegible] from two 100 at shallow end of line (opposite end from the groupers inds) female pastels partially and moves away from male arms first. Male follows arms first and catches up with her, already he is under her, there's female RL end of overhip. Not much young on so we head for sea ass. 10 small squids in 2 ft of water. They all start displaying

May 3 1972

all sorts of show attitudes with their arms all very strong, I follow them into deep water & lost sight of them,

End of dim 11:10 pm

across). Stop 8:20 a.m.

Then Arcadio goes for shallow-tow. Along shores of Ogunquit and adjacent island. Nearway Cottages and shallow waters in center of Cove. "Nothing." Stop 9:05.

Return to Jetty to find 2 new large Barracudas near ship. Have been there for some time.

It is not surprising that we have been hard to find this morning with the concentration of predators that has appeared! (Could the seals have been attracted by the earlier concentration of squids???)

Going back to ØB area 10:20 as Arcadio does shallow-tow on the way. Nice calm sunny. It is sunny now; still calm; the most spectacular predators seem to have gone. We explore the ØB area, then go on to ØA. Nothing. Then go on past ØA area. Then, 10:20, come across group of 16 squid. 2-3 ft up in 15-20 ft. of water. Over mud and bottom (little or no TG). Inds. range from large (not the largest I have ever seen) down to small medium (two are no larger, smaller than the others). Only moderately close together (often in line, smallest at one end, largest at the other).

They give the usual hostile reactions to our appearance. Then settle down. Very placid. One ind. assumes Quadruple or Quintuple Streak with brief, short escape. One does Z (arms out) when another comes too close. Most inds. usually in Ord and WS. Some Darks. One ind. does E in Dark. One ind. writhes in semi-Dark, then does Arch in complete Dark. All these displaying inds. are more or less large

Cephs., Aug 3, 1972 III

(161)

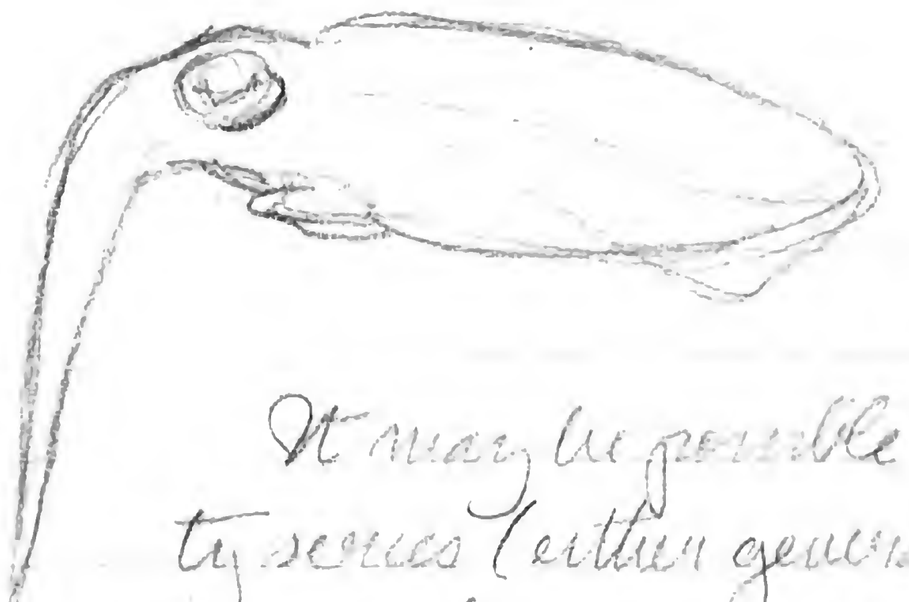
Arcadio sees bufftrace of "cowlick" from Cage Claudet? from Pedro, 82 ft.

Second wave ends. E to Dark Background, [illegible] mate has strangled second fact and [illegible] group goes to region of [illegible] and, with E in the Dale!!! Goodness that displays are [illegible] according to background.

This group obviously is not new, new [illegible] group is it in fact? Some of the smaller numbers may be remnants of the original group of A. But I assume that some of the larger numbers have just "come in" to a potential courting site. I shall call the group of C for the time being.

Going back 10-10. Pass through of A area, through of B area, and well beyond. Nothing of interest. Then, 11:00, Carlos (Anna pilot) calls us back to center of B area. Group of 9 squid has appeared. Ranging from tiny to small. In shallows, near surface in 2-3 ft of water, extreme area of pure TG. These animals are very shy and active at first, shooting around in all directions. Always close together. Very pale in color (probably a pale version of Ord — the light is brilliant here now). Then they stop moving, "huddle" under mass of floating Sargassum! We approach, and they all begin to display. All assume extreme conventional PH (3 "bars"). PH accompanied by conspicuous (but not particularly silvery) WS. And perform lots of V's. Forward, upward, downward, and split! Several assume conspicuous Tri stripes for a few seconds. In at least 2 cases, the

Fin stripes are accompanied by (or continue into) stripes along the arms. All this while V(s) continue. See the drawing p. 104. Unfortunately, I can't tell if the stripes are along edges or insides. Arms may be slightly tinted. Two inds. suddenly turn very dark all over (prepared to shoot ink?). But the rest are now darker, slighter, coloration. After some minutes, all the inds. tend to drop PH and go into Ord & WS. The splits tend to stop at same time. Then the other V's. Several inds. are left in what looks like a (straight) row on E. Flow or lens connection.



It may be possible to arrange V's in an intensity series (either general intensity and/or relative strength of escape tendency): Split > upward > forward > downward.

Stop observations 11:10 a.m.

Go on to far end of Molasses Keys (Tiatupo, Pauctupo, etc.).

Start work 12:40 p.m. Hot, sunny, calm. Arcadio starts shallow tow around Tiatupo. Over lots of coral, TG, everything. No squid. I go in for a swim in gulf 1:28. Coral, TG, etc. Still no squid. Come out 1:45. So we start over to Cuinquintupo. Arcadio tend on evening. Arrive

Cayla, May 3, 1942 V

(174)

1:55. Start around island. Arcadio catches glimpse of fish may be large group. So I go in [illegible] around. Full field group. Just 3 ones [illegible] large group of 21 ([illegible] including 3) 2 of them up in 12 ft. of water. Over clear sand white [illegible] Bottom slopes very slope of TG. Well spread out in line. One [illegible] at one end of line. ♀ of this pair is really large. All the others in the group are slightly "sub" large.

After some minutes, the group comes out of the open water to the TG slope. The ones which pass closest to me are in Dark. Definitely no WS, Y, or Pale Area.

The pair at the end may show slight traces of "courtship." The ♂ turns Pastel or semi-Pastel for a few seconds. No response by ♀.

2:15 All the eels are down low near TG. Almost all largely or completely Dark. With the conspicuous exception of the large ♀ of the pair, she is in a rather pale version of Dark with WS. Does this mean that she is rather less frightened of us than are the others? And that Dark is an indication of alarm? The answer probably is "yes" to both questions. If so, how does the causation of Dark differ from that (these) of the other alarm patterns? Is there a basic motivational difference? Or is the Dark primarily a response to alarm and to certain external circumstances? Used only when concealment is possible and/or necessary? I.E. just before shooting ink and/or trying to be cryptic.

The large ♀ of the pair shows a trace of RL

All eels retreat when Arcadio advances to photograph

Quickly relax. Crowd back. All calm & 20 Inds just "sit". This seems to be an unusual sedentary group, even for this sedentary species. As the Inds relax, they start to break up then G.S. Move slowly in connecto in all directions, start to [illegible] and also come down together on the average! S.E. a straight or slightly curving line of well-spaced inds., all facing the same way, is a defensive reaction.

Stop observing this group 2:22. Arcadio continues shallow to round island. Completes circuit 2:45. No more spud. So we go on to Pirulapo, Arcadio leading toward all the way.

2:35 We run into a huge group of young. Difficult to track down at first. But we finally get close. Group includes 70+ (perhaps 74). They are in 2½-4 ft of water, over enormous flat of TG. Perhaps ½ to ⅔ of the way up. Inds. range from smallish small to largish small. None really tiny or medium. In Ord, WS, Y. Exceedingly mobile and skittish. Start to dash this way and that. Usually very closely integrated, only a few inches apart. Whenever they dart away, many inds. change from Ord+ to Double Stroke on back and Fin Stripe on sides. (I can't be absolutely certain but I think that most of them were not streaked underneath.)

Rather surprisingly, there were absolutely no V's, Splits, or PH's. Why??? In view of the fact that these animals were also in Ord+ from time to time, I would suggest that they were relatively less frightened than inds. which perform the V-Split-PH patterns. (Of course, the inds. of this 70+

group did a lot of overt, unmutualized, escape. Perhaps this provided an outlet for much of their internal escape tendency. It is also possible that V-Spot-PH patterns tend to appear when inds. are both highly frightened and yet reluctant to move away (attracted to something else, a bunch of large prawns, an electric light and potential prey). It would appear that both smalls and larges are behaving in a predictable way.

While I am watching these smalls, Arcadio finds a group of 8 larges 100 ft away. Approx halfway up in 5 ft of water, sand and coral bottom. The inds. seem calm and non-interesting. Not my active.

The smalls eventually scoot away when a Barracuda appears. So I go over toward Arcadio. Find a single large, "caught" between the two of us. Assumes extreme E in extreme conventional PH. Body, sometimes horizontal, sometimes inclined upward ("V")

I think that the horizontal portion is an int. mov. of movement, forward or backward.

COMMENT: It is becoming increasingly obvious that inds. of this species can "adjust" their displays to their backgrounds and other ambient circumstances. Their displays are not simply expressions of internal motivation alone. They must have to make rather elaborate calculations — rather more elaborate than implied by Young et al.

I stop observations 3:25 p.m.

Arcadio continues observing group of larges. He thinks

that the rule be strictly to "cancel" now. It's apparently depending a ½ SAN.

Pitch dark at 8:00 p.m., just as it is getting dark. I think I see large octopus swimming on the surface of the water. 7:15. Dragging its arms behind it in a V!!! But it doesn't come close enough to be sure. Then, 8:10 p.m., an equal large octopus sees and comes up a fishing line hanging off the stern near the bright light. Comes up almost to the surface. It's limbs does not go down to the bottom. I.E. the octopus must have been swimming about just to have found the line.) Peculiar. Obvious, a species that we have not seen before. A scattering of very large tubercles over body. Body fairly pointed (quite slender). Small horns over eyes. Whole animal large, pale when first seen. Then flushes red, but the tubercles and horns remain white. Quite spectacular. Then lets go of line, swims to side of ship, arms dragging in V, and then clamps on to side. Reverts to pale. Eventually swims away - while I am in the head.

8:10 p.m. 5 Longtentacles-type squid show up near lights. Reddish. Circle a couple of times and then seem to disappear.

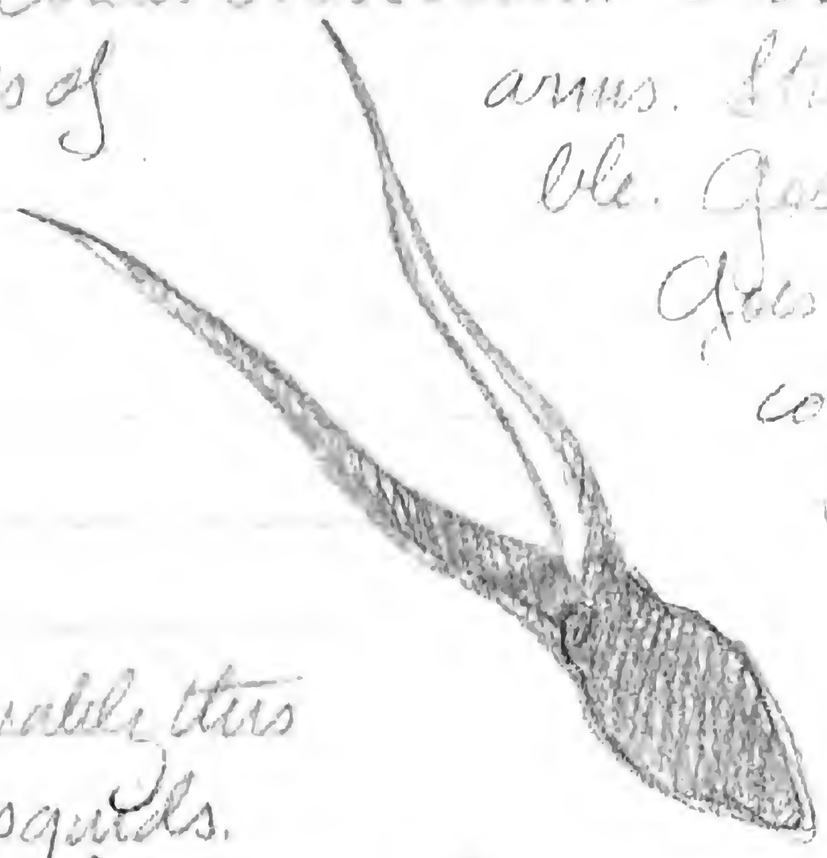
NOTE: We are quite far (1/4 mile) from the nearest island. This may help to explain why we have not seen any Sepioteuthis tonight.

8:50 A swimming octopus shows up. Almost certainly same ind. as before. Again in V. Grasps lamp cord.

Cephr., May 3, 1972, II

Then swims on and disappears.

Comes back around 8:55. Tangle [illegible] of insides of arms. Still with Y. [illegible] ble. Gas [illegible]. Also gate in [illegible]. Includes conspicuous (again). Have one (Ed [illegible]). Let us hope that Y can be identified [illegible] species competes with [illegible]



Pursuing this urinal squids.

Stopping observations 9:25 p.m.

May 4, 1972
San Blas

Going to try Pinatupo again this morning. Some wind. Run into motor trouble. Finally get into water 8:10 a.m. It is calm here. Water rather murky at this particular spot (see also below). And warm (note. the water along this side of the island was actually hot in places yesterday afternoon, especially where the squids were clustered, presumably not coincidentally)

We swim over shallow TG flat. No squid. Then move on and outward to area of mixed sand and coral. Where 8 larges seen yesterday. Come across group 3 larges 8:27 2 ft up in 3 ft of water over coral reef. 1 does E in extreme conventional PH (notice that the "bands" "continue" around

Tortuguero Sta 13Aug
May 3 1972

End of Tag Sighting Period at 1130 pm
in Tortuguero, in a small bella cabina on
[illegible] Tortuguero, around
21 [illegible] on the old [illegible] project
[illegible] tagged a new site in
a group of about 20 small and later
on saw a group of about 8 large and
low intensity [illegible] with steady
5 [illegible] RL did not notice any flutterings
of body and flaring of arms from part
of the defender, end of observation
at 1230 pm

on to bells on underside). The other 2 do Purple Quintuple Str ceb, the 2 on SC (1½ ft) Bermuda shows up. Dec. squid retreat some yards from rock again. Now just below surface & quiet. One dec. Bermuda (yellow) P in Ord, WS, Y. Then the Bermuda attacks the squid. Phones? Dunny care, they disappear in a little. 8:33

Then a very fast dfnt. example of Spot-tow upon the squid!

Continue swimming in same habitat 8:40. Come a cross a single large Portuguese of — see below. Not as enormously large as some other females I have seen, but obviously fully adult) 1½ ft up in 10 ft. of water. On border between small coral reef and semi-bare area of sand & miscellaneous coral heads and debris. (NOTE: the water in this area is much less murky than at some other sites, but it is not absolutely clear.) When first seen this animal is in extreme E, body upright, with extreme conventional PH (tends underneath), and Y. Then she does series of P's and E's, and a few Curls, in Dark. Note that the animal is dark almost all over. Even the fins are dark. Cells relatively inconspicuous. And the funnel is light, semi-transparent.) Then the female swims away a few yards. Does E's and P's in Ord, WS, Y. Then more of the same postures in Dark as it comes down to us (see sketches next page).

I am rather surprised by the general behavior of the animal. Definitely completely alone. And obviously very reluctant to leave the immediate area. Suggests to us that it may be lay-

Cephl., May 4, 1942 — I.

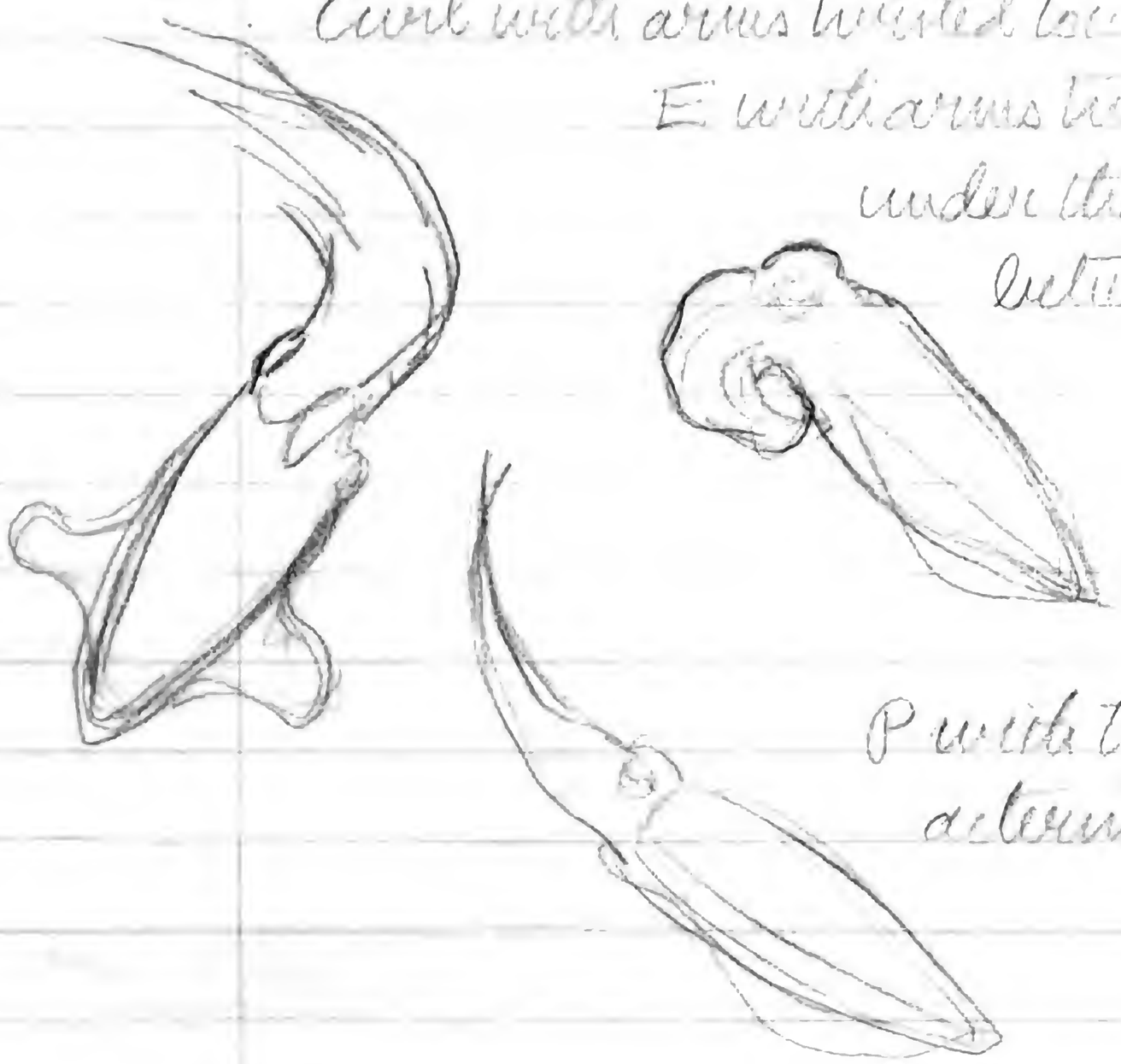
ing and/or guarding and/or carrying eggs.

Does more E's, P's, and Cephl's, in Coth Rock and Ord+. Usually sticking quite close to bottom of tank (note this is the under edge) [illegible] because aware that it is showing a definite [illegible] reconstructed site. Just about where [illegible]

Some of the display postures are quite exaggerated.

Curl with arms twisted toward and

E with arms tucked so far backward and under that there is no visible gap between arms and body.



P with tips of arms slightly clear of body

We move away a few yards. At which, the squid moves into the base of the reef. Disappears from view. 9:04. Then settles down into a definite routine. Rises and falls. Spends some seconds or minutes invisible (to us, in our position) in base of reef. Then rises up a few feet. Usually, Dark. Sometimes E and/or P. Then goes down into base again. It looks as if she were attending to something important at or

[illegible] but still [illegible] t. She must come up pounding [illegible] "[illegible]" on [illegible] [illegible]. All [illegible] [illegible]!

9:15 [illegible] up [illegible] forgotten pending [illegible] down. When she [illegible] she [illegible] usually on [illegible] Dorsal [illegible] but [illegible] bottom?

NOTE: She [illegible] not [illegible] [illegible] effort to chase [illegible] [illegible].

She [illegible] Tora always goes up and down in a narrow passageway between a Millepora and [illegible] (dark name [illegible] Porites).

Arcadio circles around to see what she is doing. She displays to him. It's [illegible], it's unconventional PH's [illegible] [illegible]. Arcadio also sees her go into "[illegible]" of [illegible] from time to time. He [illegible] forward, fins beating madly. As if she were "aerating"! Possibly with currents [illegible] by fins. More probably with jets from funnel (to fan [illegible] currents [illegible] helping [illegible] to keep [illegible] place).

9:25. He finally go forward to see if she does have egg. As he approach, she goes into "[illegible]". Looks PH. PH rather [illegible]. Sort of fortune conventional PH but with more prominent ocelli or (other) white or light spots. This makes her even more "cryptic" than usual against mixed (rather fine grained) coral background. Also makes movements as if aerating. Then darters off a few yards. Hovers in PH. Then does DM in Ord +.

Arcadio goes down to check. Finds at least 5 egg strings, possibly more. In small crevice of coral which we

must get Porter to identify SAN

COMMENT: This female seems to be in good condition. Health and fins in appearance. We have reason to suspect that she is still either laying eggs and/or taking care of them (and ilation rather than gestation).

The apparent absence of the female in most cases may be due to the fact that they have passed the peak of the breeding season, not that they have not reached it yet.

Stop observations 9:30 a.m.

This afternoon going to work at Pescadero again. Sunny and calm. Going first to look for ♀ with eggs. 1:45 p.m. Arrive site 1:50. ♀ apparently gone. There is a small Porcupine around. Eggs still O.K., apparently the same as before, but Arcadio thinks that there are 10 strings (note: according to Arcadio, the ♀ was going back to the egg mass when we left this morning).

Arcadio collects specimens of the sp. of coral to which the eggs are attached. Also some examples of adjacent corals.

Then we swim around other parts of the reef. I go over TG flat. Stop 2:20. Then Arcadio starts shallow tow. Finds single ind. (♀?), doing Pin PH, 50-100 ft from "nest". Is this the ind. we saw with the eggs this morning? Possibly not. See below.

NOTE: The site of the nest is only 250-300 ft from shore.

Arcadio continues shallow tow around island.

2:35. Finds a large 2 ft down in 2 ft. of water over sand in front of Cellar. Appears a new one (one larger than the other) [illegible] (1-1½ ft) apart. In Ord, WS, Y, Pale center. Gives at first. Movement to Ord, WS above all are calm and [illegible]. No signs courtship. Stay out during them 2:45.

See a single pelican flying around area.

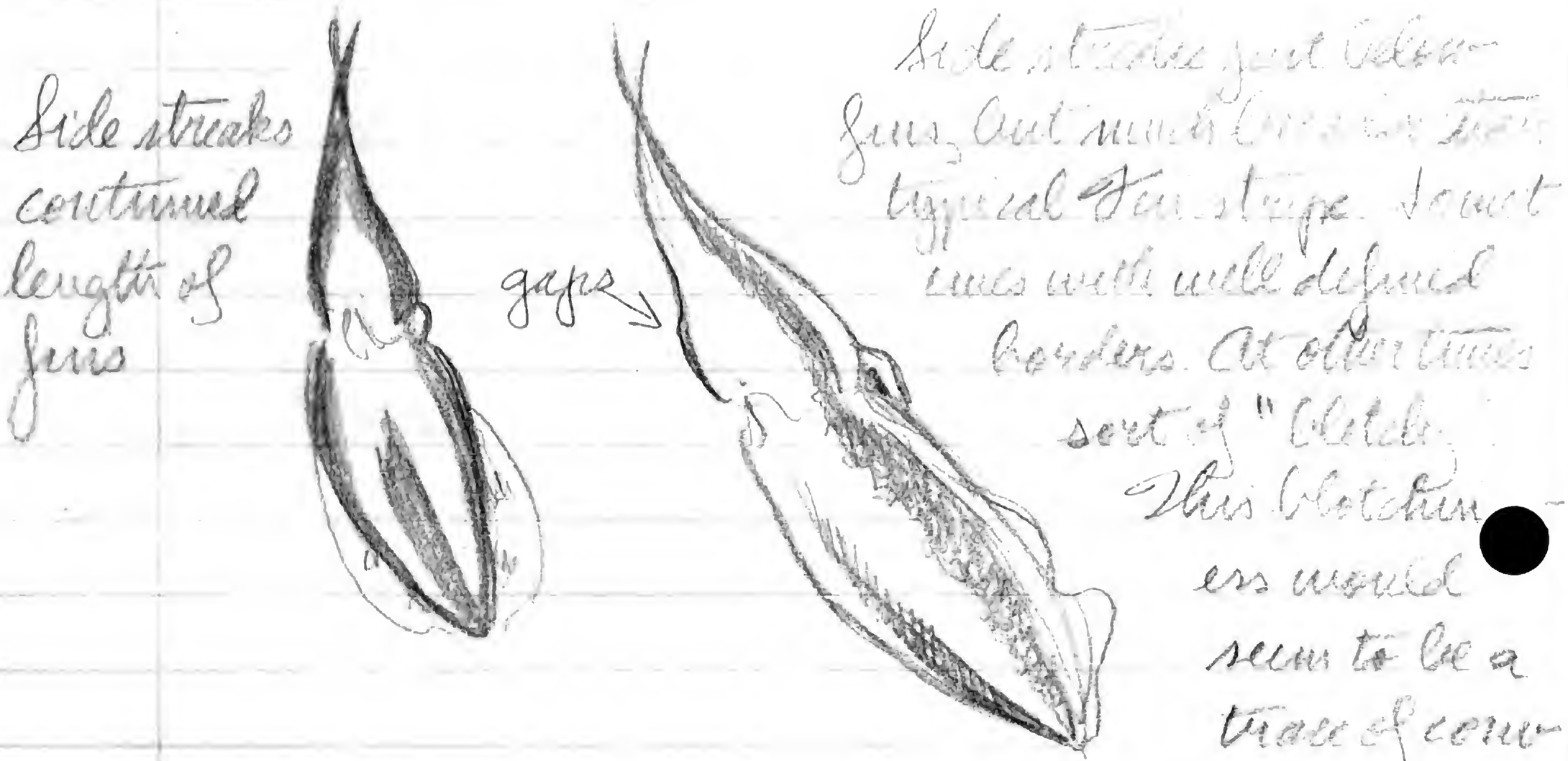
2:55. Audio finds smells. Disappears in the [illegible] gets into the water. Returns to [illegible] down. Audio goes group of smells which seems to include approximately 30 adults, 1½ ft up in 12 ft of water over extensive area of TG. Do young prefer TG more than adults? A few minutes later, we both see group of 7 smells. Previously, a fragment of 30 group. All in Ord, WS, Y, just like adults. Still low in water. Disappear 3:10.

Audio completes tour of Pinatupa, then goes on to Calibu (Cabo Ds.). Lots of mangrove on shore. Not much food in water. No squid. 4:15 pm.

Go back to Pinatupa. Check nest 4:25. Eggs still there. Apparently unchanged. No sign of ♀ at the site itself.

Then we find a single nest, 10-20 yds away. 3 ft up in 20 ft of water. Hovering over gorgonian. Reluctant to move, but does not show any conspicuous tendency to go to bottom. Quite probably larger than the ♀ seen this morning. Perhaps another ♀ who has just selected area for laying eggs but has not actually laid any

yet ???? Does a lot of display toward us. Most peculiar. At first repeated P's. PH with WS on top. But the bottom half of quintuple stack below !!! Good Luck Connie



Then starts to move backward and forward, a sort of "Rocking" to us. Usually moving no more than 3-4 ft in either direction. Forward movement always accompanied by more or less well developed P (sometimes almost Oval). Backward movements with more varied postures, sometimes quite unritualized. More often trace of E or Ē init. mov. Both unritualized and E-type postures usually (not always) accompanied by some "splaying out" of the arms and tentacles. In not quite the same way as in Z spread and related patterns. Arms fanned out rather than curved. See figure next page.

Tinatupo Lake Colo
May 4, 1972

I

Tinatupo May 4 1972 8:10 AM
at 8:30 3 large LNO PH & E shallow
water right on the surface large fewalli
posteling from PH : tornado attacks

Then I Tray ink and run for the bird
over my shoulder and (not by [illegible] I
[illegible] the only one [illegible]) Tray
[illegible] at least Then [illegible] not
changing direction [illegible] inch,
9:40 an owen order & past gravel at
bottom Martin points [illegible]
PH² (blotchy & banded over pastel) P &
E mimicry? Then dark OPD or PH with
and as she [illegible] moves away from
area when Martin spotted her. She
remains at a distance as I do not dare
not leave from cover. Instead she goes
from one cover to another and does
[illegible] nesting and P with PH² when
next to crabs (mimicry?) or gorgonians
she is obviously very reluctant to find the
area. Martin mentions she may be
guarding eggs. At this point we are
very close to the spot where we found her
so we move away about 15 to 20 ft
just as we start moving away she starts
approaching area and finally we see
her reach and disappear behind a head
of coral. Every now and then we see her
come up from behind, then she goes back.
PH² (blotchy banded PH over pastel)

May 4 1972

III

[illegible] Pagurician agonistes

[illegible]

[illegible]

There is a [illegible] small [illegible]

There is a [illegible] couple of [illegible] Do

[illegible] 9:15

end. at 9:30 Martin and I dive in to

inspect. She moves [illegible] carefully

and [illegible] go down

and [illegible] carefully notice a cluster of

[illegible] jelly-like strings, clustered at

and each like a bunch of bananas. There

may be 5 to 10 strings [illegible]

[illegible] of two [illegible] from

outside of hole (about [illegible] length)

[illegible] female could not get into cavity

where eggs are and must remain

I could not count how many eggs there

are on each string, but will do so later

This cave is in a depth of about 6 to 7 ft

and about 1½ to 2 ft from bottom in a

heavy coralline area right on the edge

where the reef drops sharply into deeper water. The coral where the eggs are hidden is Leptoria Lepriniter which seems to give a ideal protection [illegible] mineral holes and crevices and many sharp edges. After it [illegible] and [illegible] away from the hole. The egg [illegible] a very dark pattern and [illegible] and stuck her arms in the hole [illegible] PH2, her fins seemed to flutter a little faster as if she were working them against the pressure of her funnel ejecting water. Ventilating the eggs? Is she in the process of guarding or laying them? End of dive at 9:40.

1:47 Pinatupo at 150 arrive at site of nest female is gone cluster of 8-10 turtles 2-3 eggs per string many turtles [illegible] spent some time looking for eggs in other corals of the same species as the one the nest is in. go for tour until 3:30 pm see two large squid and a lot of juveniles

Go for another tour, around Makaluhi end of tour at 4:10 pm no squids or ink puffs. Go back to Pinatupo still no squid near nest. find another

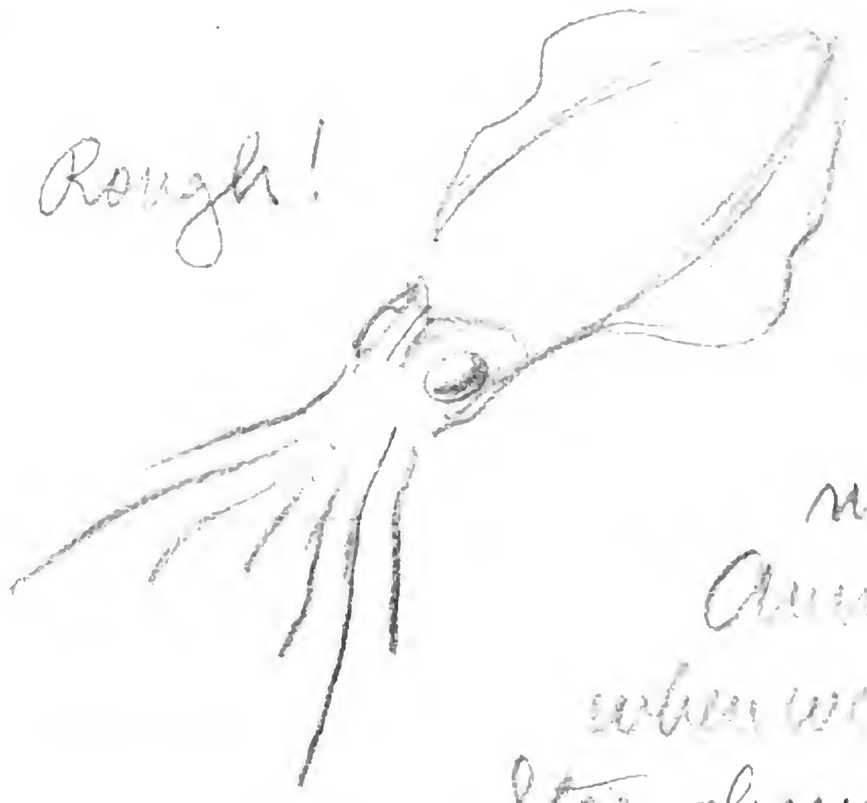
Mia Kilbourn Lou Blas
May 4 1972

V

Squid in similar pattern and attitude
close to a [illegible] area. Few P &
E can see two lateral lines and
one centre and underneath could
[illegible] to lay eggs?
Level of detail at this point

cluster of eggs

Rough!



As far as I can tell, the animal retains almost the same color pattern(s) throughout. Only, PH on top becomes less extensive, a little more Dark-blue.

Animal is still displaying in same way, when we leave 4:40.

Stop observations 4:45

COMMENT: Perhaps our observations today support Arnold's statement that females of the species die after egg-laying. If so, I shall be disappointed.

Why did the ♀ seen this morning seem to be aerating the eggs? Was the appearance misleading?

Running usual light tonight. Not many fish and no cephalopods by 8:30 pm.

ADDITIONAL COMMENT: The behavior of the last wid seen this afternoon supports an impression that has been growing on me. There is considerable individual variation in this species. Perhaps more so than would have been expected in an invertebrate or a marine organism.

May 5, 1972
San Blas.

Going to work Piñatipo again this morning. Sunny. Rather windy. Get into water 7:43 am. Go straight to "nest" area. 7:50. Eggs still there. Apparently unchanged. But no si

Cephu., May 3 1992 I

gu of g. Then we go back for lunch and again yesterday afternoon. Have difficulty finding site. Out [illegible] to so [illegible] Certainly, saw lots and lots a lot. [illegible] Continue exploring mixed sand and coral flat 8:15. [illegible] Then I go down to TG flat. Nothing flute unless rubber [illegible] today than yesterday. I then back to mixed sand, coral. I go back to "nest" area 8:24. Still don't see anything. Finally stop my own observations 8:35 a.m.

In the meantime, Arcadio has been exploring [illegible] the same region independently. Comes back 8:45. He saw one large, traveling, bull. Now important, he found another clutch of eggs. 5 ft down in 7-8 ft water. All [illegible] same species as the coral [illegible] (Sent [illegible] was [illegible] called). Arcadio has collected the specimens for identification. About 6 strings of eggs. Apparently, older than eggs of nest found yesterday (sediment accumulated). In [illegible] case "large" [illegible] for an adult to enter, i.e. larger than area in which the eggs found yesterday were deposited). The site of today's nest may be approx. 50 yds from site of yesterday's nest.

Arcadio does not see any signal near the eggs found today.

All this is suggestive, conclusive in some respects: ① ♀'s apparently do not take care of their eggs. ② the ♀ seen yesterday probably was engaged in laying. ③ the population of large on this side of the island seems to be declining fast, i.e. the breeding season may be essentially over for the adults here. Where have they gone to die?

Cephi., May 5, 1972 II.

When we go into Pt. Vista for Arcadio does shallow tow 9:00 a.m. Our [illegible] bottom of bottom: 9:10. We see a large group of squids near bottom, in 6-8 ft of water, on [illegible] flat or bed of TG. We estimate there are 100 squids in group when first seen. (NOTE: Squids prefer TG, at least on edges of areas of TG, more than the adults. At least at [illegible] in stage in their development. See also below.) By the time (10:7) get in the water, the large group seems to have broken up into smaller sub-groups (scattering presumably due to our approach).

We watch a small sub-group of approx. 30-40 inds. Largely composed of sepioteuthis, but also including 3-4 inds. of another species!!! All inds 1-2 ft above bottom. The sepioteuthis (which I shall call "sepiots" from now on) range from smallest small to large small, almost sub-medium. Now in really tiny. When first seen (by me), they are in double streak above (bellies invisible from our viewpoint). Then go into Ord & WS. Probably also (in some, certainly not all, cases).

I am again struck by how much the display behavior of the young at this stage is like the "ordinary" behavior of adults.

The inds. of the other species are about the same size(s). Also some variation. Considerably thinner. With small terminal triangular fins. Either the young of some species of (more) open waters (Illex, Loligo, Ommastrephes?), or adults of some species which I have no reference to. I shall call the species "X" for the time being.

When first seen, the X's are "Dull" in color. Sort of

Cpfs., May 3, 1972 II

(80)

pinkish medium neutral all over most of upper surface. Considerably redder than Ord color of Sepiots. Pink also slightly paler on the average. Only top of head, apparently, very reddish dark, perhaps dark brown.

The most peculiar aspect of the X's will be relationship with the Sepiots. Just moved was full mixture of species. Sometimes near center, at other times near edge. Just as often either leaders or followers. All inds. of both species range 6" to 18" apart most of the time. The X's are neither more nor less apart than are the Sepiots. The different X inds. may show some tendency to associate, insofar as they are often neighbors within the group or sub-group, but even this is not consistent. Many times the distribution seems to be random.

Once, as group retreats, an X flashes a white spot ("CL") near center of back. Apparently alarm signal. Flashed without any change in surrounding Dull.

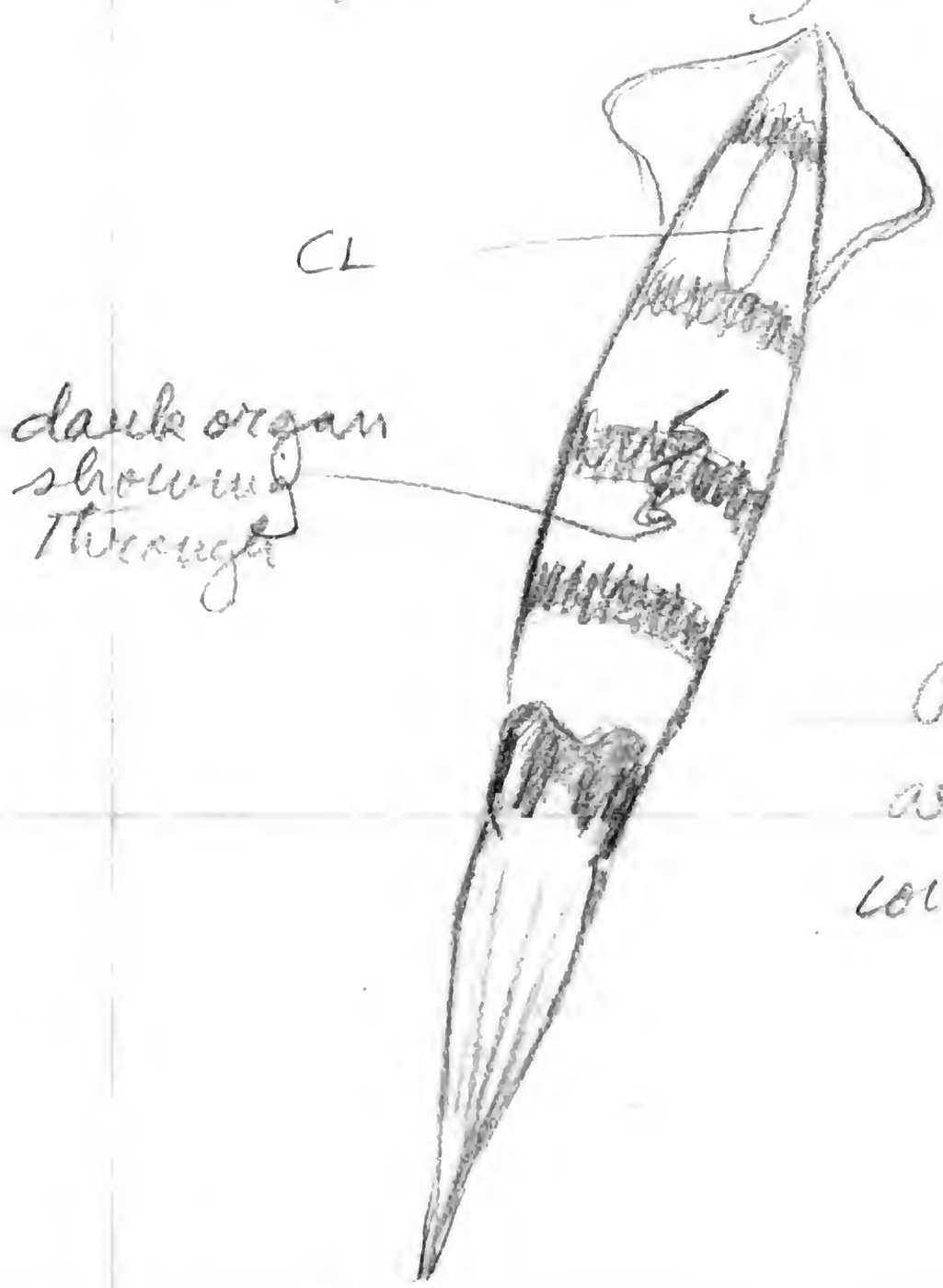
Sub-group disappears behind. Found it again 7:30. Now includes a small number (10-12?) of Sepiots and 3 X's. All inds of both species in V (arms upward). One X in dull in V. Another X in PH in V! Quite reminiscent of PH of Sepiot. Background less yellow, perhaps light dull neutral (not, I think, very pink). No Y; top of head still dark. The PH is marked by "bars" across back, in conventional style. At first I think that there are only 3 "bars". Then there seem to be 4.

All the inds. shoot away a few yards. The X with PH flashes a CL, between the two rear bars as it goes.

Catch up with some of the Sepiots a few minutes later.

9:32 Several do. Ord. WS, with definite Y and Pale Arm. Some of the Pale Arms compressed. Entering Pale, or Pale over white bar of arm area.

Then no T. Then is an X in this sub-group. Dull with dark eye ridges. Then shows faint adumbration of PH "through" Dull. Then "pulls" away, few ft. stays stationary. Retreats again. Stationary again. Etc. Etc. This vid. some-



Diagrammatic: 1 "band" PH ("bands" not really as even, clearly defined, or contrasting).

Fins less than 1/4 length body. Body longer than head and arms and (retracted) tentacles combined

- times shows CL in Dull during retreat. Sometimes traces of PH, with or without CL, when stationary.

Then all vids. approach us. Repeats in Ord, WS, Y, Pale Arm. X's (now there seem to be 2 vids. with group) in semi-PH - Dull with conspicuous equivalent of Y. Brilliant

Cephs., May 3, 1942, V.

creamy silver spots center eye ridges [illegible] spots [illegible] [illegible] medium dark brown. (I shall call this pattern "[illegible]" for the time being, even if it isn't very yellow in actual fact.)

Stop observing 9:40

COMMENTS:

(1) With their different shape and fins, X's can hardly prefer to travel at the same speed as Sepiots. Getting [illegible] this morning seemed to be behaving in typical Sepiot fashion, as if the X's were adapting to the Sepiots rather than vice versa.

(2) There may be two sexual stages in the development of young Sepiots before they become mature.

A. Young's tend to be in small groups (5-15 typical?). Commonly in shallows. More often semi-pelagic in or over deeps. Do lots of V's and Splits. Lots of PH's and Streak patterns

B. Ordinary and large [illegible] groups (40-100 typical?). Preference for exclusive TO beds near shore. Fewer V's, etc. Frequency of displays more as in adults

The formation of these large groups must entail a willingness to accept strangers. Which may explain why inds. of other species can become incorporated in a group.

FURTHER COMMENT: Thinking over all my observations so far, it seems to me that our observations of Sepiot behavior have been best at three different places: Niatupo, Ogopukeys, and Piriatupo. What do these islands have in common? Small human populations, of course. But also some other things. Adversity of habitats, all mixed up together, in

above (see above, bushy tails) Patches of TG, not nec assarily associated w. patches of sev. etc. Isolated heads. Out of sight reefs large but not pronounced. Can be present E of Cephalopod, & they probably are largely underneath the line long. axis squid.

Going back to Pendleton this afternoon, to see where mixed group was in the morning. Start 12:30 p.m. Water (after rain) not clear than before. We swim back and forth over TG-area, and groups of adjacent sand and coral, for a long time without seeing anything of value. Then, 12:55, Carlos sees a lot of swells in coral shallows, 3-4 ft of water. Arcadio and I try to track them down but fail. Finally, 1:20, we see group of 50+, 2 ft up in 6-7 ft water, center of TG-bed. Q[illegible] in holes. 10+ X's. Put all small sepiots. Most of the sepiots in O-cl, M, most of the time. Some assume streak-stripe patterns during O-cl saturate. From above, they look like double streak plus fin stripe and/or quadruple or quadruple streak.

Most of the X's do CL in Dull during retreats. One turns Pale all or almost all over (can't see what happens to dark of head). Quickly relaxes.

The social organization of the group now is a little different from what it was this morning. Many of the X's are "grouped" together, partly segregated in the same way as a sepiot age or size class in a diverse group. But the space between X's is much the same as that between sepiots. And also the same as that between an X at the edge of the X sub-group

Cepha., May 5, 1970 VII

and its nearest Sepiot neighbor(s)
Communica:

Whenever there is a retreat, all the kids of both species retreat together, at the same speed and in the same direction.

One X retreats in Dull with both CL and Y (the Y tuffs is sometimes difficult to distinguish because the eyeball is also very slow — see below)

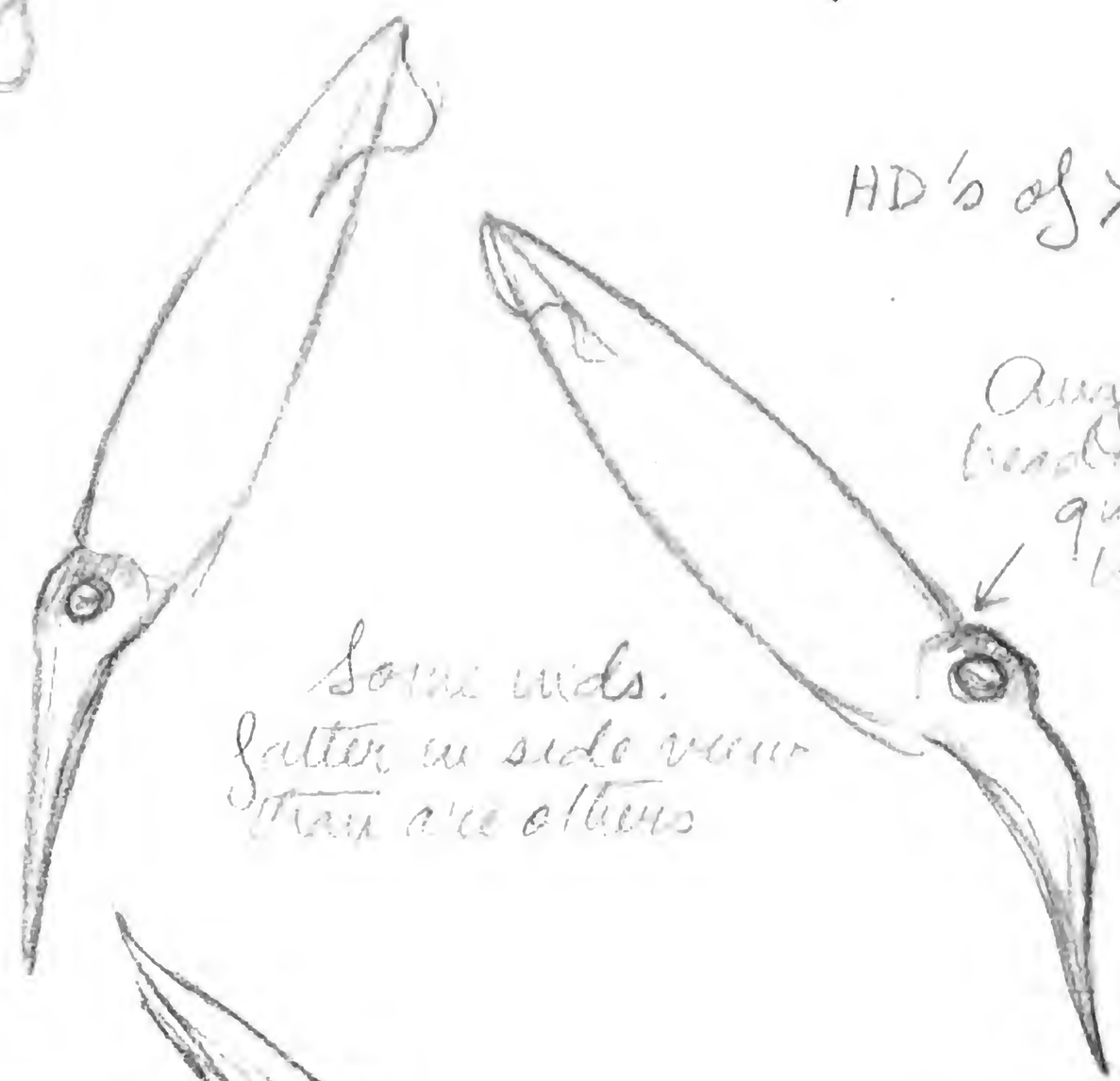
From one case at least, a mass retreat was both started and led by a Sepiot. One of the larger smalls, but by no means larger than some of the others around. It was followed as promptly by its X neighbors as by the other sepiots.

The X's tend to move in short jerks. At least when moving slowly. Certainly jerkier than the Sepiots. This probably means that the X's rely more upon gets from the funnel and less upon fin movements.

When more or less stationary, the X's often "hang" with the head lowered (I shall call this "Head-down" or "HD"). The posture may be purely functional in resting (it looks as if the animals were hanging from their fins), but it could also be a display, possibly homologous with ⊥ of Sepiots

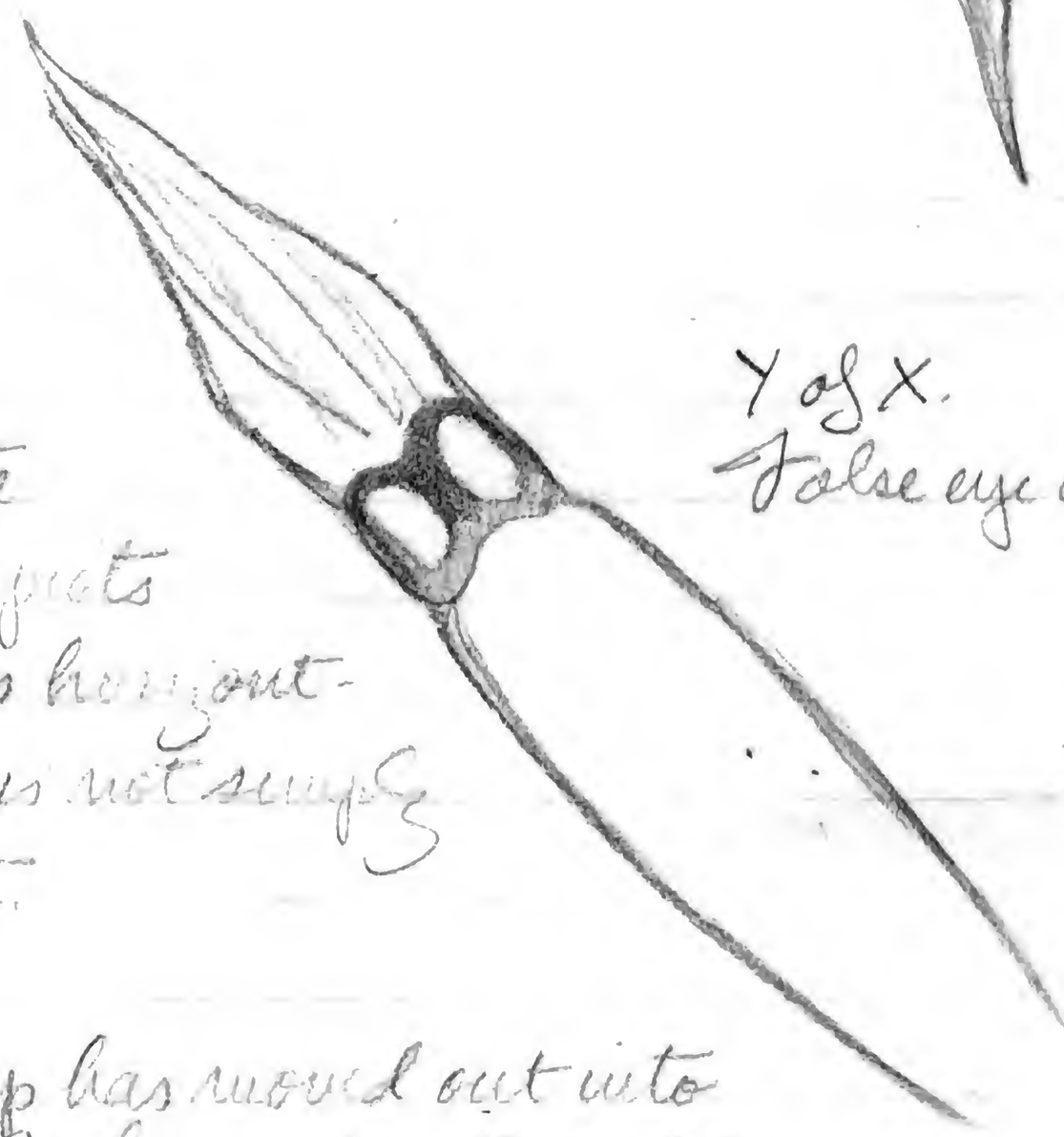
Body moves up and down in jerks

HD's of X



The HD's can be with Dull or Dull + CL.

NOTE While the X's are in HD, the fepiots have body more or less horizontal. The HD position is not always a reaction to current.



Y of X. False eye effect.

1:32. Group has moved out into deeper water now. Perhaps 10 ft. But the animals are still staying near the bottom.

There certainly are more than 10 X's here. Possibly 25 or more (vs. 3 or 4 times that number of fepiots).

Several X's in Dull + CL suddenly flash Y and retreat. The Y of this species really is very conspicuous indeed. When seen from above, the silver spots surrounded by dark are quite

Cephs., May 5, 1972 IX

good "false eyes." Quite probable, effective in defense against predators.

Three of the ind. Sepiots in this group are larger than the largest X's.

Intermpt observations 1:42 1:48.

Sepiots behaving as before. Still many in the frequency of Pale Arms at the moment. X's also behaving much as before. One ind. retreats in Dull with Y but no CL. CL probably contains less escape than Y (???).

Both species of squid ignore several species of fish as appropriately their own size assuming normal and therefore group. The fish seem to ignore them in turn.

NOTE: We have not seen any feeding this morning or this afternoon. Do the X's really feed as infrequently as the Sepiots? Or do they feed at night?

One X swims first toward one and then away from it in Dull with both CL and Y. (Is CL homologous with WS of Sepiot? Or with RL-Pic complex?)

1:58. Several Sepiots do Bug & P's and E's. Pointing to us. In Ord, WS, Y, sometimes Pale Arm.

As far as I can tell, there is no longer correlation between E's of Sepiots and HD's of X's.

Stop observations 2:05. Arcadio goes on shallow tour around most of the rest of Pantupo, adjacent reefs, and the nearby island of Montupo. No squid. Does this suggest that all the young are gathered in one place?

QUESTION: Is X the same species that we called

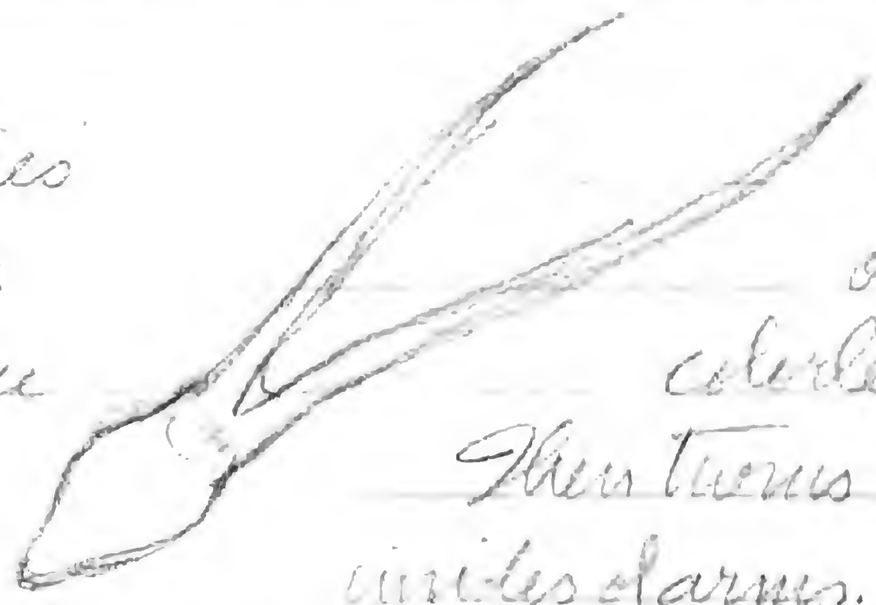
"Jonathan" "last night" >> Seems to have same display patterns (i.e. "11 Bar" PH).

Going to mail night again tonight. We have moved to Highland to Beach.

7:15 Single tiny squeteblow up. Cuttle Does Apet. Pennicle, Not been group studied later.

7:58 Large octopus comes swimming along surface in V. Prob. is same species as other night (Lindsey). Long pr. tentacles (retracted) movement very

V sometimes under than shown here



One set of arms much longer than the other. Animal apparently colorless until it gets to light. Then turns medium orange except for tips of arms. Circles light, turns; then goes off

Going out in small boat 8:25 pm. Returning. Back 8:45.

ADDITION: Arcadio says that a single X went by light last night.

9:15 pm. A new of floating TC leaves goes drifting by near the light. Drifting with them, and looking very much like one of them, is a single small squet (rather large for the class). In more or less Ord, WS. Suddenly shoots out arms, catches small prey (arthropod?), turns PH, then returns to Ord. And continues drifting with leaves. Making absolutely no attempt to swim actively. I.E. it is certainly

Cephs, May 5, 1972, XI

trading on its resemblance to a leaf to approach prey unawares. And possibly also escape predator fish (Also will a lot of good eater fish, considerably larger than the squid, accost the light at the moment.)

Stopping observations 9:25 p.m.

Thursday, 1972
John Oles

Notice a pelican flying around shores of Pautipa shortly after dawn.

We start work at Pautipa [illegible] for large group seen yesterday. Arcadio does shallow tow. Continues for 20 mins. without seeing single squid. Do these animals spend the night in deeper waters? Note, we covered this same area in boat last night with [illegible] Are groups of small Sepiola particularly mobile? (We have not seen the group at Puerto Ingio again.)

There are lots of jelly fish and at least 3 small Barracudas around here now.

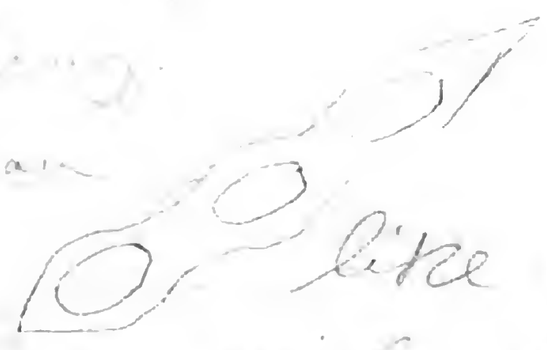
8:00 Arcadio finally sees a large group of small Sepiola 1½ ft up in 4 ft of water over pure TG. Usual "alarm" reactions to us. Ord, WS, Y, some Pale center Arms, a trace of DM by one ind. General Paling by several inds during retreat. NOTE: Squids in these circumstances give very few P's and even fewer E's. This seems to be a general rule.

There must be 40+ inds. in this group or sub-group.

Tinitupo San Blas
May 5, 1972

I

May 5 1972 Tinitupo 745 am arrive
at reef at 755 AM Doesn't see
much anything in underwater visibility
15-20 meters [illegible] feet looking
for eggs. After about 5 minutes run
into cluster of 6-8 strings in Porites furcata
crevice about 5 ft under surface
bottom about 7-8 ft. This reef crest
is about 50 yds away from other

Don't see any eggs, anyway. The eggs are
older than the young are. [illegible] I
look slightly [illegible] and [illegible]
transparent as the other strings. [illegible]
if they had a pulsating [illegible]
band of tissue. Also the eggs
bulging inside the strings.
There weren't any more than
2 or 3 eggs per string.  like so.
A little later I saw a single squid (Loligo)
swimming near [illegible] ORD & WS joins
me. The first time I dropped with [illegible] of oxygen
& again again. Then I found it [illegible]
deeper water and swimming around first I
loose it and find it again. Now [illegible] and
rocking back and forth doing E and P
ORD & WS. Then I lose [illegible]
it goes into deeper water.
We move to Pamlupa, and I go in the
water at 855 am for tour at 915 I swim
into a group of 100 jelly fish. A motley
there are two species in this group
Sepio teuthis being the predominant quantity
while there may be about 5 to 10 of
the other and they seem well integrated
I see three individuals of [illegible] x
[illegible] within 2-3 ft from me [illegible]

May 5 1972

III

but it also contained dead tissue. This capsule surrounded by Sepiatulla withdrawal of its dead nearby. This [illegible] its transparent white a PH similar to that of the Aqua and has a could nutrial. Eidoyts over the eyes and backward tissue.

May 5 72 Pantapo 12:26 pm saw one puff and dol bounced at 12:35 at 50 pm a new male female aquila 100+ again 2 species in group. This new group is unrelated. They moving their are about 15 ft. into of the other specie. When standing still, This specie tends to hang vertically in the water sort of hanging from its fins at the end of its mouth. arms are about one third the length of

The mantle. The bottom in this area is sandy completely covered with turtle grass. I go for two around Panetupo at 30 ft see nothing of interest. I walk parallel on a compass course at 330 for 1 hr and 1 min at 30 ft. Dive from Panetupo and back. Bottom is sand at 45 ft. with abundant patches near the end of Tinatupo in 35 ft of water. I see one of the retreating individuals its tentacles were about 8-10 inch way to end of Tinatupo and back to Panetupo over same bottom only closer to shore. Lots of coral and a lot of Diadema but mostly smooth sand no grooves or ink puffs. end of Dive at 4:05 pm

Panetupo April 6 1972 tow at 735 AM until 8:10 AM juvenile squids nothing but Sepioteuthis the group of about 100 + shallow water and TG with sand.

Tinatupo 8:55 AM check eggs on first nest. everything is alright, there is a small pomacentrus living in the sand

V May 5 1972

Cruising with the eggs. The eggs look in good condition but we have with the current.

Launch [illegible] at 08.00 [illegible] [illegible] at 9.15 am

Cuinquintups at 10.18 for tow until 10.36 [illegible] squids back to Dandtuples found group of 100+ at 11:05 am in shallow water over TG. There's a slight current, nothing but Sepioteuthis. Go for tow at 11.15 am no other squids, end of dive at 11.40

Family will [illegible] [illegible] Blue Tang
Group seems to be pure Sepiot No X's visible
8-10 Animals [illegible] wide-depth (10 ft) water
Still [illegible] group TG
See a few [illegible] of Double Flash and Tail Stripe. Our wid. turns back all over. Then goes into Ord, WS, Y, Pale Arm, and DM. Then returns. Returns to Ord, WS.

8:30. Now I see that there is a single X with group. I think that this X must have joined. Dull, with occasional traces of PH and/or CL, and with almost continuous Y (!). The individuals close to me, I am probable, the stimulus provoking the display. This X seems to be an absolute, full member of the group. Near center. Has [illegible] usual Sepiot-type individual distances. (At our point, all the animals "close up". Pres. [illegible] frightened by something. X closes up with the others)

COMMENT: I am still amazed that there is so little hostility among the members of groups like this, among the Sepiots themselves or between the Sepiots and the X's

Stopping observations 8:27 a.m.

Go over to Pinnatigo. Arrive 8:52. Check both clusters of eggs. Both OK and apparently unchanged. (NOTE: There is a female trial apparently living in service with fruit cluster of eggs!) Then we swim around coral and sand area. No sign of squid. More evidence that the larges have all died off here.) Try to explore TG area, but there is a heavy swell and it is too murky. Stop observations 9:15

Then go on to Cuinquintupo. Arcadio opens for shall-

Apr. May, 1970 III

(13)

our tow Partners where 21 yds. see a few dolphin and then all around island. Nothing further.

Back to Pandeiro again. Arcadio sees small Sepiot, then lost. 9 total seen around Matta in number and varied sizes. Another Group of 3 small Barracuda still around.

10:10. Arcadio finds large group (100+) of small Sepiots several hundred yards away. Far out from island but still in shallows. Most inds. 1 ft up in 3 ft water over to give usual low interest, hostile reactions.

Apparently no X's around. Arcadio believes the two species not permanent.

Stop observations 10.25 a.m.

Going to Matta this afternoon. 3 more or less large Sepiots in middle of channel when we arrive 2:00 p.m. Water is 20-30 ft deep here. Bottom sand and [illegible] of the squid are near surface. I go in water, to try to observe them but they have gone and I have trouble with my mask, etc. Arcadio goes out and sees a large group, plus miscellaneous others. SAN.

3:35 p.m. Go back to where Arcadio saw large group. 20 ft of water over usual curved bottom (this is well outside the small reef where we have done so much work on grouvous mints. Find group of 31 Sepiots, all stretched out in a line, approx. 3 ft below surface. Ranging from large (4 inds) gradually down to small medium. And matter arranged according to size, largest on right flank, smallest

on left, in general series. Tail will spread apart (more 2 to 4 ft from nearest neighbor, but see also below). All in Ord, Ws. I will see at first opportunity.

The two largest animals, on the right, show a tendency to "drift away" from the rest. Squirrel, the end individual. This individ. also shows traces of Pastel Dove, when the two go off close together, see less definite Pie, but unfortunately I can't tell which.

3:55. This bunch is moving. Now the end ind. is 10 ft away from its partner (who is still more or less in line) but not of its own. Doing a little low-intensity Rocking by ind. Apparently "trying" to "lure" its partner away from the others. Suddenly, the partner turns first D to and then yellowish all over before reverting to Ord, WS. I am not quite sure what provokes these changes.

COMMENT: This yellowish was quite like the usual background color of PH. But definite, without conspicuous mottling of any sort. Was it just an "int. mov." of PH? Or a qualitative, distinct pattern???

Then the next to the last ind. does Lateral Silver. Dark side toward the end ind., silver side toward the rest of the group.

The two end inds are approximately the same age; but it would appear that the farthest is ♀ and the nearest ♂. If so, their behavior this afternoon probably represents the very first or almost first stage of "courtship". They are just starting to show signs of wanting to break away from the

group. And the ♂ is "defending" the ♀.

Now the end unit is showing some flashing game-Partial. Doesn't evoke an obvious response

Suddenly the whole group drifts down to the bottom. And I see that 3 or 4 of the Gray and Yellow fishes begun to graze on or near a patch of [illegible] which seems to be the objective toward which the squid are aiming. The squid hang around the fish for a few minutes, then [illegible] back to their original position.

What is the purpose of such behavior? Do the squid, by any chance, expect to catch small prey stirred up by the fish? If so, they must be often disappointed. I have never seen the squid actually catch anything in the vicinity of the fish. Certainly they did not do so this afternoon

Stop observations 4:05 p.m.

Running light tonight

7:05 p.m. Single large Lepiot shows up. Inverting conventional PH and E. Throwing arms (waiting?) in E. Then drifts off, shoots away.

8:50. A single something which may have been a Dorytenthis type swims by outer edge of lighted area. 9:04 Single Dorytenthis-type (black) near light. Goes away almost immediately.

COMMENT: The fact that we are seeing so few squids at lights must mean that the local forms are not particularly nocturnal.

Stopping observation 9:20 p.m.

May 7, 1972
Sea Bles

Still at Hualupo. Bad storm late last night and early this morning. Heavy rain & strong winds. Winds still continuing when we start work, 7:30 a.m.

Anadio does a bulldozer job along the side of Hualupo Grande (this is the side where we have done only a little work so far). 7:35. He sees two large lepidotes. In 4 ft of water over coral and sand bottom. I go into water. He leaves the animals momentarily, but then finds them again. Still in approx. 4 ft of water, about halfway up. Very pale in color. This may not be quite the same thing as the ritualized Pale during escape. It may be a "cryptic" response in the circumstances of today. The bottom is very light, and the water is "milky" with silt. The paleness of the animals makes them very difficult to see. In actual fact, at the moment, they both seem to be in a bleached version of Ord, US (possibly Y?).

I get a new, good close-up view of the eye, pupil, of one of the two. Camera:

The pupil is the most conspicuous part of the animal now.

This view is from slightly behind. When viewed from the front, the anterior "horn" would be more prominent.

Cepla, May 7, 1972

Then there is some Rocking. The Cleared Ord + probably replaced by Pastel Apparently the 2 weeks ago, yet the ♀ does Pie Hitchette Paidl Go Hitchhiker Hitchhiker yet, as far as I can see Both Sullivan and Hitchhiker are not only sexual but probably also immediately "pecking order". See also below.

Both uids. shot away, and we lost them for a few seconds. Then I came upon one in very shallow water (at least) seems to have something large (3" ?) and dark held in center arms. A fish ??? Feeding during "courtship" ?

Arcadio tells me that he saw one in d. unusually coral. Looking for nest site ? SAN

Found the uids and found them again. Now we see that there are 4 uids present. Obviously two pairs. Left up on 6-7 ft. of water. In Cleared Ord, WS, 4. One ♂ does low S displ. with "Z" when another uid. (presumably ♂) comes too close. This "Z" is peculiar. The stripes have the usual form but are pale-medium grayish rather than real dark. A sort of "shadow Z". Presumably another adaptation to cypsis.

Difficult to follow actions of all 4 uids. ♀ of one pair showing definite tendency to "stray". Drifting away from group. Her mate, on the other hand, tends to stay nearer the others, presumably to make sure that they don't interfere with her.

One of the ♀'s does a

Male on Pie. Dark on hindquarters, pale gray. Also another pair. ♀ looks at all centers front upper edge mantle. But top of head is black as usual.

Female on left side. Assumes pure dark Fin Stripe on Shadow Pair.

Now one ♂ assumes the Double Streak plus Fin Stripe. Moves less back, ♀ does Pie more or less normal. But this time there is no dark on head!

I start to concentrate on one pair, while Dr. also concentrates on the other.

Now a second together ♀ on Pie. Dark on both head and front mantle. ♂ on Double Streak (dark and strong), Fin Stripe (strong), and with two longitudinal streaks left on fins (faint). ♀ on Quadruple Streak plus Fin Stripe

Fin Stripe between two pairs. The ♂ of one pair (A's) chases off both birds of the other pair (mine). The display by the aggressive ♂ except for but slight spread (no Z). Retreating ♀ does Pie. Retreating ♂ does Quadruple Streak plus Fin Stripe

Now the two pairs are swimming about 4 ft apart. One pair displays (mine?), the other does not (A's?). The ♀ does Pie. The ♂ does Double Streak plus Fin Stripe.

All these streaks and stripes certainly are intra- as well as interspecific!

It looks very much as if the pair which is not doing much hostile display are the "owners" of this area. While the other pair are behaving as "intruders". Is this "intrusion"

quite "natural"? Or have the animals been recently lighted by our appearance and/or the storm?

Note: Arcadio says that his animals are now making cop. attempts. SAW!

8:02 a.m. Now I see that there are 5 inds. present. Newcomer presumably, of Immediately "calls" his mate to one pair. Can't see display, if any. Then he displays

Still watching "my" pair. Now ♀ Pie ♂ displays (Streak ♀ think without fin strips). All the animals seem to have stopped shadow patterns now. Dorsal markings are really dark. Presumably the animals are getting used to us. But they are still maintaining the black background color in Ord. (Automatic when the ground is as light as it is here?).

I wonder if these are some of the animals which we saw on the other side of the island yesterday. And/or if their sexual behavior has been "triggered" by last night's rain? (Yes, the presumed general correlation between the principal breeding season and the beginning of the rainy season.)

Note. Arcadio says that the ♀ of his pair is still investigating corals as if looking for nest sites. He has not yet seen a successful copulation this morning. Does this mean that ♀'s start "prospecting" before cop., while still in a "courting" party??? (Certainly, A's ♀ looks very "fat", as if full of — presumably unfertilized — eggs.)

We lose sight of the animals briefly, then catch up with them again 8:10 a.m.

Now my pair is showing sex! Rocking together.

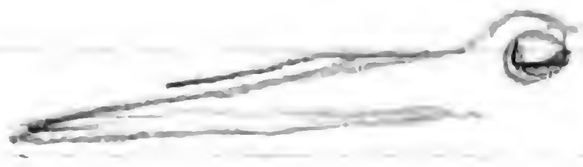
♂ turns Pastel, advances forward toward ♀ with rapid and conspicuous fluttering and flushing. She immediately Pies. He immediately retreats with only slight Double flash. Then ♂ P.P.P. ♀ flies again and he go through the whole advance-retreat performance again, with the same displays in the same order.

Throughout this period, A's pair is only a few (4-5?) yds away, also showing cop behavior SAN

Addition. Arcadia notices an interesting aspect of Pie display. Pie usually combined with unilateral fin stripe. On side away from ♂? Pourquoi? Now silver on side toward ♂? Is silver hostile (aggressive) in this species. Very lateral silver of ♂'s defending ♀'s.

Lose inds. again. Find a single pair (I don't know which one) again 2:12. ♂, close to ♀, in Pastel with flushing and fluttering. The 2 animals Rock together. ♀ in more or less "neutral", light coloration. ♂ advances forward toward ♀. ♀ Pies. ♂ darts forward, alongside and partly ahead of ♀. Then turns around and sheets arms at her head area or at the base of her arms. Obviously, a cop. attempt. Outcome, with contact, But painful, unsuccessful? The ♂ "slips" back a foot or so. ♂ still in Pastel with exaggerated flushing and fluttering. ♀ in Pie. I notice that she has her outer arms slightly raised.

But she makes no attempt to "arrange" anything in the forehead area. Then she appears



to throw something forward !!! A spew Taylor ??? The two animals continue to Rock together for some seconds more. The gradually drifts further away from the Ant and bottlends. Resume "normal" life and OK.

Animals gone again 8:22 am. Life of Protozoans a few minutes later.

ADDITIONS:

I certainly bitten and in rather extreme Pastel, with little or no Flushing or Fluttering, while swimming together at some (early ?) stage in this morning's proceedings.

Aucedo says that when a ♀ retreats from a ♂ after a copulation he is apt to assume the Stripe as well as Double Flush.

SAN

May 6 1972 8:30 pm start dive
at Mexico at 200 yds seen with
group of 35 and large 3 each
in 4, all in blue. Dark one with
paint was all about 5 ft from each
other. The depth was 25 ft and
the group is about 6 ft in diameter.
As coming around, the
groupers and parley were but all
in general very quiet. One need

does a funny looking F, like so all dark
without a WS.
Group bubbles up
and almost invisible,
eyesores on day on
water all on UR
WS Then on WS Then
all out near one in
sun while the formation
away in Dark zone
DM close to one

A large Commander opp sides, [illegible] and
pull and retreat other just pull and break
Their formation all dark forms the commander
They reform again on ORD with WS. and all
is quiet again. They are all about 12-14
under surface with bottom [illegible] of
25-30 ft. The bottom is sparse [illegible]
and TG on a slope.
3:36 pm Same area nothing at 3:40
Same group as before missing in ORD &
WS They all Darken and come down when
they noticed me. They are in Deep water
about 35 ft and about 10 ft under
surface. Their undersides are very pale
& drop down to bottom to get a look
of group from under. With the

[illegible] Top [illegible]
Twenty feet [illegible] They started Their
mind flash. [illegible] They all return to
where they [illegible] They all
[illegible] bought of
Tobacco [illegible]
May 7 1972 [illegible]
[illegible] side of Matlapa and
[illegible] at 7:30 am [illegible] 7:35 a
spot two large [illegible] fish with [illegible]
almost blending with their surroundings
(the water is not very clear) all quiet.
[illegible] a fish goes by and as usual
[illegible] away. [illegible] with them
and see one [illegible] go into a clump
of algae [illegible] their [illegible] &
look but see no eggs. [illegible]
fish join. The two dad [illegible] been
watching, They [illegible] with that us

There is a matter may have something in its arms, it's close to the eyes and if angle and makes it [illegible] a little, [illegible] the and looks a little [illegible] [illegible] a [illegible] There's a [illegible] of [illegible] of the fins and [illegible] has [illegible] [illegible] a [illegible] seen [illegible] [illegible] from [illegible] twice or three times. One [illegible] attempt directed at thick individual [illegible] flutters and approaches female, then goes under her, female goes pale and pales, also shows a dark thin line over fin

opposite from side from which male may be approaching her. male switched side of approach and female paled that side and another line appeared on other side. As for male when rejected, darkened both sides of w.s. and showed two thin dark lines under fins. This goes on for quite a while. Male is relentless and female rejects him over and over. There is one successful copulation

V

Walls approached parallel to Tremont
and walls for the semicircular pale
Then many magically walls turned around
and powerful Tremont streets
running from middle towards as it
[illegible] magnificently.

IV

Reserved for display.

June 21, 1972
San Blas

Dorsal view of Melliwa showing [illegible] outline of small [illegible] spots.

Awake at 8:15 [illegible] 9:00 am. Apparently no squids. Geology dives out by [illegible] sandbars are exposed, also [illegible] (low now). Then goes on to III area still no squids.

9:40, visit III area (coming from I & II), Carlos and Lucile find group of squids. Dominant [illegible] group includes 14 inds. Ranging sizes from small to medium. About half wing up in 2 ft water, mud TG, sand, Deadena bottom. All inds. quite close together, 3" - 6" apart. At first in Ord, WS, Y. Several inds. make brief retreats. Tend to adopt Double Streak + Fin Stripe during retreat. Double Streak and Fin Stripe combined with partial or complete DM in one or two cases. One ind. does downward V (in Ordt, D thinks). Then some inds. do more or less slight E in Ordt + then group gradually relaxes. All in Ord, WS, Y, without further display.

Then the group darts away a few yards. Arcadio follows them, but I go exploring. Come back 9:50. Group behaving as before. Rather dull.

A few minutes later, Carlos notices large inds. Only about 20 ft away from the group of smalls and mediums but apparently <u>not</u> actually integrated with them at the moment

There are 3 beings present when I first arrive on the scene. Obviously a "couting" one. The pair plus one "escort" or "outsider". Ends of pair swimming, usually behind side by side, close ("touching") together. Escort swimming generally, usually behind, facing same direction, 2-3 ft. away.

2 or perhaps all 3 inds. go Dark, approach as usual on to me. Then do same E in Dark and for Ord, usually.

Then the escort disappears. And is then that one of the inds. of the pair begins to do Lateral Selves!!!

I presume that the ind. which does Lateral Selves is the ♂. But it is certainly the larger, longer and perhaps plumper, of the two!!! (This could conceivably be a homosexual pair. But I will call the ind. which does Lateral Selves "♂" in the following account, and the other ind. "♀", simply for the sake of clarity and convenience, without prejudice.)

The 2 inds. of the pair swim about together for some minutes. The presumed ♂ does repeated Lateral Selves. The other ind. does nothing at all in the way of color changes. Just in ordinary, Ord, usually or always with WS, possibly some ✓ for some or all of the time.

The interesting thing about this Lateral Selves bch. over is the problem of releasing stimuli. As far as I can tell, there is no other squid around, closely, at any time during the performance. Nor do the Lateral Selves seem to be released by or directed toward me (no "broadsides" presented). If so, then the Lateral Selves are provoked by the presumed ♀

Cgh., June 21, 1972, III

(206)

Again! Yes, it is remarkable that the conspicuous part of the display, the silver side, is displayed away from the releasing [illegible]. Presumably, as a "protection" against possible "intruders". Contrast this a bit to actual "intruders".

At the ends of the pass are swimming together, they pass over a mouth of inured sand and scattered coral etc. bottom. Very little TG. (D.E. is laying type habitats?) Usually halfway up in 2-4 ft water.)

The lateral silver comes and goes, or, at least, sometimes much stronger than at other times. At its weakest, it is confined to little more than one side of the arms plus a trace of RL. At its strongest, it is quite uniform along whole side of body. Eye brow ridges are particularly brilliant. Quite pure silver. Much brighter than in 1, and without yellowish tinge.

At one point during the swim, one ind., probably the presumed ♂, displays spread. Probable, without ♀!

Then one or both inds. eyes (?) ink. Both dart off and disappear immediately. I can't see any predator in immediate neighborhood. Is this hostility ultrospecific? Is this pair at a particularly early stage of courtship?

Then Carlos and Sheila find a large group of small and medium squids. Ca. 40 inds. In 2-3 ft water over TG. Not far from where group of 14 seen earlier. Quite probably incorporates 14. All inds. close together. Behaving as usual. Ind. WS, Y. 2 escape with Double Streak and Fin Stripe.

I shall call the area of this group "IV", and the area of the courting pair (two) "V".

Stop observations 10.10 a.m.

Go back to IV area 2.35 p.m. & lie bat and call. Swim around IV and V areas for some minutes without seeing anything of interest. Then come across pair (Cows) 2:50. About 20 ft from where V is seen [illegible] Pair. Cows same V pair, although I rather doubt it. [illegible] "sex role differentiation" is "normal" in the past year. The animal playing the ♂ role is the smaller of the two.

Then just seen, the animals are in 35 ft water over mixed sand coral bottom. No TG in immediate vicinity. Just swimming about calmly, now the leader in a way, i.e. backward, facing same direction. Almost mirrored. ♂ stops, turns forward, rapidly, and "strikes" at arm-head area of ♀. Obvious copulation. Definite contact. Can't tell if successful or not. No immediate visible rearrangement of spermatophores, but some motion suggestive arm movements later on (see below). No ♂ appears to be on Ord & WS throughout the period immediately before and during the cop! Certainly no extreme Postil. The ♀ also on Ord & WS at first. Shows brief RL as ♂ starts to advance. Then flashes Postil immediately before and during contact. Then goes Pie immediately after cop. ♂ shows trace of Double Streak and Pie Stripe immediately after cop. Then the 2 animals "relax". Go back into Ord & WS and resume swimming together as before. Going rather rapidly. "Pirouetting" over fairly large area (100 m. in diameter?)

After some minutes, ♂ starts to "Bend" toward ♀

occasionally. She also assumes brief Pies from time to time, probably in response to ♂ Bends and/or other int. mov. of approach. Once she does quite elaborate swirling, then drifts with arms stretched out in semi-V. Could this have anything to do with sperm display ???

Then I happens to drift too close to annuals. Both E in rather pale Ond, WS, Y.

Then they swim off into slightly deeper water. Around 8 ft. Usually 2-4 ft down. Both Cougel, sand. And sex occurs 2 copulations within a minute? Preceded by very fast, "tight" (short arc) Rocking in Ond, WS. ♂ Bends during Rocking. Then ♂ shoots forward to ♀. This time he is in Pastel, with Flushing and Fluttering. ♀ does not change color ♂ "strikes"; definite contact ♀ Pies briefly. ♂ retreats a foot or so. Comes forward again. Still ♂ again in Pastel, Fluttering, Flushing ♂ back to normal color (?). ♂ strikes again. ♀ Pies again. Both relax. Continue swimming together again.

Obviously there is some considerable variation in coloring associated with copulations. Especially as regards Pastel ♂ (or the absence thereof).

Stop observations 3:10 pm.

All the time, I was watching this pair, Arcadio was observing a very large group (or combination of 2 semi-distinct semi-groups) a few hundred feet away. Over 120 inds. Group IV plus additions? SAN.

COMMENT: The population would certainly appear to

be "up" here now. Behavior and sound Apparently very different from early May.

Back into water 5:35 pm. Can't find anything in V area. But then find two large groups of sardines, medium, a few small, and large, 5 to 10 and large in the area 5:45. 1-2 ft up in 3-4 ft water, very easily, prior TG. In Ord with WS and Y and (almost zero) PCA Centro Amno ("PCA"). Several inds. do slight P display, without change of color

This presumably is larger, same as large group seen earlier today. Apparently divided into 2-3 smaller groups, clusters of inds. separated by a few ft or yds. much of the time.

There are quite a lot of medium small sardines in the neighborhood, but they tend to keep yds. away from the squid. Apparently concentrating.

All the squid start away when a 2 ft Barracuda approaches. Come back as soon as the Barracuda leaves.

Behave as before. The medium small sardines also still (again) milling around. Now the squid are beginning to show an interest in them. Several of the medium and larger medium squid advance slowly, swimming forward, toward the sardines (and also towards us, since we are "behind" the fish). These squid assume double stripe — fin stripe as they approach. Probably also some time P. Then stop, retreat backward, resume Ord +.

5:55 The squid seem to have relaxed, in the sense of not worrying about us anymore. And their color has chan

get somewhat. Only slightly comparatively pale or light. We in comparatively fine and unemphatic. Towards no YOPCA. Only between Sabelin, US Eden, and YOPCA happening when Oil is and some particularly close.

The Sandbar we still around. Perhaps the other small animals. On the other left side of feeding is increasing even more. We begin to see a bit of apparently sure enough feeding stalks.

6:02. One or two stalks at present without changing angles at all. Too small that I can't identify it. Probably sandbar but could be small crustacean or tread.

The adult seems to have disappeared now. Perhaps gone off quite deeper water.

One with large medium size definite RL!

Now I notice that many of the medium kids are floating with their tentacles extended. Sometimes also slight hypostal. Tips of tentacles often whitish.

Is this extension a "feeding intention movement" and/or indication of hunger? Probably yes. And some of the kids are making big advances toward the sandbar. Sometimes tentacles are curled up at very tips during advances

All or most of these advances on left side with US. Sometimes

mes also 1 by inds. near me.

Now I see several cards in the fading at small pos. in what appears to be Card III here medium lavender all over. [illegible] to be accepted

What can this mean? Is the "fading Pastel" the same as the "capitalized Pastel"? Is it a sort of indication that all fear, all inhibitions have been left behind, arms and head first.

NOTE: All feeling of tiness seem to be lost, hand forward, arms and head first.

COMMENT: Would say that this group is little or no feeling evaluation with affection. It begins to look as if the process is going in a progressive (at least evening of feeling. Why? Related visibility? (Compare terrestrial conditions!)

I stop observations c. 15 p.m. Awake continues ca. 5 mins. more.

SAN.

Run light behind boat at night.

7:15 p.m. Not quite night yet. Several unusual squid show up under light. All appear to be lots. One makes feeling stabs at something near light. Successful? In any case, it shows conspicuous behavior as it "burns" by light for a few seconds afterwards (gentle, burnish, contact?) At first was pale all over, except for conspicuous dark streak down center of back. Then bars" of "barred PH" superimposed across ways over long

I

Moloaniega, Los Blos
June 28 1972

Night light observation
7:15 pm. Placed light in water
very dark with calm waters.
I saw squid in bottom fairly well
sandy and mobile on east side
of Dock at Moloaniega. Organisms
start gathering around the light
in the usual - pinfish, copepods
and other micro organisms, then
doubles etc. At 7:35 pm a
young squid makes a brief
appearance swimming on the
surface (ORD & WS) then pales and
captures a small shrimp? and
starts sinking as it swims away
into deeper water away from the
dock. Carlos and Jim porter
believe that the squid population
has increased a lot in the last
few weeks. Carlos saw a group
of about 40 (assorted sizes) in
front of his house, this morning.
and a group of 200+ by the Dock
on Friday. He has also seen large

groups at low tide point by the small beach where he goes for his drinking water. This last was last wednesday, and it was a group of about twenty large. Jim Porter has encountered them at night in about eighty feet of water. He mentioned a group of about 4 or 5 large ones. He gave me the idea that he was encountering them more often than he has in the past. I wonder if we are not approaching a peak population and whether it will be in all the islands or just localized. The variety in sizes seems to indicate that this species spawns throughout the year. Also could it be that several groups have recently migrated into this area? I am almost certain that they avoid artificial lights at night. Ended observations at 10 pm, no more squids.

6/21/72 Malamuya 8.55 AM Begin dive on shallows it's hard to see at any distance because of the high concentration of sardines. I swim all the way to the eastside of the islands but see nothing. I turn back and

I

Malibu, San Blas
June 21, 1972

[illegible] past the [illegible] of motion
a few [illegible] large brown [illegible]
and [illegible] pelts [illegible] at the
clouds of [illegible] [illegible] not
a [illegible] [illegible] [illegible] [illegible]
They [illegible] [illegible] [illegible] of
14 [illegible] individuals. They are
seen [illegible] about crab & [illegible]
T.G. There is a lot of [illegible]
in the water. I see [illegible] PHILIPS
and notice a complete [illegible] do
a there [illegible] [illegible] [illegible] type
also [illegible]

The group is in extremely
shallow water of less than a
meter. Pedro calls me again,
he has found a group of 55
young squid on turtle grass
and sand and in that area
of the island where bottom slopes

steeply into deeper water. When I
find them they are in their usual
leports formation but they break up
and form like an. They start filing
past me one by one following the leader
of the group towards
deep water, but
then their leader
changes its
mind
(why?) and returns into the shallows.
He DRS over PHT & WS with wide few
strikes as he swims past me, some
of his followers follow suit. Everything
is quiet again. They all assume a dark
OKD pattern with mostly no WS.
except for a few. There are 5 or 6
very young ones in this group
all at the end opposite the largest one.
There is no sigl order however and
they have not resumed their usual
leports formation. I saw one large
squid earlier by the dead coral. He
swam past me in a pale pattern
with vestiges of a WS. I only saw
him briefly then lost him.
I notice another large squid coming up
from the deep. He too is pale and

Malibu, San Pedro
June 21, 1972

[illegible] Dorsal fin
[illegible] Tail [illegible]
[illegible] Appears
[illegible] [illegible]
[illegible] [illegible]
[illegible] [illegible]
[illegible] [illegible] To the
[illegible] area first, he goes past
a school of abundant and
[illegible] which [illegible] first
he does not darken or pale
before or after mating nor did
he increase his speed it seems
to me he went through the aforesaid
sequence in a very bored fashion.
This is the first time I see one of
these animals dark while swimming
[illegible] first end of dive at 10:35 AM
Start dive at 9:40 pm Head S. [illegible]
west of dock at Malibu, swimming
against mild current at 2:40 pm
I feel the group of 50+ in same
place except that now it has
become a group of 120+ They
go from [illegible] 5 or 6 [illegible]
I see 1 or 2 two different groups

in the formation. The morning's group is keeping a tight formation and are medium small. The afternoons are slightly larger and are keeping no formation. The two groups did not interact while I stayed in the theme. There is a large pen detached from main group. At first I think it's a counting pen, but see no signs of counting. When I approach an individual or a group of them he or they go into a PHE US with fin stripes in the young this display is more pronounced and held for longer periods of time than in the older crowds. I also noticed that if I press my pursuit after an individual he will immediately display PHE US with fin stripes and he will keep this pattern back as long as I am coming closer to him but once he starts to outdistance me this pattern will start to fade gradually as we become farther and farther apart and finally give way to a pale pastel throughout the underside of the mantle. I have only seen this done by the young.

IV Malinalco, San Blas
June 21, 1972

[illegible] Tell [illegible] Could Tell
[illegible] a
[illegible]

[illegible] display
of collective mimicry. A
garfish swam directly over the
group. The whole group [illegible]
[illegible] gently
to the bottom motile first
and turned into a light green
PH & was very much like the
color of surrounding turtle grass.
It was uncanny because a
moment before the garfish
swam over them they were all in
dark ORD & was in a horizontal
position to the bottom, all very
conspicuous and the next the
whole group seemed to disappear
in thin water. It took a trained
eye to detect them in the grass.
I could see their arms waving
slowly with a sway not unlike
that of turtle grass waving with

The current, and this indicating
gradually watching the point
the gentish and then. The diff
was no more than 3½ feet so
the gen must have been less than
3 feet from that directly under.
They never lost the coral.
One of the large yellow boats started
its engine about 50 meters away.
The whole group moved by paddling
and three of the large individuals
started for deeper water while TH &
DM then they changed their mind
and rejoined the group. are they
susceptible to vibrations? end of
observations at 3:45 pm. went
for deep dive around 4 but
no squids except the group that
did been observing earlier in same
area end of tour at 4:15 pm.
Begin another dive at 5:39 pm
arrive at study area (same as previous
dive) at 5:44 pm The same group
of 120+ is still there. They are
feeding too. I see one attack, he
comes towards me arms first with
his tentacles extended, he fails and
retreats almost immediately. I notice

V

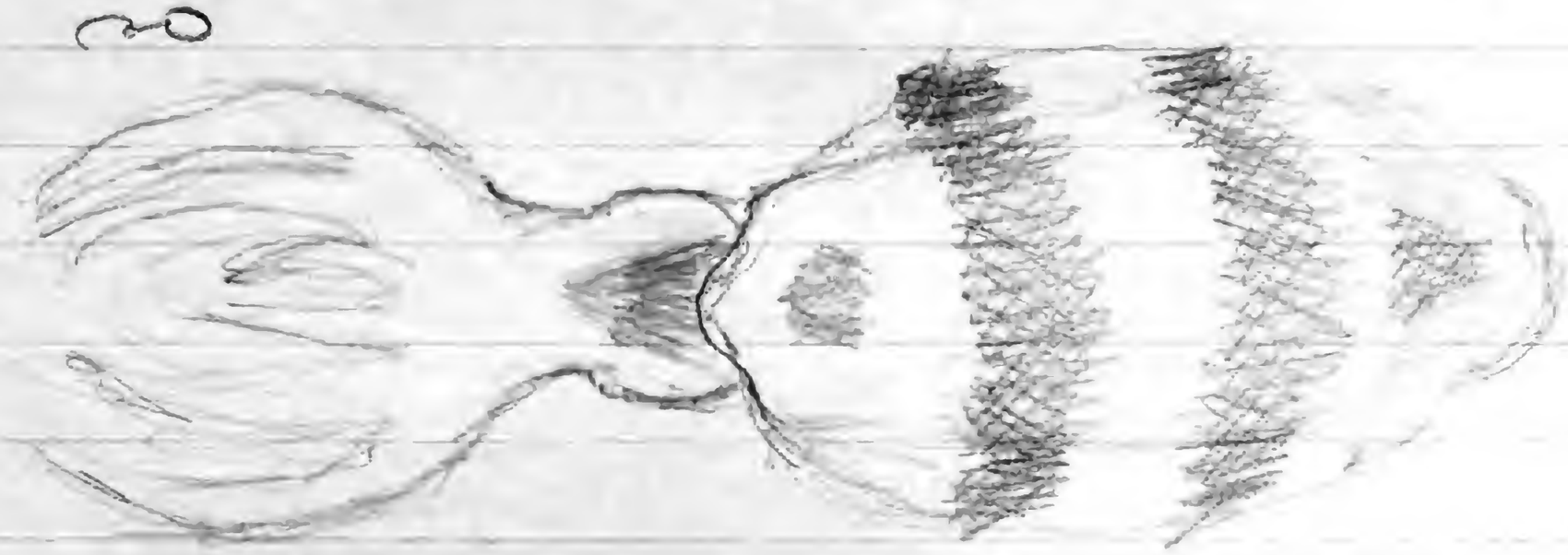
Malunegra, San Blas
June 21, 1972

he is displaying fin stripes, then I see another and another attack at the same school of minnows, they are all displaying fin streaks, I see one in DM pattern as he goes for its prey. All these are young squid. I have never noticed these displays on the mature individuals. So far they have all been unsuccessful. A great number of them, if not all keep their tentacles extended while in the group whether preying or not is this a typical prior to feeding posture? I think so. I see another young individual attack, it goes along the bottom and under the school of minnows in a clear pattern with DM then shoots up and fails to catch anything, goes back down to the bottom and works its way back to the group without changing pattern until it has joined with the others, then ORP & WS and clear. Suddenly a small fish (cornugil?)

about the same size as the young squids runs into the group and makes a very disinterested and unsuccessful attack upon one of the young squids. The squid reacts by moving away a few inches and turning gold brown yellow at the end of the mantle. This wave of color moved the length of the mantle and on to the arms to disappear at the tips. The fish repeated its attacks on other young squids and they all reacted in exactly the same way. end of dive at 6:18 pm.

Night light observations:

7:00 pm At 7:15 pm a group of 5 or 6 young squids darted into the light one made an attack on the surface right next to the light, flared its arms right after and went into a reddish zebra pattern, like so



VI Malaspina, Los Cabos
June 21 1972

do they feeding time? We
saw some of them at two times
before

Night light attracts squids, at
8:20 I spent some time watching the
light. The squids seem like red eyes
in the dark and seemed scared and
[illegible] to the light. Their
feeding habits become more
pronounced at night than in the
daytime. One number of they
d noticed 3 or 4 large Dosyteuthis
at the edge of the light, but only
briefly. They are the largest d have
seen so far, as long as this page
is wide. The squids in general seem
to be afraid of the artificial light
but the presence of minnows under
the light is sometimes too strong
a temptation.

9:15 pm d moved on the boat with
Carlos to the area which d'd encountered
the 1204 group. Some of them where
still there, a few inches under the
surface and in the curl up position

The group as a whole has disappeared. The different individuals seem to be spread out all over the area, even as far as the east side of the island. All of them floating a few inches under the surface and curling ⊂⊃ and rolling their not close to a piece of sargassum of about their color to which they resemble. Do they do this all the time while young? I did not see any mating or courting and they in deeper water? Some of the young (medium) do that (Porter in conversation). A large percentage of the young are certainly gone, probably in deeper water. I did see some extremely young ones clinging with the sargassum. They were not plentiful in the daytime, yet I see more of them than I do the larger and more plentiful. Could it be that only some of the young and the very young remain on the surface mimicking the debris and the sargassum? While the older retreat into deeper waters? End of observations at 945 pm.

[illegible] ship. All of the Cstrip alone, and stee[illegible] accompanied by one of the Spread Arms [illegible] OW were dark working on arms. Cat [illegible] at 1815 Z.

[illegible] 4 hours to show up at Cyber [illegible] have 3/4 hour [illegible] Cyber [illegible] [illegible] Dr. [illegible] to the [illegible] [illegible] get it close to the [illegible] SAN

[illegible] Cyber [illegible] least some [illegible] [illegible]

[illegible] more active at night than [illegible] thought I had 24-hours a day organism!

June 22, 1972
San Blas

Still at Malunega. Rather windier and more cloudy today than yesterday.

2:35 a.m. A group of 24 mesopelagic show up by ship. In fairly shallow water in III area. Quite near surface.

COMMENT: This may well be a "sub-group" of the enormous IV assemblage seen yesterday. I would rather expect these animals to rejoin the IV later in the day. The appearance of these animals here is further evidence that large assemblages break up at night. And this sort of cycle may be ex

Cephl., June 22, 1972, II.

dence that migrates in period of greatest activity. He [illegible] during the middle of the day [illegible] resting.

The scattering at night may take different forms. Medusae break up into swelling [illegible] clumps may behave differently. Another [illegible] were above last night. Did [illegible] angle? He did not see any [illegible] deeper waters? (Yes, Arnaldo's notes on Jan. [illegible] observations.)

The group of 24 Ulm meetings was very [illegible] and coordinated. Dido answer for [illegible] periods of Ord, WS, Y, and [illegible] color pattern. Latter case [illegible] the same as pattern after feed at night, which I have called by various names or group [illegible] arcs (e.g. "light PH", p. 158, or "extreme bowed form of PH" etc.). Doubtless it is closely related to "Feed PH", but it probably deserves a name of its own. Dubious case. He [illegible] seen this morning are more or less the same as p. 158. Can be summarized diagrammatically [illegible] The bars themselves are dark red or reddish brown. Areas between bars on body and fins usually trans parent

The animals this morning are lots of V's, large and slightly flattened. Frequently upward flow with extend Cent. Occasionally downward flow of the V's occur during Ben, but these are all some with Ord+.

All of most of Ben is also combined with extreme Y. I can't see what's prevailing changes from Ord+ to Ben+ or vice versa. But nothing precludes interpreting Ben+ as an alarm or feeding reaction.

Does Ben+ last longer or tight longer because animals are more active after lights stimulated them?

Is Ben+ cryptic and/or disruptive? Does it mislead potential prey?

One of the animals is clutching rather large sand dune when first seen this morning.

Go into water 8:10 a.m. Explore IV area. Find group of 60-70 squids and medium exactly where large group seen yesterday afternoon. 1-2 ft up in 2-5 ft of water over FG. All closely packed together, in Ord, WS, Y and PCA. Apparently not feeding. Perhaps not surprising as there are no sardines around at the moment.

One medium squid, turns more or less yellow all over. Then darks all over (definitely no WS). Then re-assumes Ord+.

Now a medium red fish (common blue and green thing) starts to swim around and through group of squid (fish just feeding on plankton?). Movements sometimes force one or more individual squid(s) to retreat a few inches.

Cephl., June 22, 1972, IV

The squid turned to turn yellow brown, during night. Thus "general yellow" might be intermediate between CB and PH (i.e. PH without blotches).

One ind. possibly charging in [illegible] upslope attack. Otherwise as yesterday:

8:25 More bioluminescence in [illegible]

Then I swim over to V area. Water rough and murky. There also is a small Barracuda around for squid squid. So I go back to IV group, which was [illegible] watching all the time. Much as before. Weather [illegible] they have not been feeding and often poised [illegible]

Stop observations 9:15 a.m.

Arcadio writes well group I [illegible] and medium in I area on way back SW.

Go on to Paulito area. Arcadio has area Arcadio finds, stands shallow [illegible] stops. Explores area where mixed group found on Aug 3.

Weather cool, overcast

12:35 Comes across blobs of ink. In 5 ft of water over TG. I go into water swim around for some time without seeing anything of interest. 12:55 Carlos sees 4 small (tiny) squid near boat. They disappear. A few minutes later, we finally find group. Includes 40+ inds. Ranging from rather large-ish small (perhaps even small medium) down to tiny. 3½ ft up in 5 ft of water over pure thick TG. All or most inds. in Ord, WS, Y, PCA at first. Very shy and mobile.

There do not seem to be any X around. A few inds. have

tentacles rather extended. Did I later see any actual feeding. All of a sudden, we felt [illegible] of the eels. (medium size eels) [illegible] Did Lars RL very briefly! Probably very [illegible]

1:08. Animals seem to be less shy now. Have drifted into shallower waters. 1 ft. upon 3 ft of water. They also are showing a tendency to break up into smaller groups or subgroups (Presumable "scattering" is a sign of relaxation — during the daytime.) Finally they all shoot off and disappear. Probably scared off by a predator.

COMMENTS: It is my impression that the eels here now are approximately the same size as the ones seen in the same area in early May. Considering how fast squid grow, this must mean that there has been a complete turnover of population in the interim.

Obviously this area is ideal for young squid of an appreciable range of sizes (and presumably ranges). It is the nearest thing to a full scale "nursery" that we have seen. Why is it so ideal? Partly because it is a really immense flat of TG. And yet it is perhaps surprising to find the young assembled in an environment which provides so few hiding places, nooks and crannies. (I have never seen a squid actually go down into the TG-thing.) The water is not particularly clear. And the area is not teeming w/ predators or overflowing with prey. It is, however, relatively very well protected from strong wave action. Is this the answer.

After the squid leave, Arcadio goes for another sho

Dive Tour Stage 1:25pm

When we got over to Dive Site [illegible] to water immediately. [illegible] found in the [illegible].

I go swimming [illegible] over TG flat. No squid. If the always [illegible] over TG here is real, it suggests that any young which hatched recently, may have gone over to Sanctuary Mountain (evidence, confirmation, of an initial "pelagic" stage.)

I go back to coral and step off Quadrat 2 10. In the meantime, however, Arcadio has found a group for I go to join him. Group includes 44 eels. [illegible] medium to large (at least 6 eels). They are in [illegible] on our mixed bottom (sand, coral etc., TG).

Most of the eels are in Dark, WS, Y, and PEA when I arrive. But there is also some courtship [illegible] ♀'s are Pre-mig frequently when attended by 1 or 2 ♂'s (each).

CORRECTION: Perhaps the situation is not so simple. Certainly the ♀'s who are involved in courtship [illegible] are no more than 2. But the ♂'s may be more numerous than I originally supposed. Each of the courted ♀'s may be accompanied by 1 or 2 ♂'s at any given moment, but ♂'s may also be "relaying" one another. Perhaps ca 4 ♂'s involved in total.

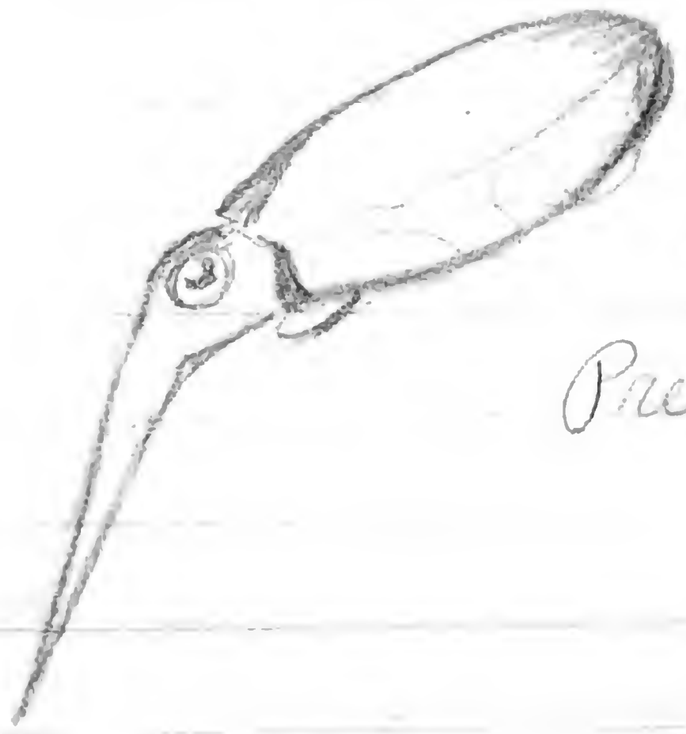
My general impression is that the sex tag was unsuccessful, on the whole or in the short run, but also quite high intensity, see also comments below.

The ♀'s would peck with ♂'s quite frequently. And ♂'s would make forced approaches quite frequently. But none of the approaches ever led to actual contact. The ♀'s always gave way to the ♂'s come in. And the ♂'s "broke off" at the last moment. (Wonder if our one ♂ approach ejaculate into the water.) Again Pie was attacked by a new female Pie was a repeat!!!

Also a ♂ "broke off" after an approach which was frustrated by a Pie by a ♀, he usually "dropped back" behind her. At least one ♂ did a big low intensity Pie himself as he dropped back!

As would be expected, the animals also reacted to us from time to time, whenever we got too close. Several cases of embed back. Once, a medium or medium-large did Pie advancing backward to me!

COMMENT: Is Pie an expression of high intensity hostility rather than sexuality? If so, is it produced when an individual is not frightened but still not willing to attack?



Notice appearance of "swollen" rear end. Presumably due to eggs?

Cephs., June 22, 1972. VIII

I noticed one peculiar aspect of a Pico [illegible] arms are often pointed downward during Pic (as shown in previous page). This can be seen in [illegible] but becomes obvious probably only indirect. In the case of the [illegible] downward pointing ray will be [illegible] than an "after effect" of locomotion. [illegible] rise, backward and diagonally, when Pic is in response to a [illegible] think that I may have seen such downward pointing rays [illegible] before without paying much attention to it.)

There were some even more obvious [illegible] between some cuts this afternoon. Squids [illegible] form(s) of Z (sometimes, perhaps, as [illegible] keys on Pianos, but not well seen). These [illegible] tics must have been between O's. Once, however, I saw a spread performed by a presumed [illegible] toward a T, after he had approached him, just after [illegible] Pic, perhaps even superimposed upon or combined with the Pic.

I stop observations 2:30. Arcadio continues until 2:50. SEE HIS NOTES (he has more data than I do).

ADDITION: While the squid were courting, there were the "usual" Gray and Yellow-Jackets (Yellow-footed) feeding in TG below them. Are these jackets an eight squids as "sentinels"???

GENERAL COMMENT: One problem has just occurred to me. We have seen two "forms" of apparent light [illegible] copulation and/or parental protection, behavior. A Cabrillo guarding with young looking on. Or an isolated pair (with or without

VII

Malmuga San Blas
June 22, 1972

8:11 am Reach, and area as yesterday at 8:20 am N.T. a group of 57+ young in ORD-WS-PCA. The leader DM & PH guarding, when a small fish approaches him out of a crevice, the little fish goes after other squids and they all reach in similar fashion except no DM. Every now and then an individual in the group turns without back, like this in IR for no apparent reason at all. I notice a young squid in ORD-WS with fin stripes which originate at the tip of the arms and extends far into the mantle and sometimes all the way to the end of the mantle. I try to read him into becoming a little darker but instead it inks, shoots to the surface arm first and immediately reverses and comes back to the same place in PH-WS-Y and fin stripes, its fins fluttering nervously I photograph him a few times and he allows me to come closer. I go back to

ship and I run into a group of 17 young all reacting to the presence of the body by fanning and displaying their whole repertoire of postures, it all looks very hilarious. I photograph them. End of observation at 9:15 AM

Paratupo, Los Elas
June 22, 1972

12:15 Tour on T.G. area of island. After 20 minutes or so run into group of 14 who go on and join several other groups to form a group of 50+ they are as young as the group we encountered in this same area last trip. There are no signs of any larger squids. It seems to me that when young the Sepiots favor shallow turtlegrass areas more so than any other. End of observations at 1:25 pm

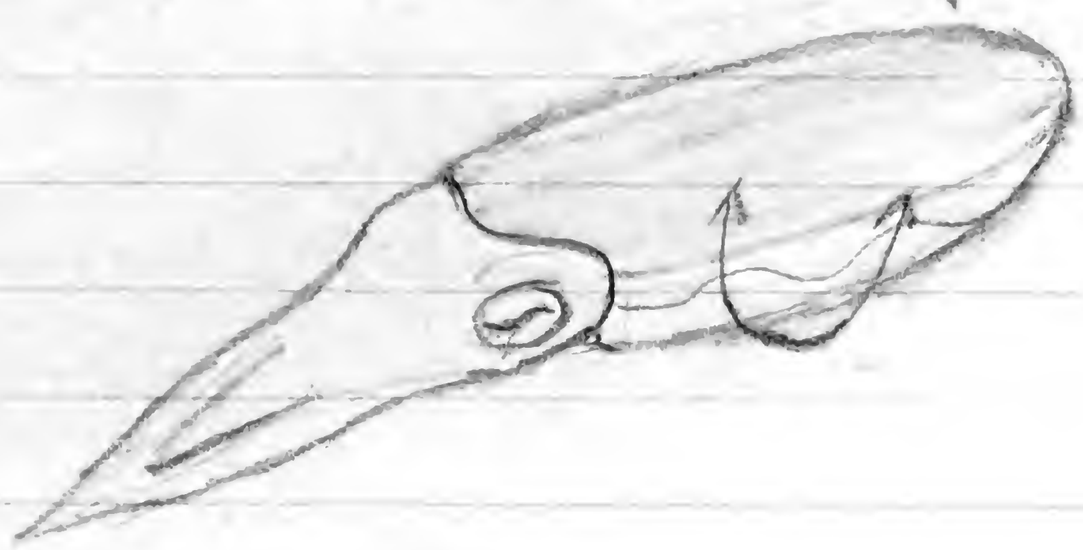
Piristupo 1:35 p.m. The nest is empty and it looks as if the coral had broken up some. It certainly has deteriorated some. I try searching for the second nest but I am not sure where it is. Then I run into a group of 4-07 large squids. Immediately I notice a courting pair at the end of the

VIII

Piña Tupo, San Blas
June 22, 1972

bird. I notice some more courting within the group. Several females "pick" at least three times during the small. There is some low key courting and a couple of females with a female I see no successful couplings. Then Martin comes in the water and starts courting. I go on to see if I run into other groups. Nothing. I go back to group. They are still at it Martin hasn't seen any successful cop. either. At one time I noticed a female start fluttering just as the male did, Then the male followed suit and the female flagrantly pied. I saw this bird at least twice more, once by another female. Could she be enticing him? in all three cases it seemed that way for the males reacted by fluttering and an attempt to copulate. In all three cases the females "pied" I have also noticed that the male when fluttering and very close to the

female starts a rocking motion like so. Is it part of the pre-copulatory display or is it simply trying to find a way past the female's defenses to copulate?



After an unsuccessful copulation attempt between a female and its partner, a third squid which had been following this couple moved forward from its position behind the courting party passed very quickly and positioned itself under the "pied" female and attempted copulation. It seems to me that the male was successful in passing spermatophores to the female, but she did not accept it and immediatelly ejected them as she rapidly swam away, paling as she went. All throughout my observations, a group of large "yellow goatfishes" "Mulloidichthys Martinicus" (Cuvier) grazed directly under the group of squids and moved with them along

IX

Pirintapu, Sarikei
June 22, 1972

the reef. We first noticed this at Ogopukip during our last trip here but have found no reason for this behavior from part of the goatfishes (They certainly follow the squid groups wherever they go in the shallows of the reef, from 20 ft and less.) The only reason I can offer is that perhaps the yellow goatfish is using the squids as lookouts. When they frighten, the goatfish runs for cover.

[illegible] Stud 5 ♂), and novel Lateral Silver (absent in [illegible] ♂). What is the difference? Group copulation, nuptious must occur before or after "island" mes. Perhaps the group nuptio is probably [illegible]. In this connection, I should note that the 2 ♀ [illegible] counted must actually have [illegible] some slight landing to drift away, with their escorts, from the main body of the group. But they always came back after a few minutes.

[illegible] from before dark until just 6:30 p.m. [illegible] a single exploded. Is this because the boat is found far from shore (several hundred yards?) Are Sepioteuthis and its associates (X) only [illegible] at night?

NOTE: I have seen a number of pelicans here and at Nalunga this trip. Apparently the pelican breeding season is over, or at least coming to an end.

June 23, 1972
San Blas

Here was heavy rain and lightning early this morning, before dawn. Gradually decreasing. Lightning stops. Gentle rain continues. We finally go over to Piratupo. To area where counting group seen yesterday. Into water 9:45 a.m. Calm. Cool. Rather murky.

Find 3 larges 9:48. 3 ft up in 10 ft of water, over TO and sand with little [illegible] Observed a "counter

two" ♂♀; a ♂ (♂1) [illegible]
very close to her all the time [illegible] behind", always on side of [illegible]
is always between ♂2 and the ♀.)

All three males are in more or less full
WS most of the time sometimes with some trace of [illegible]
PCA, but never very extreme. The ♀'s ears are usually so
more pinkish or brownish than those of the ♂'s. Also with
the indication of Pastel? She also has a little yellow
mottle inside her, toward rear of head, and
crows on her left side than on her right side.

Both ♂'s have trace of LW all over. The ♂2
usually or always more [illegible] than ♂1.

All three males outlunge ♂1 back and forth during
their courtship.

You will see
by mutual feeding
♀ outlunge ♂1 and ♂1 [illegible]
in going forward ♂1 [illegible]
in lead when group goes [illegible]
ward (♂1 "along the house",
at least for changes in direction???)
The ♀ and ♂1 are always facing
in the same direction. But ♂2,
the "arrangement" — as also
below — occasionally faces in opposite
direction, even while continuing to move with the

Sept., June 23, 1972, III.

other Quartz as clear as before.

Then ♀ turns the Sunbeam, uses an extreme type of Pie, letting the ☿ [illegible] "Downward Pointing" Pie [illegible] ♀ uses right hand low. Then also on above [illegible] Pale Blue Jeans, Cape, [illegible] Pants, without cape [illegible]

Now the ♀ is seen using semi-Pastel. Upon which ☿ uses superimposed the dark Blue and Red markings of Typical Pie.

Then ♀ uses an complete Pie with Downward Pointing again. ♂1 follows in Double Stroke and Tri Stripe. And ♂2 follows in Slight PH with Spread (and probably also slight Zen arms). All this may be preceded by appearance of a 4th and. Another ♂?

The 4th stays around for a few seconds. Then disappears again 10:02. The other three resume behavior as before. All normal. Movements generally slow and relaxed. Some slight, slow-footing. No more Pies, for the moment.

Why is there no Tatral Silver? Aren't the ♂'s (or ♂1) excited enough? If not, why not? See also below.

Even, once in a while, when the whole group is going backward, ♂1 accelerates toward ♂2. Presumably, hostile at which point, the Ord of ♂1 tends to become darker, more sharply differentiated, a little more Double Stroke-like. ♂2 doesn't react very strongly.

[illegible] continuing as before 10:10 a.m.

Cyb., June 23, 1972, IV

(20)

I notice that all 3 cuds. have been forming in the spread in usual "courting" manner. Suddenly, suddenly does send - V; without change in coloration. Why?

By 10:13, everything is so calm as to be almost dull.

I notice that there is a fiber [illegible] swimming around in mid-water, quite near the squid. Little or nothing in the way of interaction, unless perhaps the squid tend to retreat a little if the fiber comes near.

Arcadia swims off to left for a few minutes to 10:16. I remain behind. Suddenly the (a?) 4th mid. (no) appears. This provokes a sudden outburst of rapid swimming, back and forth and also irregular circling. Lots of Pics, most with rises and downward peering. Pics light brown, and probably 3, of the mids. (Further evidence that Pics are hostile, not purely female sexual.) At least once, an mid., presumably ♂, rises after another in Pic, and does "court" Double Streak and Fin flirps as "he" does so.

Then the 4th leaves. Everything goes calm again. 4th back within a few minutes. Another outburst of [illegible], as before. Lots of Pics, etc. 10:20 Then 4th goes again. And there is calm again.

COMMENT: The outbursts of [illegible] in response to the 4th mid. have three implications. They suggest that both the ♀ and ♂ 1 have, in some sense, "accepted" ♂ 2 as an integr

Cayuga, June 23, 1972, V

also now has left the "family". Strange the 4th returns "alone"

9:00 Now the 4th comes back for the second or third time, 10:20. Now he is over on his own. The three others continue swimming as before. Evidently he has dark feathers superimposed upon white Pattern!

A few min. later. I lose the animals (I think that they swim away). So I go over to Jim Cowles, 100-150 ft away, to see if he is not [illegible] group. Jim McIlvers. 4 ft high, 10 ft [illegible] to Dr. Dodge, N.S.Y., RA Cuadro says that group includes approximately 23 birds in total. Including one pair of large-medium & small-larges which are showing courtship behavior. And one large who comes and goes. This latter may well be the 4th of the group that I saw earlier watching. Presumably "shuttling" back and forth.

COMMENT This group of 23 may well be "remnant" of group of 44 seen yesterday, most of the "courting" adults have left, to go on their own. Probably the two observed today is one of these separated units. So far so good. The general sequence confirms the hypothesis that pairs (and trios) are formed within large groups and then segregate out. But it is remarkable that the two observed this morning were much less active, social, than the courting adults of the group observed yesterday. This in spite of the fact that they presumably are more advanced. Why? Possibly the ♂'s who were most active yesterday went off with other pairs or trios? Or is the general rule [illegible] pairs [illegible] to the

usual of intense crowding and consequent compulsions, an almost inevitable after-effect or by-product of [illegible] and attention of the distal phase of segregation.

12:45 pm Back on Station. See 5 and (5) Sepiots clustered around anchor rope. Yes, [illegible] Anchor rope, new, taut (new diagonal). All [illegible] 1. Staying, as usual, with rear side toward rope, head and arms pointing outward. One ind. turns out [illegible] WS) buff. Then reverts to "normal".

After some minutes, slips around [illegible] rope becomes more needs, nuzzle. At which point the animals swim away! I.e. they want here, not [illegible] entrance for protection. Yes work of Hobbs, etc.

Go out again in the afternoon. Again to Sentinel. It is still overcast, but the rain has stopped. Anchor in a shallow tow, 2:25 pm, as we approached the shoal. Getting of interest. Reach appropriate group area and both go into water, 2:32. The water is colder but clearer than this morning. We swim about, exploring.

2:50 pm. Come across group of 7 squid. 4 ft. up in 8 ft. of water, over mixed TG, sand, coral, bottom. [illegible] inds. are large-ish medium or small-ish large. In [illegible], WS, Y, and PCR. Retreat before us. Not very fast. But all inds. close together and assume semi-Pastel as they go.

What really is motivation of Pastel?

One ind., presumably ♀, does rise, flashes, [illegible] Pointing during retreat.

Sept. June 23, 1942, VII

(226)

Men & females usually disappear leaving one behind. [illegible] Rarely [illegible] Bigger water all covered. Du Ord & Men & Females [illegible]

Sometimes [illegible] [illegible] may be accompanied a few minutes later, 3:10 pm Du & with Ord & Dragfyers

3:12. Accompanied by swarm of a large bell [illegible] [illegible] The two biggest seem to be [illegible] & does the [illegible] Dragfly & Pedding [illegible] Pirating (Dp?). [illegible] Men with Cottiaqui. Men without cottiaqui. At least once (perhaps always?) ♀ does flutter with Pie (cottis typical? SAN). The attached or follows the ♀ closely throughout. Sometimes in Ord and US. At other times in Double Streak. Some Double Streaks with fair stripe, some without. All following with flutters!!! Flutter an expression of "conflict"?

The Pie patterns of these ♀ are rather characteristic

White stripe down midline of rear half of back (very conspicuous against silver). Black line along midline of front half of body. Note peculiar arrangement of black near front of mantle.

Also NOTE that fins attached high upon body (this is characteristic of all mids, ♂ and ♀, large or medium — and presumably also [illegible])

Capt., June 23, 1972, VIII.

Several large ♀'s are much more restless [illegible] be toward rear than are the [illegible] (Dorothy, also "nuzzle" in [illegible]).

At least one other and [illegible]

Dia. Fish Circle.

Several inds. do Cir. Dnce + turn.

Then the (principal) courting ♀ follows the ♂'s for some minutes. Then a lower [illegible] the 2 ♂'s. Spreads, with PH [illegible] arms. Followed by another flurry [illegible] one or both ♂'s. [illegible] semi-Pastel. Yes Hesitating [illegible].

A few minutes later, several inds. turn entirely Dark, apparently as reaction to our approach.

Then are both Yellow and Spotted [illegible] swimming nearby. Confidence? SAN.

All courtship seems to have stopped 3:25 p.m.

But the ♂ and ♀ which were courting earlier, the largest inds. in the group, are still swimming together at one end of the "line" which is the usual Cand. Pyjama formation of the group.

All inds. in Ord+. Then one turns first "yellow" and then all Dark, apparently in response to [illegible]. Relaxes immediately. Now I see that several inds. have tentacles slightly extended. Many [illegible] lower in water. Are the animals getting ready to feed? Is this why courtship has stopped? Note. It is [illegible], and

Sat, June 23, 1972, IX. (228)

[illegible] (I hope the animals might think that it is a strong [illegible])

Then [illegible] all the [illegible] Pole and dart off. Back [illegible] [illegible] Cabin Out + etc.

The largest [illegible], the Pack, are [illegible] their relative position [illegible] the [illegible]. This sort of [illegible] [illegible] [illegible] [illegible] [illegible] occurs [illegible] [illegible] [illegible]

Everything [illegible]

COMMENT: Why are the animals here during so few E's toward us? Are they particularly tame? And/or is this an unusual [illegible]? And, again, why so few (no) Lateral Silvers??? Another unusual quirk???

A Yellow-Gray Fish swims through group, producing white "yellow" - Dark responses.

Stop observations 3:40.

COMMENT: Are the animals less active sexually today? Yellows single, because the weather is less good today? Is it a temperature and/or light effect?

Awake to stagnant water until 3:45. Shoots a medium. Shuts bud & photographs specimen.

Then we go on to Hualupo. Run light from before dark. Without attracting any cephalopod

Nothing by 9:15 pm.

June 1972
Lauder

Working at Matupo [illegible] Sea water 7:45 am. Usual swell refl[illegible]. Later [illegible] cool. We swim around usual areas. No sign [illegible] lots of small sandbars, in dispersal formation. But [illegible] substantial Barracuda. Finally stop 8:05 am.

Arcadio goes for shallow tow. 8:12. [illegible] + medium along edge of reef flat and channel. Loses [illegible].

8:23. Reach area where counting pass and [illegible] seen during last run. Lots of gray [illegible] in shallows, which are therefore muddy, but water underneath [illegible] out. Lots of small sandbars in light formation. 8:30. Sa[illegible] pair of large. 2 ft up on left of [illegible] over sand and coral. 9 in Dbl +. 7 in Double Streak and Tin Stripe. Tin Stripe is comparatively broad. 9 E. whole pattern is reminiscent of Quadruple Streak. The animals seem to be wary. Start retreating immediately, into deep water, over TB and sand, to an offshore reef. 7 in lead during retreat (as would be expected of an animal in Double Streak Tin Stripe?). But disappear. Arcadio says that there are Barracudas, a sand shark, and lots of jacks in area. Not surprising that squid are nervous.

I come out of water 8:43. Arcadio goes for shallow tow along channel and creek, then off to near shore of "Little Matupo" (Achutupo???). Finds squid,

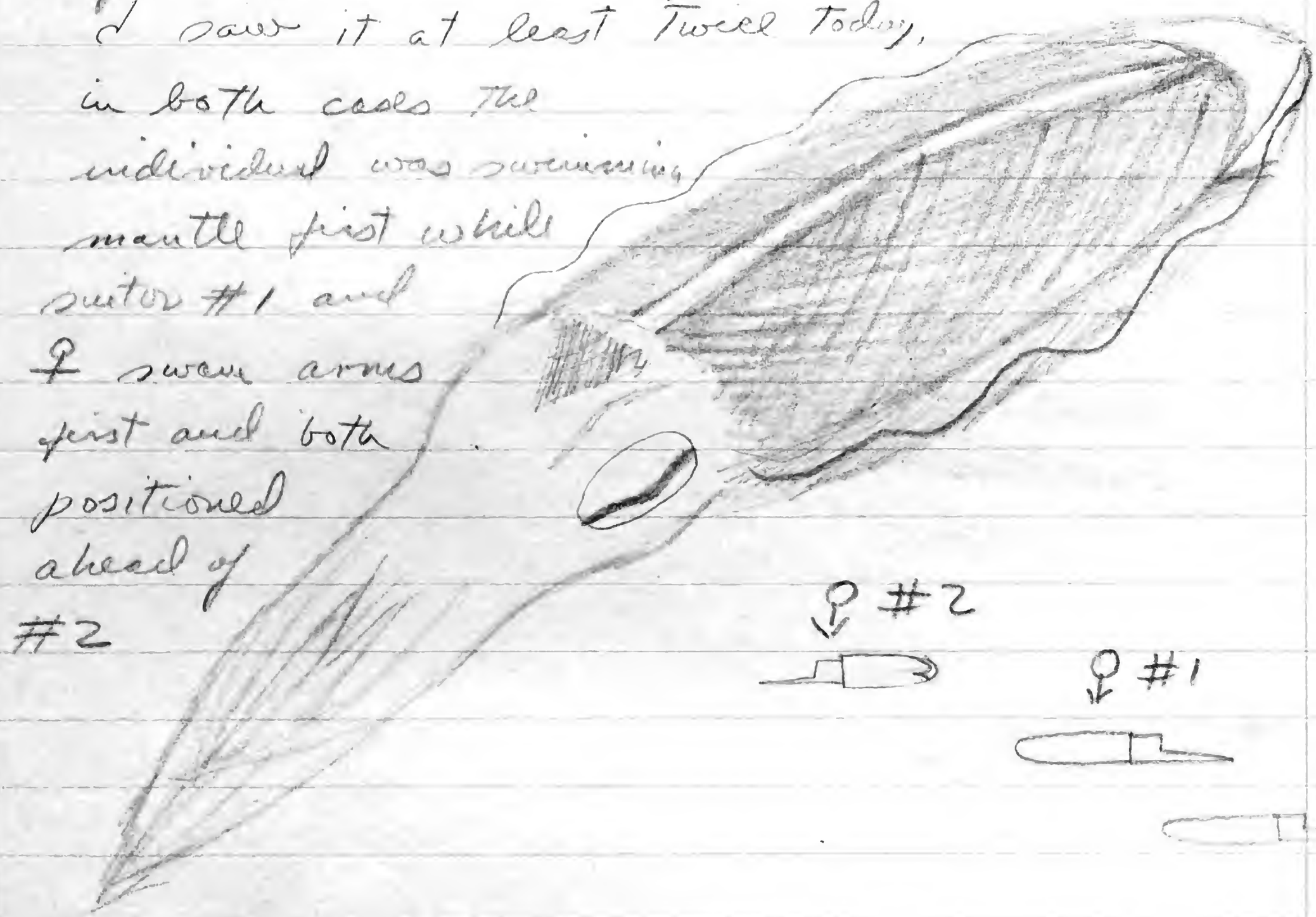
X

Pine Tree. San Blas
June 23 1972

very, very, very, most windy at all.
[illegible] at 9:15 am. At 9:55 am I see
a school of 5 large [illegible] [illegible]
[illegible] water

[illegible] OFD [illegible]
streak on the
mantle and
fluttering pale
bus fins moving
rapidly
and its
body
half
↓
rotates when its very close to the female.
The female shoots up near the surface
keeping it "pil" coloration. The male
gives up, and goes back to OFD tws.
I notice a young spotted goatfish
"Pseudupeneus Maculatus" (Bloch)

feeding mostly under the group of 3 squids that I'd been observing. Once the squids began frightened and moved rapidly for about 15 ft. The goofus watched them, then backed up and went on to feed under the opposite location. I been only seen [illegible] I noticed the female of the group flutterin in a way I've never seen her entourage of 2 males remained quiet and very cool. Today I noticed a white point at the end of the mantle of outer #2 of the trio I saw it at least twice today, in both cases the individual was swimming mantle first while outer #1 and ♀ swam arms first and both positioned ahead of #2



Today's group seems to me like part of yesterday's

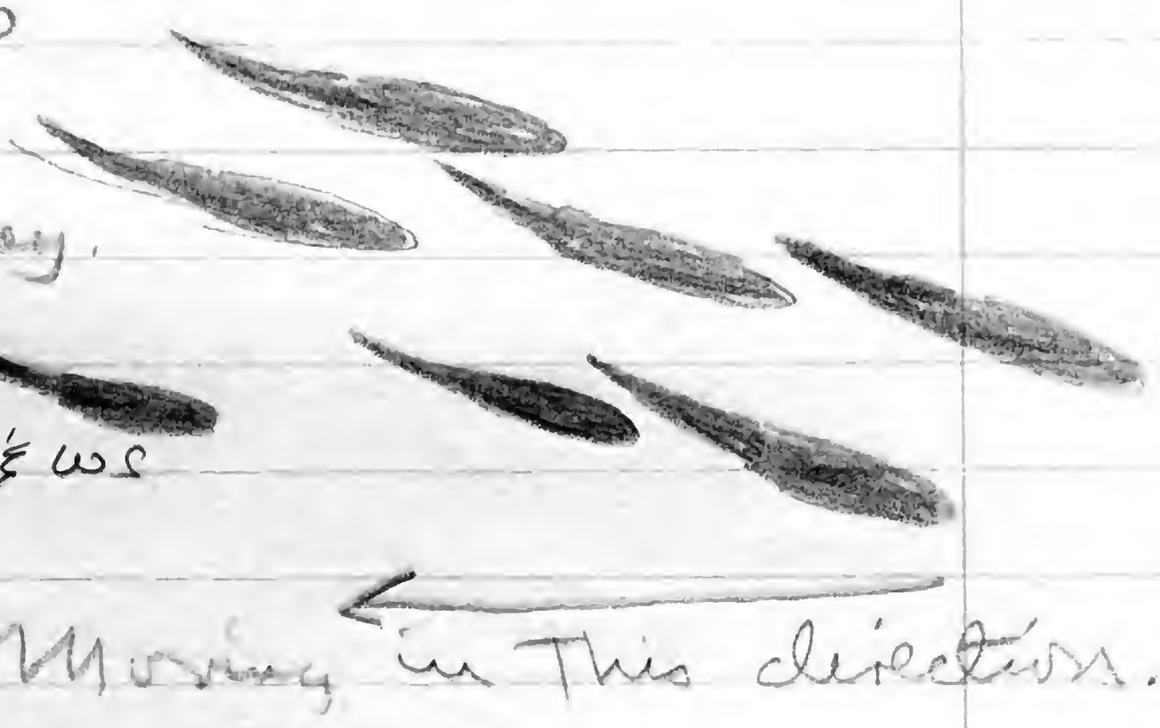
group most of them were medium (young) except for 3 or 4 who were fairly large.

Pinfish grey, mid blue, or mainly or white very calm water. I start with a Tow from the beginning of the reef that extends east from the island. It's 2:27 pm. The water is extremely clear there, about 100 ft visibility. We are headed to our study area, I see no squid along this reef. We arrive at study area at 2:35 The water here is a little murky but better than this morning. I swim all the way to nest #1 area, but see no squid. We swim around out I see no squid until 3:15 pm a group of 16 large & some medium two males are quarreling over a female. Some courtship. I see no successful copulation. The water here is about 7 feet deep and bottom is coral and some TG. There are a couple of goatfishes yellow & spotted grazing under the squids & water there a while. Suddenly

The squid bolt, the goatfish do not follow the squids, but run in every direction, usually opposite from the squid. Every time calms down and the squid return to the same area, the goatfish all return and resume grazing directly under the squid. It occurs to me that the goatfish are using the squid not only as sentinels, but also as decoy. When the squid return after being frightened, they do it moving arms first and very straight but tilting their entire body up like so.

I observed them do this at least three times today.

I think they were in pale ORD & WS with PCA.



Moving in this direction.

Cetti, June 24, 1972, II, (230)

[illegible] Herd group of 19 lepiots and 8 X's. (These X's [illegible] Dry Valley. But I shall continue to call them X.) All the lepiots are more or less large. 6 of the X's also are large (as large as and the specimens seen by Are and in Wash. Gen.) The are all very probably should be classed as mature. Herd group is seen first, it is in 10 ft of water, out and in [illegible] bottom. It moves out to deeper water (15 ft), [illegible] 1-2 ft above bottom.

Some of the lepiots are [illegible] at first (2-3 pens). Still group, [illegible] pens, rather tightly integrated. But the X's form a definite sub-group. Tend to stick together in unspecific cluster. But not necessarily closer to one another than the outlying members of the subgroup are to the nearest lepiot.

Most of the lepiots are in Dull + all or most of the time some go Dark from time to time, presumably, as reaction to us.

Several of the ♀ lepiots do conventional rule, Pie, DP performances. There also is at least one elaborate Z spread on counter, as at Ogupuloup (darker und. above, lighter und. below — surely these can't all be "rape" attempts.)

The X's are usually in Dull.

There are spotted Goatfish feeding in the neighborhood.

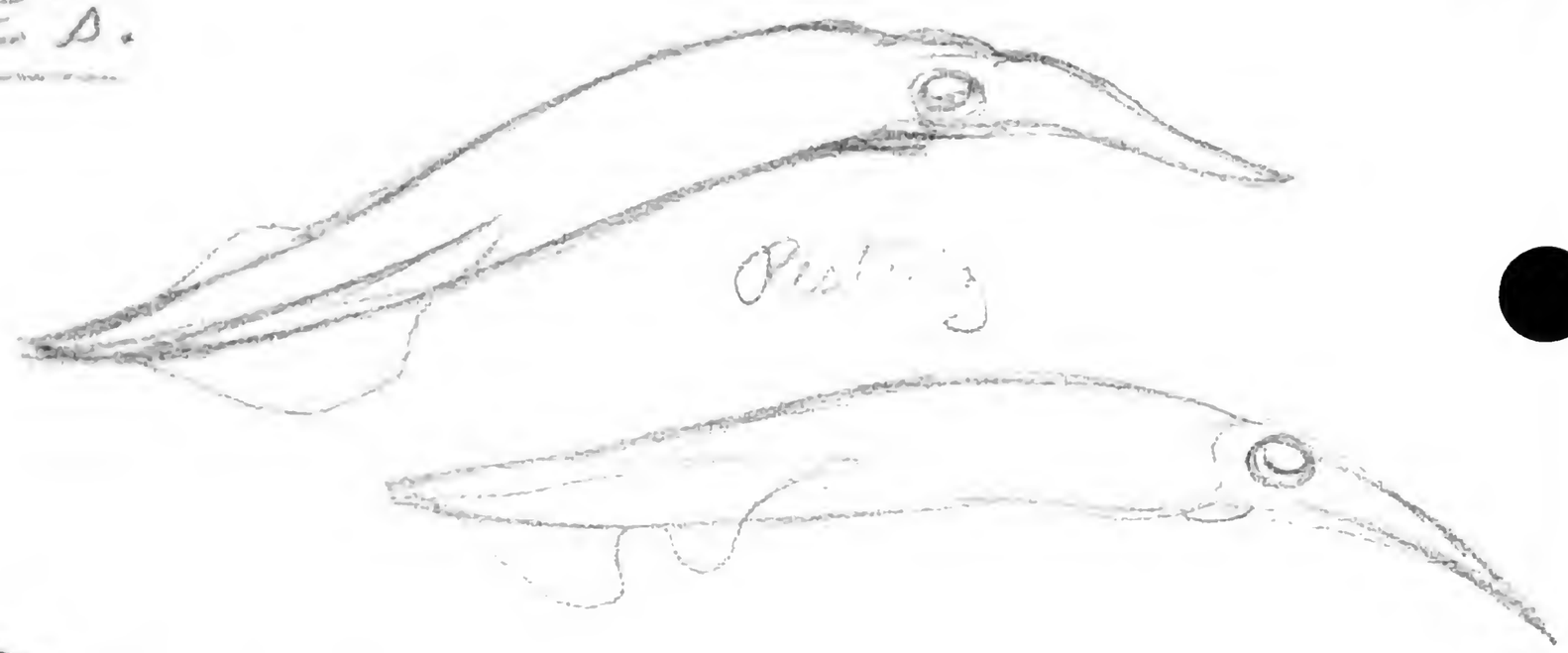
Suddenly everyone, both lepiots and X's, turn Pale, retreat a few yards. Then stop. Resume Onds and Dulls.

Notice that X's have characteristic postures. HD's as seen below. Also some "curved" semi-horizontal postures in

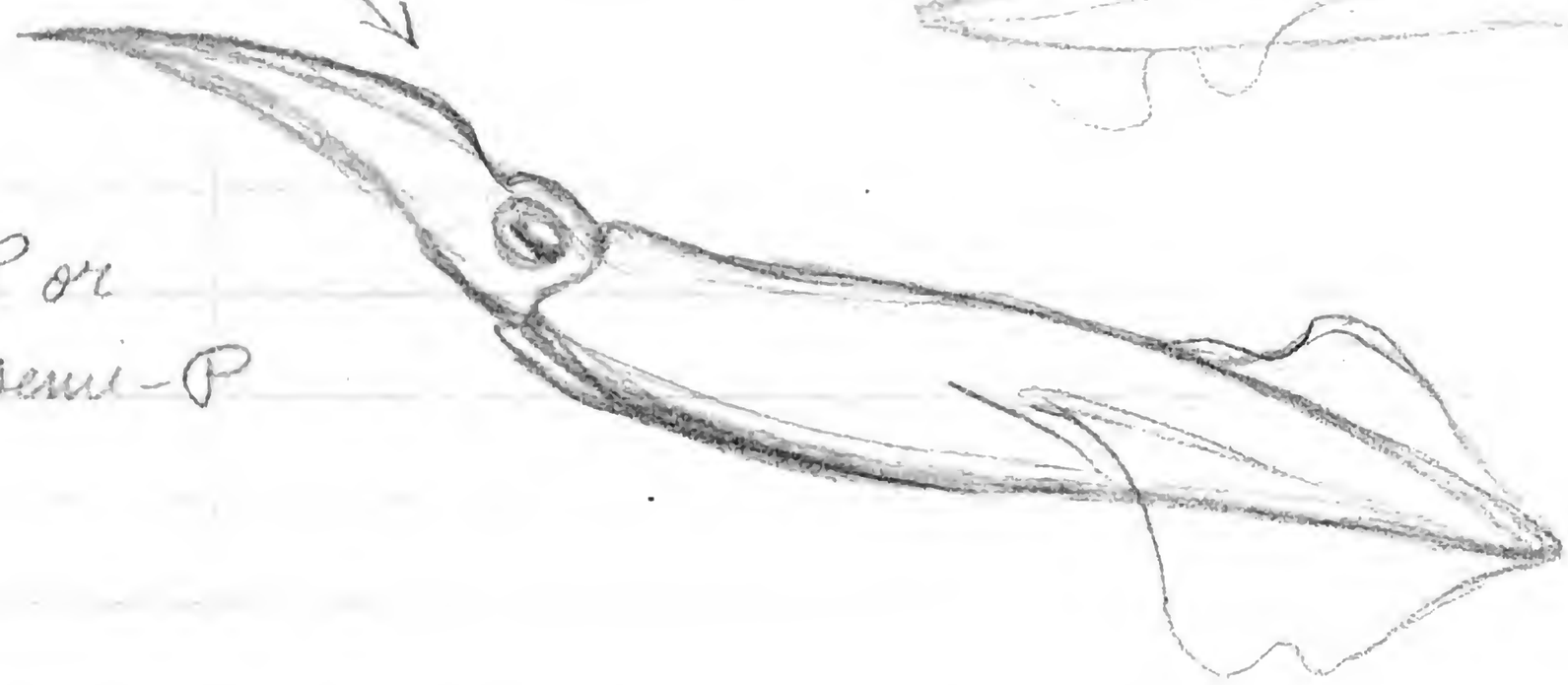
Ceph., June 24, 1942. III

231

so P's and E's.

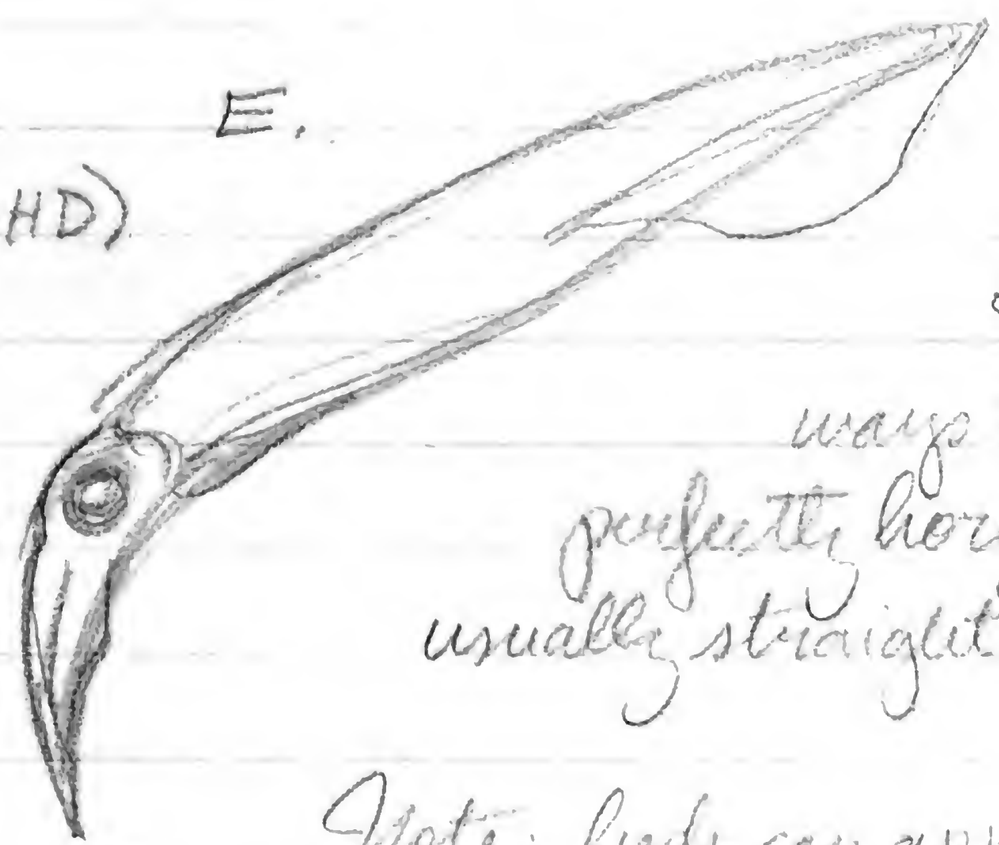


"Spade"



P or
semi-P

One x does E and CL.
9:02 Squirts do E and Dark, to us.
One x does E without CL.



E.
(+HD)

Note: Body is not always tilted in E. Can be perfectly horizontal. Perhaps usually straight.

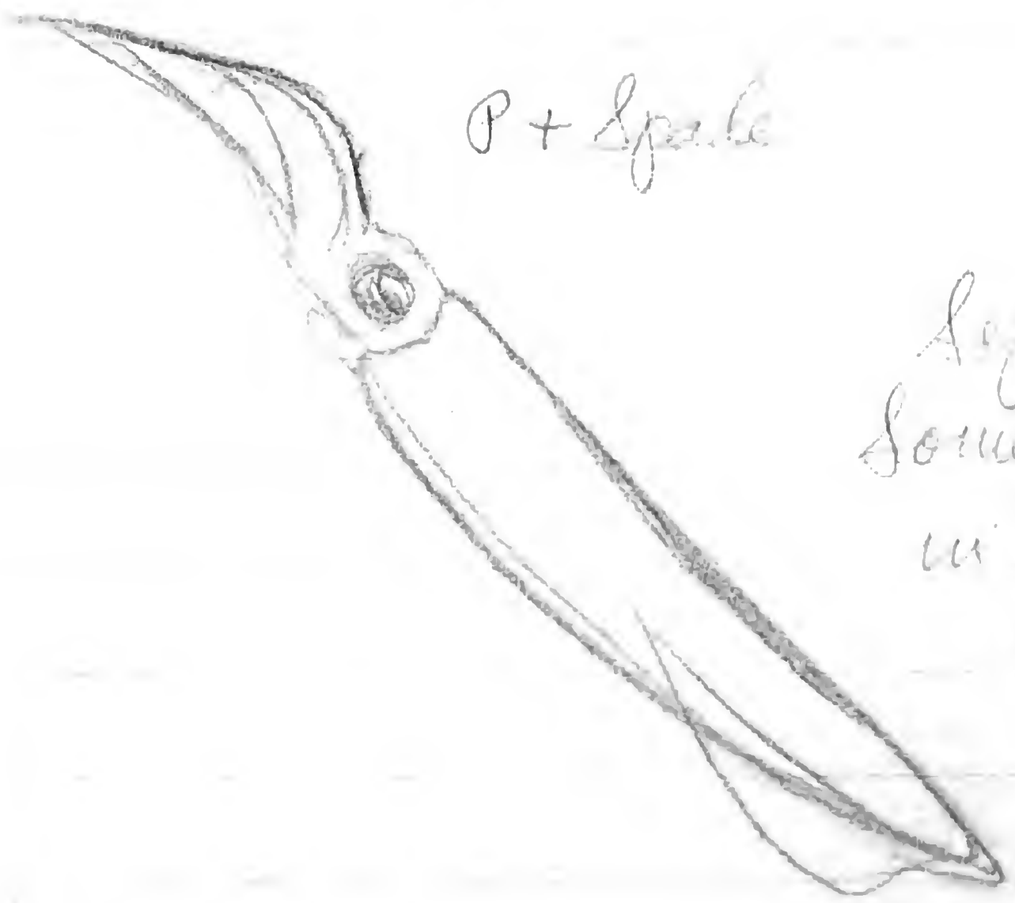
Note: body can appear to be slightly S-shaped in a variety of postures. Not sure if this is "real" or not. It certainly is exaggerated, in effect, by fins.

The lepiots seem to be coming less frequently now. Mornings are quite dark. This is perhaps surprising, but cuvette bottom is very light! They are not cryptic now. Do their darkness and the presence of X's = Spade probably and directed toward the X's?

Most of the X's are in HD. Hamilton start to alternate P's and E's (again). All in Dell, at least most of time. Notice that tentacles seem to be spread at Casa during all or most P's visit. Also, last least some simple HD's. I shall call this pattern "Spade".

Spade
View from above,

Spade seems to be more extreme with E's than with P's or HD's, on the average (probably a fair amount of variation).



P + Spade

Lepiots are also E's now. Sometimes in Dark. Sometimes in Dark +. 9:08. Apparently the E's of Lepiots are not direct responses to X's. Nor are the E's (or P's) of X's direct responses to Lepiots. But I wonder if there could be an "indirect" connection. Are Lepiots doing anything

more E's than they would otherwise because the X's are losing E's? Or vice versa? How does one explain [illegible] communication? (Certainly it [illegible] one another's alarm signals.)

X P's and E's continue. Next week Jule [illegible] with CL. E's more likely to be accompanied by CL [illegible]

My impression is that CL's are more common [illegible] we are far away then when we are [illegible] Do CL "[illegible]" fear? What sort of signal is it, what [illegible] sound [illegible]

The spatial organization [illegible] a "nucleus" of X's, with 3 [illegible] of legs

Continued.

All ends turn Pale and hard off again. Back in Dark at 9:14.

The X's do not seem to be coming. And even the leg lets come back. Gradually the movement (X's) are still 18 inches apart. I forget 9 P. the "[illegible]" that were coming [illegible] (Bones [illegible].)

Now, the Legs start to Rock again. Still little or no alternating. The leg is still P Rig and E Lig from time to time. [illegible]

NOTE: The X's are also still on time. Alternation of HD's and/or E's with P's or unrelated horizontal postures is quite reminiscent of Legs Rocking in physical form. But I doubt it is a display per se. Perhaps normal "resting"? Response to wave action? I may add, however, that the HD phase is usually longer than any contrary "horizontal or up" vessel phase. Is HD the "sleeping" position?

I get out of water 9:15 a.m. Go back 9:27. Anadoc has been little or no pacing in the interim. (He has a snap of 9 RL with 27 Tolerated Silver. SAN.)

Now X's are a nucleus between 2 wings of Legs

One or more X's does CL. Without either E or P. Then more HD by X's. HD by one of the medians is almost vertical. X's still alternating P's and E's from time to time. E's in either horizontal or HD

Cephs., June 24, 1972, VII.

All X's turn Pale and retract. Pock-marked [illegible]
One ind. does lf. L is ND without E.

Not exaggerated

Body [illegible] weighing

I suppose that ND and E are related, but it may be convenient to continue to treat them separately for the time being.

COMMENT: It is really [illegible] that there is absolutely no significant specific habitat, with this genus. So far as the annuals are "resting".

Still CL's occasionally. In horizontal, ND and E are semi-E positions. I can't tell what [illegible] anything, regarding them.

Stop observations 9:40 am.

Going back to same area in afternoon. Still surf, but with more wind. Into water 1:20 p.m. Mixed groups still there, but considerably reduced in size. Flow includes 8 large Sepiots and 5 large X's. Sepiots in Dark. Some do E in Dark. Then some do P in Dark.

All the annuals are very low. 1 ft or less above bott om (in 15-20 ft. of water), still even TC (or algae) and sand. Still segregated, but not quite in same ways as earlier. See diagram on next page.

Cape Jasmine, 1972, VIII.

(236)

X's are very close together. Piled upward. Quite dense "sub-E". All best colonies in vesta. And there is quite close to patch of little "bushes" Presumably cryptic.
(Addition: the X inds cannot be more than 2"-3" apart)

The lepiots are semi-at more dispersed. No closer than 1' at their closest. Now 4 are in E, 3 in P (1 apparently gone). Postures maintained for a long time. Are their annuals also semi-alert? (Are P and E characteristic of annuals which are "disturbed" but still reluctant to move?)

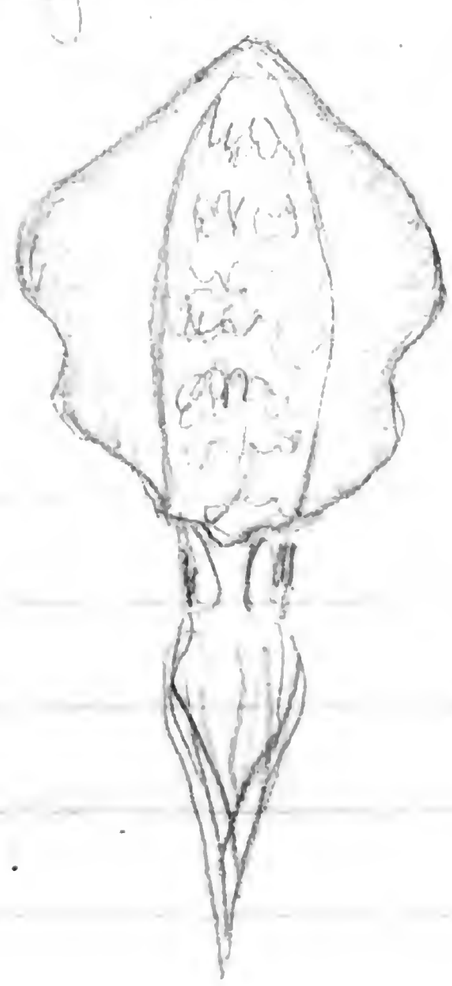
Stop observations 1:35. Arcadio goes for shallow tow. In channel. Investigates floating bangassum. Nothing. Goes around Little Natiga. Completes circuit. As boat returns to our area, the squid ink, retreat, return. Then we go on to offshore reef. Arcadio sees blobs of ink 2:05. Then 12 small lepiots, 5 ft below surface in 30 ft of water over sand. Disappear immediately. We stop 2:15.

Out again after in afternoon. To mixed group site (after Vicki yacht has passed over) Into water 3:40 p.m.

Ogli., June 24, 1972, IX

Found 6 large X's and 23 lepets (20 large, 3 medium) COMMENT: This reasonable range would suggest that the lepets, at least, disperse into rel. [illegible] during the day, "sleep" during the hottest part of the day [illegible] the diurnal rounds cycle: [illegible] groups in morning, small groups at noon, large groups [illegible] afternoon ???

There are some Z-Spread encounters among the lepets. Dark above, light below, as usual and as at Oguguebup. One of the vids. involved in such an encounter seems [illegible] w PH. Notice that the fins are transparent with dark brownish borders in this PH. Quite conspicuous.



The X's are in HD, some with CL from time to time.

Lepets also (still) dominate P's and E's.

Spacing of animals is still distinctive. Horizontal spread shown in diagram on next page. The X's are still in, close to bottom. The large lepets have come up, to mid-water or only a few feet below surface. (They also are showing a tendency to move inshore, nearer to larger clumps of coral, etc.) The medium lepets are lower than the larges of the same species, but not as low as the X's. There are spotted goatfish below the large lepets.

Cpb, June 24, 1972, V.

(238)

Medium spiroids

Row of large spiroids

The X's are often on HD. And the HD's are often w/ step, usually vertical.

3:33 Now seems to be only 4 X's around now. Apparently scattering as afternoon wears on. But see below.

The X just first from us does E in Dull, body horizontal. Then goes vile HD as I approach. Still in Dull. Is HD an alarm, "hiding", cryptic reaction (If so, just the reverse of cryptic upward P of spiroids)? Then this X goes horizontal and assumes distinctive color pattern. The first of a series which I shall call "Neptune" ("Nep" ♆). More or less continue so:

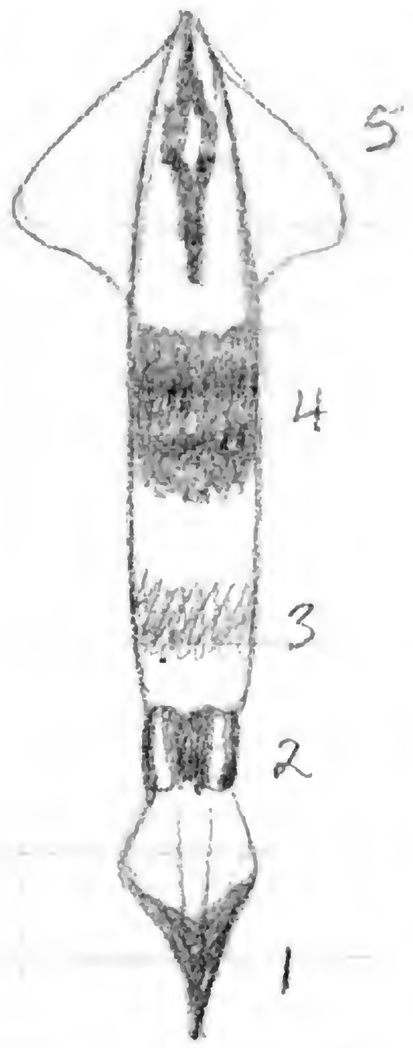
Then relaxes back into Dull.

The 3 medium spiroids are now at least 20 ft away from the others. In contact E and P in Ord +. Turn Pale as I approach.

One X also turns entirely Pale (apparently essentially completely transparent – internal organs almost invisible)

Then another mid. X goes entirely Pale except for mid-body band and "crown". Then gradually goes darker in stitch motions to form a more complicated Neptune [illegible]

Cayh., June 24, 1972, XI (239)



Light spot in center was seen to be EL.

Not now

Light orange in center (left dark in middle, Bas Commissure?)

With "Y" (Olive)

With Spade

Background is blue, Pale, perhaps transparent

Presumably this is not PH ???

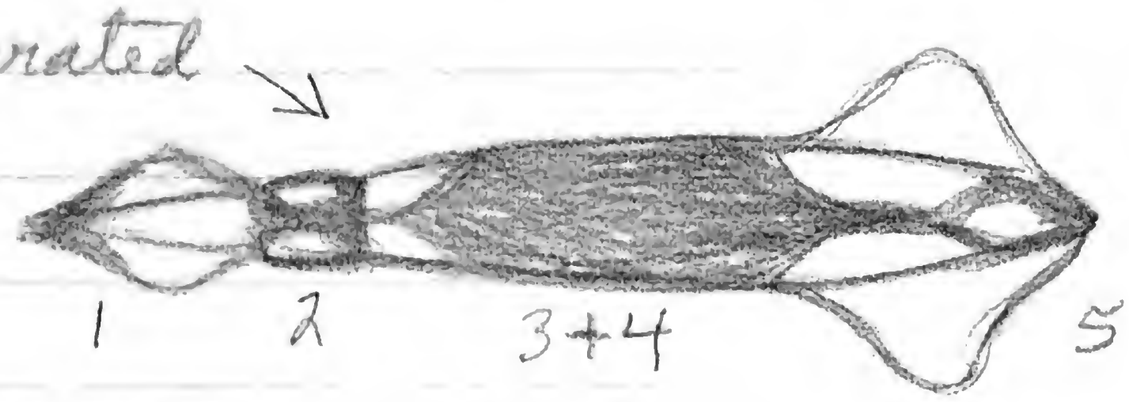
Can't tell what rules are to apply (or perhaps a fish (not Goatfish) swimming nearby.

4:02 pm. Fish swim, then [illegible] Pale and retreats. Then returns. Resumes comp[illegible] as before; all 5 areas dark and distinct from surround.

There seem to be only 3 X's now.

One X assumes still another version of Map

Again exaggerated



Then another and does same (1-2-3+4-5)

(one of the Spades with Map "expands" a little to formulate might be called a low-intensity Spread with "semi-Z" (consequence dark flecks of [illegible] stripes, on arms)

4:10 p.m. Six seals are still near the bottom, still at the same site. But the leopard have drifted slightly farther away. The [illegible] seal [illegible] the leopards. The [illegible] seal [illegible] the leopards. And [illegible] leopard [illegible] on past bottom. Past Dark and [illegible] to Hi Orl+. Then the ♀ measures Orl+ and the ♂ does lateral flicker, while Rocking continues. This pair is "at end of the line" of leopards, but not really allowed.

The ♂ leopard goes Dark when fish approaches. Dark combined with PCA. And also Spade. (Meaning the "spreading of the bases of the arms" which I have seen in leopards before is the exact equivalent of the Spade of X.)

Then the ♀ of this pair goes Pold. The ♂ accelerates and approaches but in a non-known manner of Orl+. Then the ♀ leaves to Orl+. Immediately falls back. Does this mean that Pold is an "invitation" display?

There seems to be other pairs of leopards doing lateral, except slip some distance away from me. But it is my impression that concept slip in general is not yet fully advanced in this group (which may explain why it is still a group).

Lateral flicker presumably is not high intensity, at least not advanced, as a sexual pattern.

I go out of water 4:12 p.m. Go back in 4:20. One leopard does Dark Z-PH with Z spread to an wide [illegible] Orl+ [illegible]

There seems to be a counting pattern in the size of the part group. ? does Pie. ? [illegible]

There are 3 X's still around. [illegible]

The species is very reluctant, [illegible] and is (still or again) [illegible] on [illegible] page 237 but without [illegible] Pale throughout. [illegible] yellow accents. Map, with slight HD. [illegible]

4+3+2

4:30. One of the inds. in Map (the "first") suddenly also turns entirely Pale as a full passing.

Then one ind. does Map in P.

2 - 4

Spade?

I am not sure of the underside

All of the X's disappear 4:32. Due to appearance of jaws?

I stop observations.

But Arcadia tells me that all X's are back a few minutes later.

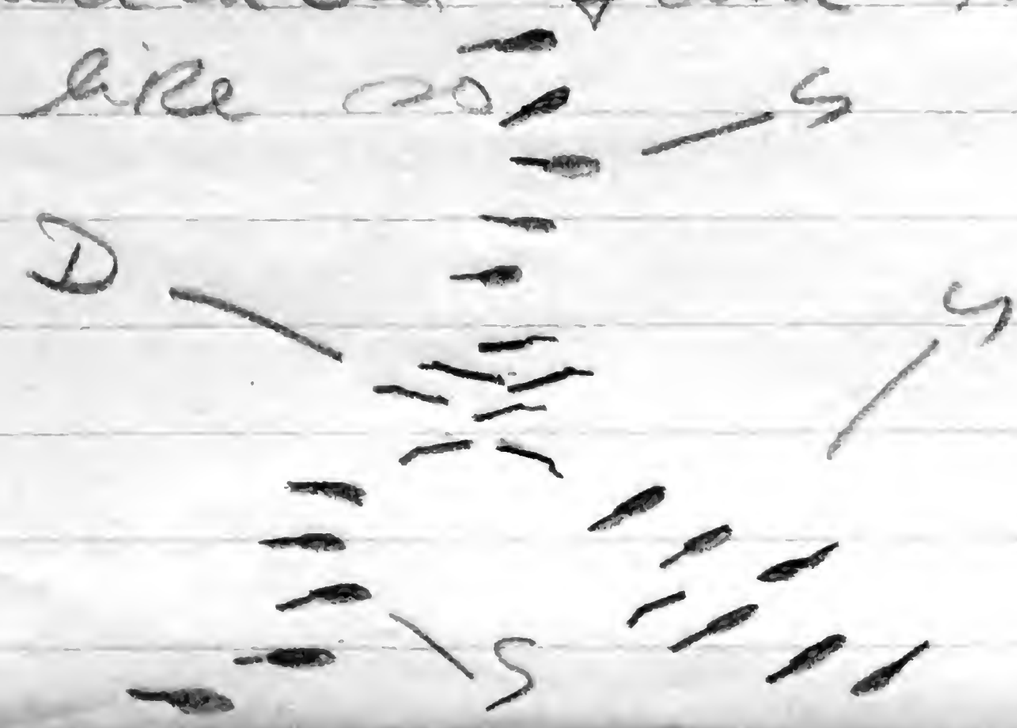
SIAN.

XII

Miatepo, San Blas
June 24 1972

7:44 a.m. The usual crew, I swim out into deep water, lots of fingers, water is very clear but we are unable to see the small crew and the [illegible] and [illegible] I see [illegible] I chase it [illegible] I swim along the bulkhead and see two large brown stingrays & another brownish one smaller than the first but still quite large. This may explain the absence of squid.
I go for Tour at 8:05 a.m. I swim into 7 medium squids, when I see them they are moving parallel to and but in the opposite direction. They are all in PH with fins stripes I follow them but they never stop moving. I lose them in deep water.
I go on with Tour over deep slope of Island water there is murky with a lot of minnows as usual.
Then I get into corally area & sand where we saw 2 courting pairs

last time here. There are a lot of gazers and the water is clear but a little murky in clouds near the shore. Probably from the gazers. I see a sand shark (6-7 feet in length come over the sand in the deep fringe of the reef. It stays around the reef briefly, then goes on to deeper water, I notice a remora on back of its dorsal fin. A few minutes later I see Martin following two large sepiots. He loses them a few moments later. I go for tour around small Miatupo at 8:53 am I run into 26 ind. its a mixed group of large sepiots and 8 Dorys teuthis. The group is not well integrated. The Dorys stayed in a group in the center of the flock and the sepiots out in two or three ragged lines which radiated from the group of Dorys like

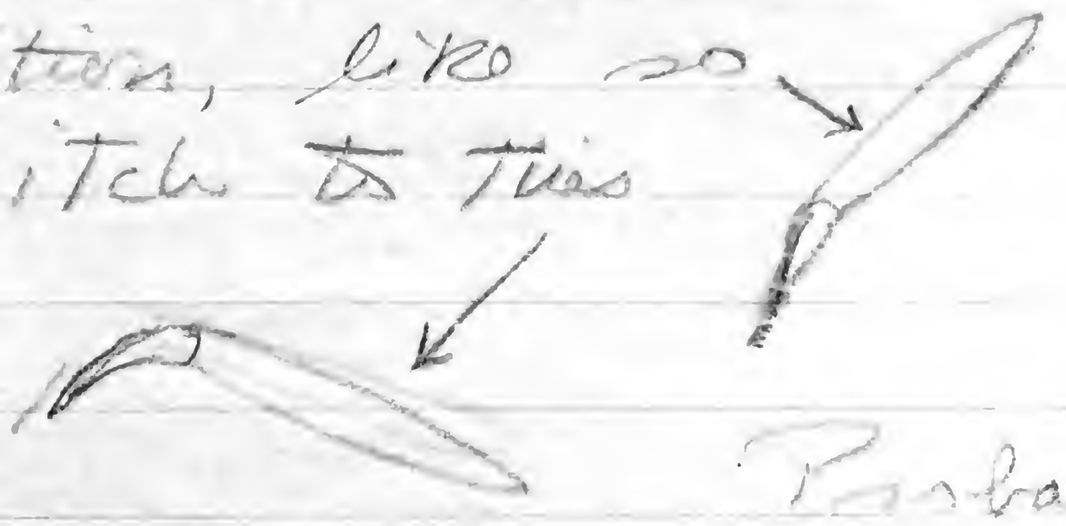


XIII

Mitapo Sam Bay
June 24 1972

Like the Lepitis the Dogs also pale when frightened also they'll go into a light brown reddish embroidery like pattern with pale when they are approached closely by me (fear?) Their movements are clumsy and quite jerky, also very stiff when turning around on center. I noticed some rocking (counting?) but nothing came of it. One I saw them switch to a barred pattern over pale (why?) They seem less concerned with our presence than the lepitis, but they keep their distance. Their CL (center light) seems a little chromic. at one time I saw one approach another Th CL very bright as it to attempt copulation. The ind that was being approached simply retreated without any change in color pattern End of observations at 940 am

1:00 pm On small Y-Lattice drawn same group as this morning. ORD WS PEA When I see the Doreys, they are in an almost vertical arms down position, like so and then switch to this



Probably to watch us better. I am too far away to notice any change in color pattern, but I don't think they did. There are some spotted goatfish in vicinity of group. Squids are close to the bottom just like this morning and less than 50 ft away from where we originally found them. I count 16 individuals, including 8 clongs, one of the clongs is well integrated in the Sepiots group; the other seven are keeping pretty much to themselves next to a group of green calcareous algae HALIMEDA OPUNTIA. The bottom is sandy and the depth about 15 to 17 ft near the deep slope. There's a slight current due east or so and it's a very sunny day. The formation

detrimental probably due to our velocity. The Dingo remains in the cove all day. The Copies get down on the Coral in shallower water. Martin turns Thing (The Dingo) out watching for Dave to get active. He's probably right. The Tuna that we had in Pam Town was at night and they were awfully active. At 1:33 pm I go for tour around island. Some dark puffs, very small (Rickfordiotoutnys Pulchella?) Later on I see some larger ink puffs, probably Sepiots. I head towards our study area in Large Matapa Tow we get out of predators, our barracuda are very active. Look on other side of island 5-6 ft. Seemed interested in trap set there by the Indians. Just around island, on lee side I run into group of 15-20 med & large Sepiots. I come upon them rather suddenly. They ink and bolt. They'll probably be back to same place, end of Tow 3:15 pm

3:45 pm Back to small Mantas
the Aspots are still over the reef
and the Dogs are over sand by the
calcareous algae. The dogs are
too well integrated. The Aspots
seem to be paired off, not social
sexual activity, but RIOR-WS pattern
Aspots ♀? were paired to a generally
PH WS spotted ARMS ♀? I noticed a Aspot go
slowly from an ORD & WS pattern into
a zebra with flaring of arms, fluttering
of body etc for no apparent reason
at all. Then it went back to ORD very
slow. I see 18 aspots in the group
now. I also noticed that RI-ORD-WS Aspots
keep flashing their rear light on the back
of the body facing their partner, even
though this one may not be displaying
a flutter or copulatory advances.
The male was usually in a dark PH-WS
with spotted arms. 7:15 pm Dive & Tour
on small Mantas. Spotted Dogs in
a group of 8 in same place I left
them earlier, but started moving away
as soon as the light hit them. Did
not see any aspots. Covered the bottom
like sand and coral dips down to
30-35 ft but no aspots. Do They

XV

Mintupo, Sonsbles
June 24 1972

go into deeper water at night or does the group disperse and then regroup in the morning?

Tok, June 24, 1972, XIV.

Fantastic light at night.
2:15 p.m. Just [illegible] show-up. Large Pair? Stag low. In Ord (+) upper Dark

June 25, 1972
San Blas

Still at Indigo. Lots of [illegible] night and at dawn also local fishermen. But everything calm and clear now. Go to nurse group area. Into water 8:00 a.m. Cold. Moderately clear.

Find group ca. 25 females almost immediately. 3 ft up in 8 ft water over coral and sand bottom. Group inds. range from large to medium. Include at least 3 courting pairs.

Lots of Pseudo ♀'s, correlated with Double Streaks + Fin flaps, or Double Streaks alone by ♂'s. It is my impression that ♀'s tend to assume Pseudo before ♂'s get their Streak-flaps pattern. But I also saw [illegible] that the ♂'s are in response to approach movements mostly by the ♂'s.

One ind. suddenly retreats a few feet in PH + DM. When not in normal or high intensity hostile display, most inds. are in Ord, WS, Y, PCA. Two inds. retreat before a fish in Dark. But Dards seem rather less common now than during observations yesterday. Why? Could it have something to do with T° regulation during periods of repose???

♀ in Pic. ♂ follows in Ord +. Bottom Rock
♀ in Pic. ♂ follows in Double Streak. Bottom rock
[illegible]

All the squid are more or less in line. Pattern is ugly, the two most inland contains [illegible] the line, next to (but not interfering with [illegible]. It is more common to see contains [illegible] of a line)

2 of our pair and 1 is so approaches [illegible] Double-Jen-Stripe. They do not use bad [illegible] more or less horizontally. The 3rd shows after [illegible] fast twisting chase, extending for 10 yds or so and [illegible] yds. Both inds turn Pastel or [illegible] between Pastel and Pale. Then chase stops. 9 resumes O [illegible] and [illegible] Ord +.

Another fast twisting chase between a [illegible] (don't know if same inds or not). Both inds. [illegible] between Pastel and Ord. And both [illegible] manner. The chase attracts a 3rd ind., presumably other ♂. This 3rd displays to the other two. Does PH with [illegible] facing them. PH, not Z, markings on arms. This seems to [illegible] due to the pair. They move on more slowly in Ord +. 3rd ind does not follow. Also resumes Ord +.

Same pair a few minutes later. 9 does Pa [illegible] DP, as ♂ approaches in Double Stripe (and Jen-Stripe?) [illegible] twisting chase with extreme fluttering. Both inds. again assume intermediate between Pastel and Ord. A 3rd ind. (same?) approaches in PH. Chase stops. All relax.

8:17. Same pair starts again. 9 [illegible] Double Stripe. Fast twisting, fluttering chase develops. 9 [illegible]

Cayo, June 29, 1972, III

auxs in Pic throughout, but ♂ gets into Postl. Then (again) 3rd aux appears in PH. No ♂ seen has been joining the ♀ does PH, with first ♀ down on arms, back all white.

[illegible] fish are swimming through and around [illegible] but not at all.

Then Pic [illegible] chasing ♀ along in Pic, ♂ always in Double Flash, with no other Fin Flips.

Then there was a [illegible] bottle in water. Possibly between 2 ♂s (?) [illegible] does PH with ♀ and 2 markings on arms. The better ♂ is [illegible], has belly light at the time, almost cutaway, also Fin Flips.

Now there was two going ♀ in Pic, followed by ♂ 1 in Double Flash and Fin Flips, followed by ♂ 2 in Ord +.

Courtship behavior is nearly continuous this morning. So far it does not appear (to me) to be very high intensity, but seems to be there.

2:30 Repeats look for X's. No sign of them. Definitely not at all [illegible] coming in. X's must be much more mobile than repeats. Is this because they hunt their prey actively? What can their prey be? Which brings up another subject. X's must be largely nocturnal. And at least some repeats also are at least sometimes active at night. Why are most cephalopods nocturnal? Is this true of relatively large predators in general? Even on land?

Out of water 8:35. Back in 8:45.

Repeats still there. Behaving as before.

[illegible] adults all leaving

Cephi, June 25, 1972, IV

3 pairs of lenses behind. He pairs are still coupling, [illegible] by middle. Each pair about 6 ft from [illegible] Not the others, the bulk of the group are [illegible] ft. away.

A male starts up at 30 ft away, [illegible] squid do not react in any way. [illegible] But the main body of the group [illegible] back to the [illegible] pairs, away from the center of the boat and [illegible] significant?

Go to look for Y again 2:55 p.m. Not in sight.

Back to Sepioteuthis. Motor [illegible] at low active. (But Ariadne tells me that [illegible] a few minutes earlier. At edge group 300.)

Out of water 4:05 p.m.

Going to visit some other islands this afternoon, heading out toward algal ridge. Start with Orgetipo. Not [illegible] enough. Get into water 12:50 p.m. Nice ref. Floating [illegible] Lots of small sardines in dispersed formations. No squid. 1:15. Stop. Then out to Muchutipo. Arrive 1:30. Ariadne does shallow tow. Over large TG flat, then sand, then more TG again, more sand, and finally more TG in very sheltered bay. No squid. Why? (The whole area is very [illegible] of the "nursery" on Ponetipo.) Stop 1:55 p.m.

Back to area of mixed group near Muatipo. 2:15. 9 large Sepioteuthis still there. In end, same place as the morning. Ind, WS, Y, PCA. One ind. does E on Ind + to us. Another does PH with spread, Z on arms, presumably also to us (?)

Go to look for X's. No success.
Back to depth 2.20. Finds still in Ord, WS, Y, PCA
rest of time. One ind. has extreme PCA with fade Comme
ce.

Presumably tentacles. Quite transparent.

Indicator of arms

Then several of the animals, presumably females, go into semi-Pastel. One presumed ♀ combines semi-Pastel with dark marks of Pie.

Then several inds. go Dark. One ind. does extreme Curl in Dark.

2.30 p.m. Two inds, presumably pair, suddenly go into (what I suppose) a cryptic pattern. P with body nearly vertical, with Ord, WS, PCA, and possibly Spade (with tentacles brown, not transparent). Low in water. Just beside and slightly above gorgonian. See sketch next page.

Then one of these P-vertical-cryptic animals does PH and Spread Z pattern on arms, when 3rd ind. approaches with

in one foot. 3rd retracts the other, rises on cuttles

[illegible]

[illegible] us.

Then pair goes P-cuttle again. Then in staghorn coral. Is this posture a mating posture? Then another pair [illegible] on bottom of all fours. Entire, dark (medium brown) below, except for funnel, which is transparent.

Another vid. is [illegible] Each time it retracts a few feet and seems pale. Then, when [illegible] stops (goes away), the squid advances again in Ord+ and Curl. What does this tell us about Curl? A "relief" pattern? A "Twinkle Display"???

There are Spotted Goatfish around (still)

Courtship is still continuing, at a not very high rate. Not among the vids. being cuttle near the bottom. But among the others, who are swimming higher up. I see one female approached by 2 ♂'s, at about 7 minute intervals. Each time she rises, Pics, DP's. The first ♂ is in Double Streak-Twilstripe during approach. Quickly [illegible] assumes Ord+. The second ♂ is in Quadruple (perhaps even

[illegible] – I can't see Bill) Stick plus tail flings during [illegible] (Use measure [illegible] of [illegible] good [illegible]. Note: [illegible] Mission not an established [illegible]. [illegible] and [illegible] [illegible] or [illegible] [illegible] (see [illegible])

Stop [illegible] 2:15 pm.

Again [illegible] Stop 6. Into water near shore 3:35 pm. Human Minds. The [illegible] movement is characteristic: extensive TG, some [illegible], a fair amount of sand, large numbers of Dasyatis, many butterfly rays, many stingrays. We swam around until 4:20. Then Arcadia goes for shellfish-tow until 4:50 pm. No squid.

This is not perhaps surprising. The concentration of detritus feeders so great here, which, as to suggest that there is too much debris for squid. Some [illegible] of the TG.

It does not, however, mean that adjacent habitats are unfavorable. To wit: the [illegible] open water.

The Jettys [illegible] quite far off shore here. In fairly deep water. And small (tiny) squid start to appear by the ship fairly soon.

6:14 pm. 3 squids near surface. Fairly or less Ord +. Rather scattered, 5-20 ft apart. Soon swim off.

7:15. Running light. 4 squids (tiny) appear at surface. Not very close together. More or less Ord + at first. Then the arms and tentacles of one vid. turn entirely white or transparent. A few seconds later, same vid. does upward V [illegible] (arms [illegible] or transparent?) The [illegible]

Cepl., June 25 1972, VIII

wd. does V-Cwl.

The wds. drift off but [illegible] repeat collections of sounds like [illegible] unthing. Less feeling. [illegible] almost as long as the [illegible] Ord + ? When far out, Can't get SAN

More legends, words [illegible] later. SAN George Ord Yoagan

June 26 1972
San Blas

Still at Salar Grande. Some bat clouds. Very windy. Water rough. Go over to (another) island called "Orgulujo" (aw. II on "Orgulujo de Salar"). Anchor stays shallow to 7:45. Goes all the way around island. Then on to adjacent island of Ikunpsu 8:02. Tows all around island. On to adjacent small islet ("Yantupo"). No squid anywhere. (Note: the islands here are rather scattered. They do enclose a "lagoon" but only very partially. I.E. the rough weather is having full effect here.)

We go on to another larger island (name unknown) 8:35. Almost immediately, Arcadio sees puff of ink. Then sees one in approx. 20 ft of water. I go in. We swim around until 8:55. Find more puffs of ink. All small, black, near surface, in deep water. I.E. probably emitted by small squids. But the animals themselves remain invisible (Apparently generally not always shy!)

XVI

Maitupo Lou Blas
June 25 1972

8:01 AM Resume diving in same area as yesterday at Small Maitupo 28 ind 6 mod. OPD-WS-PCA I notice 2 or 3 counting groups still have keyed counting. They are in a separate formation. They are in 7-8 ft (3 meters) water, sea fan gorgonians and small grazers everywhere, lazy about and then one darts through the group, the squid nearest to the passing grazer PH-WS but does not attract much. I notice one of the paired females flutter without the RH first male seems a little excited in PH-WS with dark mottled arms but does not make any advances. Second male cuts in with no fluttering also in PH-WS. DMA but does not press on everything cools again. Every now and then I notice a female pair and a little bit of fluttering from the males, but not much. Everything seems quite dull.

Most Terns are beginning to peck up two males display zebra & flatter and flare, depending male under attacker, preventing attacker from approaching ♀ then depending ♀ shoots away from attacker goes light very light lowender and flutters as he approaches "pied" ♀. the attacker follows behind in a Z pattern. Depending ♀ attempts cop. but fails. Attacking ♀ again approaches and depending ♀ hits him with arms rapidly as in copulation. Attacker ♀ falls and retreats rapidly. At this point there really start picking up there's at least 3 pairs attempting cop. at the same time and they are darting in and out of the group in all directions. The ♀ are all pied RL, their RL moving from one side of the body to the other always to the side from which the ♀ may be making its advances. The males are fluttering and lowender everything is moving rapidly. There's at least two second males, each following a courting pair and they are in Z & DF and also very excited, for

XVII

Miatupo, San Blas
June 25 1972

a while it looks like a free for all. I cannot take notes and watch. There is one (I think) successful coupling. I see the female in light ORD-WS bunching up her small arms as if arranging aperture spikes. Everything cools off again. Minutes later, I see 2 juveniles approaching the main group. They are close to the surface and travelling arms first like so in banned pattern. I approach them and they start to swim towards open sea. I photograph them and they change their posture several times. I go back to group and a few minutes later about 15-18 of them leave moving arms first as if to investigate some occurrence that has called their attention. They all are in very light ORD pattern I do not detect a WS. 9 ind are left behind. Before the group moved away to investigate? these 9 ind were all below the group that left. I notice 3 pairs

and perhaps a fourth group + I attached males. Thus, a switch from a wild but everything is pretty dull a moment to observed the other group and immediately notice a frio counting. Their movements are terribly fast and accident. Both males and in 2 most of the time except when either is approaching the female to attempt copulation. Both males are large and dark styl. This is real competition, though one seems to have already established supremacy. The female is almost constantly in "PIC" & RL moving very fast and passing one advance of the another, her RL switching rapidly from one half of her body to the other always to the side from which she was being approached. She is almost always swimming rapidly and darting in every direction. Every now and then the males will flare & ⚡ at each other, then the female will stand by out of waiting the outcome, then first ♀ would resume the chase while second ♀ attempted to beat him to it. Fluttering males seem to display a dark inner line on the lower section of their mouth

Niatupo, Low Blas
June 25 1972

its not conspicuous but fairly easy to detect once noticed. Finally just made successful in coupling with the female. The second male following behind in 2 feet but as action decreased gradually. They were still at it when we left Tues, but all may have played. and of course, at 9:15 AM. 9:45 received [illegible] at same area, and they dull. Then went for tour around around Niatupo, no other groups. end of tour & deep tour at 10:45 am.

ORGITUPO, Lemon Keys NOT FAR FROM Niatupo 12:50 pm We explore the area The bottom is covered by heads of coral and large clumps no squids we stop observations at 1:20 pm. Then go on to Huichutupo and explore, the area lots of TG some sand areas with starfish no squid we stop at 1:55 pm The area looks interesting, ideal habitat for young as well as large squid

Arnold Ritzpo 2:15 pm 5 large ind.
18 ft deep sand near coral ORD-WS-PCA
very light. I see one approach the
group arms first, does a circle & turns
around joins the group and I then
goes ORD-WS and does an E and
rocks. Then a ♀ peels from the
group and heads to me and meets
an approaching ♀ she "pies" and
♀ flutters as he turns around and
goes parallel with her to the group.
More squid come in from deeper water.
I go investigate but find no more
squids. The water is not very clear
and the squids are behaving very well.
I see two ind almost vertical and
parallel to a gorgonian. They are in
Dark PH & WS PCA with wide fin stripes
and a wide ventral stripe. At 2:41 pm
there are 10 ind. in the group. They are
all in PH & WS it occurs to me that when
they are all in a uniform pattern, there
will be no action. End of observations 2:45pm
Salon: 3.56 pm I swim and tour over
T.G. areas, sand, and coral, lots of
sea urchins spread all over the place,
also sea stars no squids. end of
observations at 4:55 pm

XIX

Lake, Sin Blas
June 25 1972

Nightlight [illegible] 7:15 pm.
[illegible] and
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] swimming [illegible]
[illegible]
[illegible] flying.
The [illegible] very close to the
surface, and [illegible] right out. They seem
to [illegible] something then go on
with the [illegible] to swallow it. Probably
copepods. There's a high concentration
of them in the immediacy of
the light. I noticed two such
separates, extremely small. So there
must be absent to separate in the vicinity
of the light. Given this takes a minimum
about the same size as the first and
then a third follows suit. This last
one caught a smaller minnow than
its predecessors. Again another attack,
they feed upon a very small organism and
probably a small cockleteate, for

an instant later the squid lets go of [illegible]
and darts away from and clubbing the
arms, violently into strings. Another
successful attack. The squid [illegible] Spin
bombes the arms then
slowly mantle first with the [illegible]
tracking long.
Now a medium size squid joins the
show darts in in dark reddish brown
pattern grabs a small organism and
darts away in same pattern plus
M.D. Now I see a juvenile attack,
its in dark reddish but patterned as
"pie"? It succeeds, and darts out
again without changing pattern.
End of observations, at 9:30 pm.

Mon we go to Pohnpei. Weather were sunny now but still windy. Go into water 10:30 leave our new, wide areas, to flat and long [illegible] sunlines. Just off Steadfast Point [illegible]

[illegible] at [illegible] Jefferson Lower but [illegible] [illegible] Go into water 1:25 pm. Warm but not very clear. Lower overturned area another side of island. Total number of Rabbitfish. 1:45. Find black ink in 5 ft of water gun TG. Squirts little, find more ink in deeper water. But we can't see the squid themselves. Usually stop at 2:00 pm. NOTE: It is interesting that the squid of this island are much rarer, shier, and for at a different stage of the annual cycle from the squid of Palauan which is so clearly.

Mon Arcadio goes for shallow-tow along reefs between Pohnpei and Nukuoroh (?) and around the Cotton. No squid by 2:45. So we stop.

I go into water to inspect another rope of Jettings by Pohnpei. Still no squid.

We moved by [illegible]. Arrive 5:45 pm. I go into water, in shallows by boat 6:00 pm. Results poor. Several small Barracuda around. No squid. Also inspect another rope. No squid. Arcadio goes for shallow tow. No squid. Out of water 6:15 pm

Run lights at night. Nothing by 8:30 pm.

ADDITION. According to Arcadio, nothing came in later either

January 17, 1972
New Bedford

Copulating. Both Vegetative. Approximately
[illegible] Tow along with Fulvescens [illegible]
Cordwalkers, 7:45-8:00 [illegible]

Then we went [illegible] to see Hand [illegible] about [illegible]
edulis. Group of 6 larges and 2 nuds on [illegible]
ow). See James Nutter dolmet. Nu 6 larges [illegible] 3
paws. Approximately 25 down in [illegible]
very steep here). [illegible]

All nids in Ord + most [illegible] Nag
es contains courting, [illegible] +

The pair of largest larges is at the end of [illegible]
and courting most intensely, ♀ goes [illegible] with DR →
follows, fluttering in [illegible] perhaps faint trace of Pastel
Streak and Tan Stripe. Then there is a brief turning chase. Both
nids. in Ord + with perhaps trace of Pastel or semi-Pastel, per
haps stronger in ♀ than in ♂? Then the 2 nuds. move more
slowly side by side. ♀ does a little writhing (not extreme, most
tips of arms and tentacles) from time to time. Has she already
been copulated with? Both nids. in Ord +. ♀ shows trace RL
Incarnadine (not correlated with writhing). Then the ♀ shoots
backward. The ♂ shoots backward after her. Both in Ord +
at least above. But ♀ also has "Spotted Belly" below
(small dark spots on light ground, as in some Z populations)
As the ♀ continues to shoot backward, the ♂ still follows but

XI Salar, San Blas
June 26, 1972

Departed [illegible] 7:51 am. Tour around island [illegible] real bues, flat with [illegible] in [illegible] & [illegible]. The [illegible] is flat and [illegible] [illegible] good [illegible] per [illegible] 8:25 am. Unusual [illegible] 8:37 am coral [illegible] [illegible] and deep [illegible] with occasional coral and [illegible], plenty of [illegible] squids are [illegible]. 8:55 am

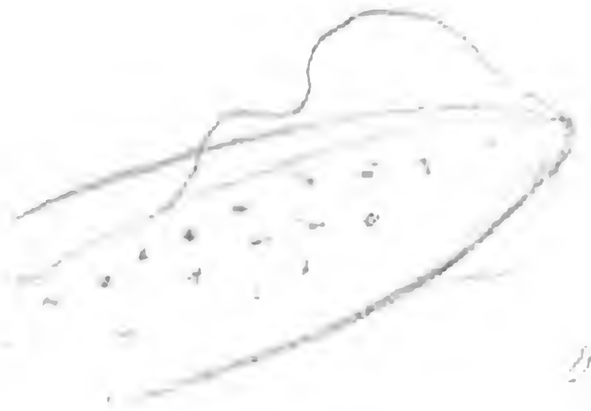
Porvenir 10:58 am on front of Pangle Gem's hotel slight [illegible] lots of jelly fish [illegible] shallow [illegible] [illegible] coral reef, some rubble. There are lots of striped blue jacks. N head towards dock side of island. water There is murky with churned sand, no squid [illegible] of observation 11:42 am, 1:27 pm Go for swim along west side reef (Porvenir) [illegible] putts

but no squids 2:02 pm. Then go
for Tow along reefs in front of
dock at Portlock and all the way to
Wichob Inala, around Tuna island and
back to Portlock course [illegible] Out
no squid 2:55 pm
Ogopukip: 5:50 pm [illegible]
anchor line to shoal [illegible]
sandy bottom and sandy post
65 no squid 6:00 pm Then go
shallow Tow along west side of
island and back to ship lots of
large anchovies, grunters and
jacks, and large barracuda, no
squids. Bottom TG and shallow
with usual beds of coral and
sponges. End at 6:30 pm.
Night observations 6:30 pm
Sardines and copepods, no squids
end of observation 9:15 pm

Capb., June 27, 1972, II.

[illegible] to feeding, about the arms and tentacles and to touch the [illegible] "mouth" [illegible] contact. Defensive cap. [illegible] reversible [illegible] cap. [illegible] [illegible] pressing [illegible] [illegible] Spotted Belly, ♂ Texas PH [illegible] and cut [illegible] Fallen relicts, ♂ residents [illegible] + [illegible] Fallen called, both in Oral + Nort. [illegible] [illegible] [illegible]

Cephs., June 27, 1972, III



Recorded in the Eastern
Nine Hours Observation Y.
Rudolph Lewis

8.20 a.m. All the spread seen
moderate speed without leaving the surface of the water.
Ray? Beak seen unused.

2 Pelicans go South. Black Hen yellow Beak Pelicans
Now I notice that ♂'s of course are larger. Flocking
with them ♀'s often (not always) have white Breast
(light white or light blue) beneath the Eyes extend while
length of fins. Continuous and Gentle Pattern to the
fin movements more common than Sharp Gentle
Glide. I shall call this "WE" Now I know I have WE
that I am watching now seem to be using their fins more G
not fluttering.

The ♂ of one courting pair has bred, slight pull with
Z spread when a 3rd and approaches pair. Latter retreats.
♂ relaxes.

NOTE: There do not seem to be any red "lines" in
this group now. Is this another indication that pairs are comparatively well adjusted and advanced? Probably yes.

Watching one pair rather relaxed now. Interesting
size relationship. The presumed ♂ seems to be slightly larger than
the presumed ♀. Contours not shorter. But the presumed ♀ is not
really plumper. Presumed ♀ does occasional Pit, usually
without rise and DP, as the 2 animals swim together. Alive at
least 1 bud Pastel or semi-Pastel. Otherwise in more or less Ord+

[illegible] Two with dark markings of Pa superimposed upon Ord & Postal Airs at C-[illegible] & [illegible] unknown, temporarily PCA Cacalos [illegible]. Presumably "[illegible]" & Quite out with a blown [illegible] of [illegible] [illegible]

Cattleyanum

Acrorhodopsis

Stripe in Transparent, not white or blue as in WB. Check of Transparent [illegible]

corresponding exactly to the light stripe of (WB.) I shall call this dark stripe "BB".) Like the WB's, it is concealed, the BB was coloured with apparently minimal pigmentation.

What are the functions of WB and BB???

Both the ♂ and the ♀ have "Spade" all or most of the time. I call, developed in both (i.e. not modified by extreme PCA of ♀) I note particularly, and know of it. And well, there for, there is [illegible] of regular descriptions. The bulge is definitely due to outer arms. Not tentacles. Probably outer arms

so I suppose now all the others, "Spades" of this are time.

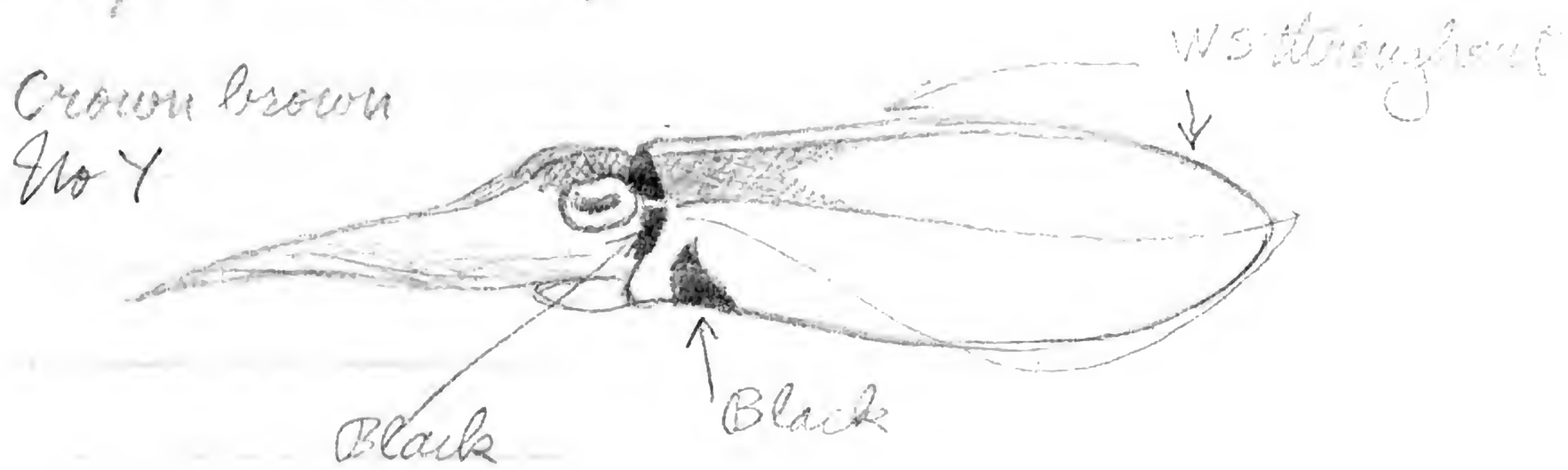
These outer arms, unlike are quite transparent, in the particular part at this particul

NOTE: The "Spade" is difficult to see, or, at least, to notice. I am not sure that it is ritual-used in descriptions. And I can't

Ceph., June 27, 1972, V.

tell if it is rare or common.

Set out below is a sketch of a medium high Pelag. ♀ (at intervals at which some of the females [illegible] DF and/or semi-Partial)



Countship seems to be breaking up since 8:37 a.m.

Group has become larger (as would be expected as the morning wears on). There is now one more medium. And 2 smalls have appeared 10 ft away.

Group is also showing a tendency to drift into shallower water. A sign of relaxation?

One medium does what looks like Bar on underside! With PH above???

Smalls do DF without color change during brief rebirth.

Stop observations 8:40. Arcadio Tow back to boat without seeing anything more.

Go back to same place 11:00 a.m. Sunny, still windy. Find 18 squid at almost exactly same place as last. 2 ft down in 10 ft. of water over staghorn coral. (The increase in group seems to be due to addition of 1 more medium.)

Squid retreat before large group surgeonfishes (Ac. authurus) But not far and without changing color.

Cgb. June 24, 1972, VI

There is still some courting in progress. Some Pies. One pair of Larges in semi-detached at end of line.

Watching another pair, this detached at other end. Both Paul & Pat [illegible] and Rolling together, Pat usually short [illegible] Pat on Pat's back. [illegible] relaxes the [illegible] [illegible] of the following performance. Pat has DP on Paul at [illegible] time. ♀ does accept Pies, with mis and DP (and of course BB). [illegible] ♀ receives Ords & betw en Pies. He ♂ seems quite erect. He makes many accelerated approaches to ♀. Also does lots of Bending. He does not change color. Each time he gets close, however, the ♀ (in either Ord & or Pie, whatever she happens to be in at the time) the ♀ (also) assumes Spackled Belly. Her pattern is more complex, morphologically, than I thought. Spots over whole lower surface of body, small and roundish on sides, below fins. Larger, more barrelike near center of belly.

Crude Approximation

His behavior continues for several minutes. Pies and Ords with BB, retreats, occasional Spackles by ♀. Ords, approaches, and bends by ♂. Twice the ♂ shows trace of Double Streak - Tri Stripe during approaches. But their patterns are not very extreme, more or less superimposed upon Ord &. Both mids may show brief flush of semi-Pastel on Ord & from [illegible]

swimming head forward. And ♂ suddenly, a bit forward, gets ahead of ♀, turns toward her, darts his arms & tentacles at her forehead, turns back, and falls behind her. He does all this without any color change. Hunter: the ♀ seems to be in Ord + before the mating cop., at least about Sleeve on her belly. The ♂ untangles, moves ventral but I can't see that the cop. was successful. The ♀ immediately leaves! still in Ord + (BB etc) after contact. Hunter: the ♂ with arms as if arranging spermatophore(s). But the ♂ under ♀ does not seem to be new "relative". He moves suddenly forward after only a few seconds. He moves appreciably and turns in Ord + and Diagonal semi-Pastels. ♀ moves sideways and rises in Ord +, Pie +, BB, also with occasional semi-Pastels. The stat. mottle does sparkle. Bell: when ♂ gets close. But then the ♂ gets behind ♀ & in Banner. The 2 animals resume swimming more or less together.

11:17 a.m. Group seems to have shrunk to 15. Small crit gone?

Most of the remaining inds. have gone Dark. Notice that fins are dark in Dark. Ocelli on back and fins run out. 2-3 inds. have kept a trace of WS, but the others have lost it completely. Most of the animals are still fairly near the surface, but it looks as if they are beginning to rest, to take their mid-day "siesta". Some inds. are floating more or less horizontally. Now are in a "HD", ind. nearly like the HD of X!!! 3 or 4 are in P with body oblique. These P animals are near a

Ceph., June 27, 1972, VIII.

Gorgonian. ♀ ♂ thus are cryptic

HD of medium depth
Only eyes of female light

Nidorella extrema

One ind., large, apparently ♀, near Gorgonian, assumes extreme E in Dark. No pressure mate and several neighbors continue P in dark. Then I look away for an instant. Turn back to find pressure mate of ♀ in lateral silver (unusual orientation, silver side away from ♀). The ♀ comes out of her Dark E, changes color. Goes "Bar" underneath (Ord + above ???) Is this reaction to approach of neighbor? Then both animals relax (?). ♀ resumes E + Dark. ♂ goes Dark in more or less horizontal position.

I go further away from these animals. ♀ stops E (i.e., her E was a reaction to my presence). Then assumes "cryptic" P with upward pointing body. Still Dark. ♂ also assumes P with upward pointing body.

Dark must be resting color (among other things). Resting postures can take 2 forms. I. P with upward body. This is most characteristic of animals near gorgonians, corals, etc. II. HD. This seems to be most characteristic of animals in more

Capsule, June 27 1970, IX

(59)

open water. I may be cryptic because it resembles bamboo, a coelenterate or plant. II may be cryptic because it resembles dead floating leaf or blade of TF.

Flop observed from 11:30 a.m.

NOTE: One of the more common Double bed c[illegible] light marks or streaks toward tips and/or on underarms and tentacles. Due to upper Display Pigment, SAN

Back to same place 3:10 p.m. Windy and cloudy. Group of squid exactly where we left them. 15 large and [illegible]

No longer Double Mast in Ord+.

Some country. Watch 2 pairs at more length. Call them X and Y.

Y. ♂ and ♀ swimming together. ♂ little larger. ♂ in Ord+, RL, and WB. ♀ in Ord+, occasional Pie, occasional dark marks of Pie. [illegible] upper Ord+

X. Also swimming together ♂ in Ord+ with RL, but no WB (definite). ♀ in Pie, then in Ord+. ♂ suddenly does spread, with Z pattern on arms, but rest of body still in Ord+. Provoked by and directed toward neighbor ♀. Then ♀ advances in Pie+. ♂ follows in Ord+, then does sudden Speckled Bell (again toward neighbor ♀) ♀ resumes Ord and moves backward. ♂ follows, loses Speckle, returns Ord+. Both calm for the moment

NOTE: the medium sized alien still has white on underarms and tentacles. Also tends to separate arms and tentacles in what looks like forward V. I am now fairly convinced that it is injured or sick in some way. Another medium

(as all figures seem at long ranges, the group should be easy to recognize again!)

As far as I can tell, all the continuing ones don't have "Spec" like the morning.

3:15 X Pair of adults, does spread, 2 marks on arms, Ord on head and body. Then advances on q in Double flank. Pair stops. q Pies, rises, DP. Then both Rock together q in Pie +, ↗ in Ord +.

Y Pair ↗ and q Rock together, Both in Ord + with RL. ↗, RL is more extreme than is that of the q. He also (still) has continuous WE.

One mother, who has been in Ord +, goes Pale with DN as I pass over. Then relaxes into Ord + again.

Another mother does E in Ord + as courting pair passes by. (This E fans, certainly, intraspecific.)

Y Pair ↗ and q Rocking together q in Ord + with double markings of Pie. Sheets forward. Assumes extreme Pie. ↗ follows. Pair passes through center of group. ↗ suddenly assumes PH on back and does spread, 2 marks on arms, in E !!! Then relaxes. Both mals of pair retreat.

3:26. Y's continuing to Rock, q in Pie almost all the time. Is this only ↗ is so irritable ??? Is this characteristically post-copulatory ???

Everything calm 3:30 p.m. So we go off to explore. Swim along steep slope coral reef. Nothing. I get out of water 3:40. Arcadia continues with shallow low. Around island entrance reef.

Cgfh., June 27, 1972, II

4:05 pm. Husband and Heterosexual mutilg. Audio sees 4 nudibs. In Cgfh. Dr V. [illegible] some other aum nudibs. [illegible] (which is found thick in the water here, too).

Then see 3 sharks. Approximately.

Running light at night. Roll up at 8:15 pm.

June 28, 1972
San Blas

Still Cgfh. Current. Fairly. Go to near where group seen yesterday. Into water 7:00 am. Find squid almost immediately. 3 large, approximately 30 ft from where we left them yesterday afternoon. 3 ft up in 8 ft water. Over sand of sand-coral bottom. All in Ord, WS, Y, PCA.

One, presumably ♀, assumes dark marks of Pce (" DM) in Ord+. Then loses DM, returns Ord+; then does RL in Ord+.

Perhaps all 3 nds. are doing some "Spade". As yesterday. I am now fairly convinced that this pattern is not initiated in this species.

7:05. 4th individual arrives. Coming from deep water, further out. Slightly smaller than the others. Small nb large or largish nudibrin. By comparison, it seems obvious that original group of 3 is a trio, composed of one ♀ and two ♂'s in the usual way (♂2 slightly smaller than ♂1). Both ♂'s of trio do RL as 4th arrives. Then stop RL, back into ordinary Ord+, when the 4th comes closer and seems to

XXI

Ogopuka, Santa Ana
June 27 1972

7:45 AM Tow along west side of island. Tide is low, island side and it's slightly sloppy. We start along east side & slopes pretty steep. Water fairly clear, about 50 ft. Then go into channel TG and along west side of island in depth about [illegible] to 7 m. TG. We go around island and into lee side. At BIO we see group of 14 dolphins in about 20 ft of water. 6 large & a medium ORD-US and lovely gentle, relaxed turn and over coral right on edge of vertical drop. There's a lot of small fish around them. I miss one well in mouth & all stress on ORD-US. Then ♀ next to ♀ Z goes pic. a courtship chase follows with much fluttering. There's a medium ♀ following this pair, but it's not trying very hard, probably because #1 ♀ is much larger. courtship chase is repeated about twice then ♀ went ORD-US (pale) with a speckled belly & ♀ fluttering and a successful

copulation occurred. There mostly at this point were not as rapid as usual. The ♀ coupled and then the ♀ retreated rounded first her arms around the copulatophores, this lasted for a while. When coupling occurred second ♀ went Z mildly and then truly coupled but stopped and went back to ORD-WS. There's some mild courtship from mid-dom pair, some "pile" & fluttering, but its all over royal. also from large pair at opposite end of line from first couple but its also low royal. Suddenly something frightens them and they all disappear. A few minutes later they all come back to same spot. (NOTE: when I first found them, the group was at edge of drop and about 20 ft from surface. After we'd been there a while the group rose to about 5-6 ft from surface and positioned themselves over shallower section of the reef.) When they return, the coupling pair is showing a difference in patterns ♀ is in ORD-WS while ♀ is in DH-WS & see another ♀ pass in middle of group a couple close follows but nothing happens. coupling pair again in Pile and fluttering then same ♀ switches to mild Z and comes from behind ♀ and

XXII

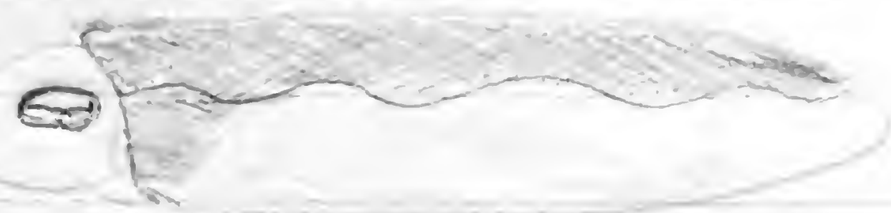
W.P. [illegible] Ogopogo, Dawson
E.B. [illegible] June 27, 1962

bits ♀ with arms in back of mantle
♀ does not appear to flex in any way.
A medium size light ♂ and MD for
[illegible] are all in close-up
zone [illegible] and courting displays in
Pair 1 could be in flattening. Then
Beyond [illegible] appears relinquishing in
[illegible] 35 ft ♀ [illegible] and ♂ [illegible] away
from Dawson. They all [illegible] but [illegible]
for a few seconds. [illegible] and
all back. Was counting from compling
pair and two other pairs but all
[illegible]. Here I count 15 incl. another
medium has joined group. I also notice
one medium has captured something
and is working its arms. Probably
squid. Again I noticed a few moments
earlier with tentacles extended, dit in
ORP Lwe very pale. Wait I see 2
juveniles approach the group, that raises
the group to 17 incl (NOTE: during courtship
I noticed the male to display a thin white
border on the fins.) End of observations
at 8:45 am. I turned back, and when

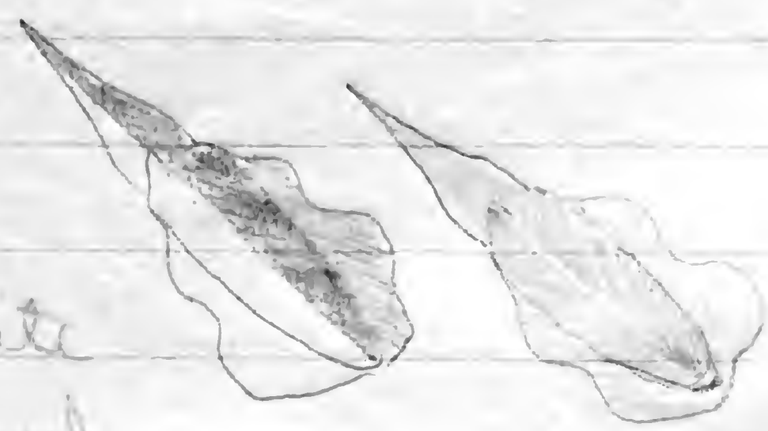
I started Tracking a mated 19 large males of the same The group we had been with. Further on I noticed another large ray of this but did not see any of the squids. End of shallow Dive 8:55 am

11:05 second Dive on the ridge. Visibility are now 18 and the ridge is covered with sea anemone & squids. Good bottom at about 7 ft depth.

Typical leopards formation without single-order one large pair cruds towards me slowly in ORD-WS ♀ with dark dotted bottom & ♀ in ORD-WS also with a slightly pale underside

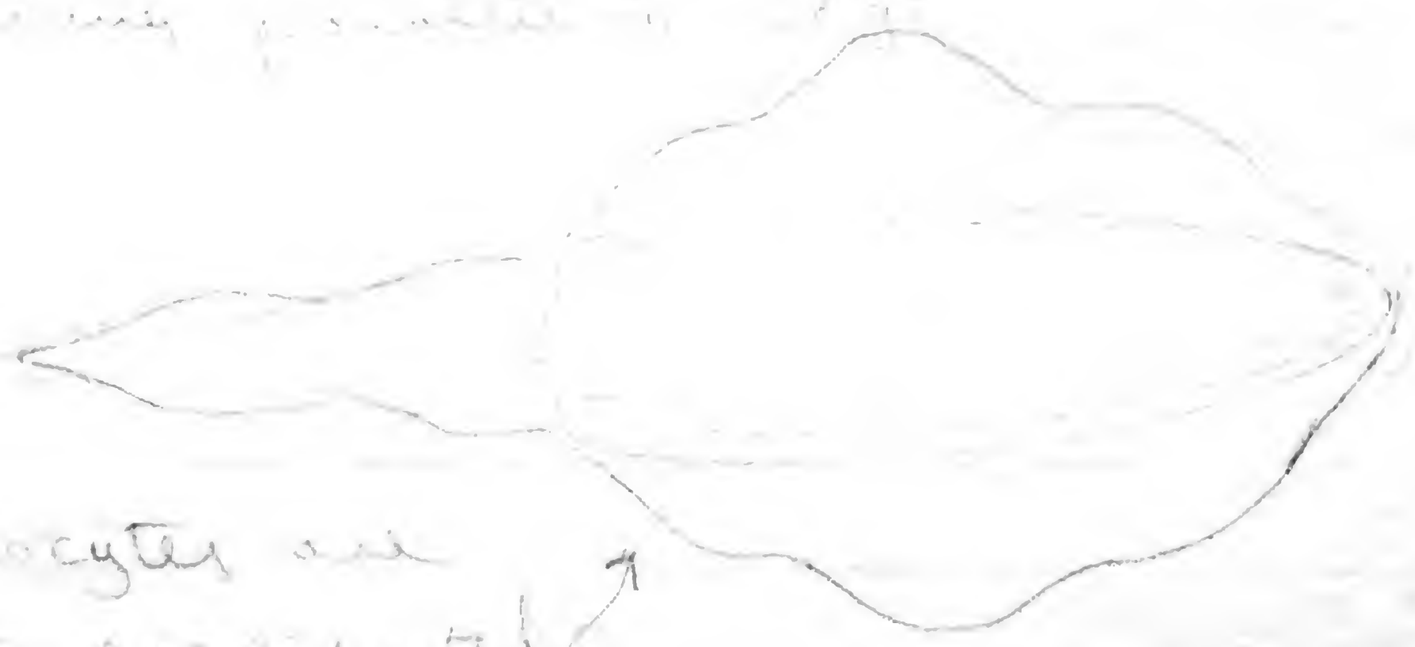


both approach at about 1 ft from my mask (I am hanging vertical to surface) ♀ is closest to me and it pokes the back of its mantle closest to me



They do not go into PH or any fear pattern but proceed past me quite sedately. It's sunny and I can see quite clearly a beautiful iridescent blue tonality along the edge of the mantle next to the fins. I am the group, and fourth from one and I notice a medium sized

Ogopogo, Lac Clio
June 27, 1972



melanocytes are quite conspicuous.
Martin thinks it may be sleeping
Now they all seem to be doing it, but not to the extent of the second described.
Two large males have gone cryptic over a shallow area, they are without dark pigment and have gone postural towards in a vertical attitude. A few there and they all remain this way. The group has broken up in three sections, the sleeping group, all in dark, and closer to the gorgonian, three juveniles in ORD-WS and a third group over the steep drop into dark active and

continue End of observations at 1:45 p.m.
3:11 pm Resume observations. Large barracuda
in study area, but again out of still
frame. Down river the sequence [illegible] The
barracuda is out of sight. [illegible]
to the surface again. Same behavior
as before this crossing [illegible]
courtship etc. Mantas start to go
exploring and we follow around the
island a ways and we end up on the
edge of deep water, then I go
back down but see nothing either.
Once on windward side of island
I see with a medium size with
a lot of swirling around them. When
I see them they are all in formed
display they are all facing out
down below me and they are
doing a split with the ends curled
up, they look like like almost
exact replicas of the sangroom
surrounding them. Especially since
these mantas are out of my line
of vision and all I see are their arms
more or less like so
Then I notice 3 sharks,
two large 7-9 and one
small 3-4 circling slowly below. End
of observations 4:15 pm.

4th arm [illegible] 4th [illegible] immediately back [illegible] separate.

Backing toward ♂2 does RL in Ord + again.

4th arm comes back 17:04. It stays flagged apart from the others. All 2 numbers of tube facing in same direction. 4th spends most of time facing in opposite direction. Begins feeding in Ord +. Both ♂s of tube [illegible] RL.

♂1 suddenly "flares", spreads arms (pattern V-like, but less extreme than in other observed, including V or fan-spread). Also waves arms. Again with RL. All this done while backing toward ♂2. Then does it again. Arms are PCA, not Z. Then both rules. Back to Ord + alone.

Then [illegible] as shown, or has shown, any trace of pattern like or BB. Another B pattern only high intensity?

4th arm goes again 17:12.

♀ of trio goes into lighter, brighter color (probably, intermediate between PH and semi-Pastel). WS greatly reduced (narrowed) but still visible. At same time, shoots out tentacles. Feeding? If so, prey is very small. Copepod?

♂1 flares and waves

With RL in Ord +, backing toward ♂2 as before. Again,

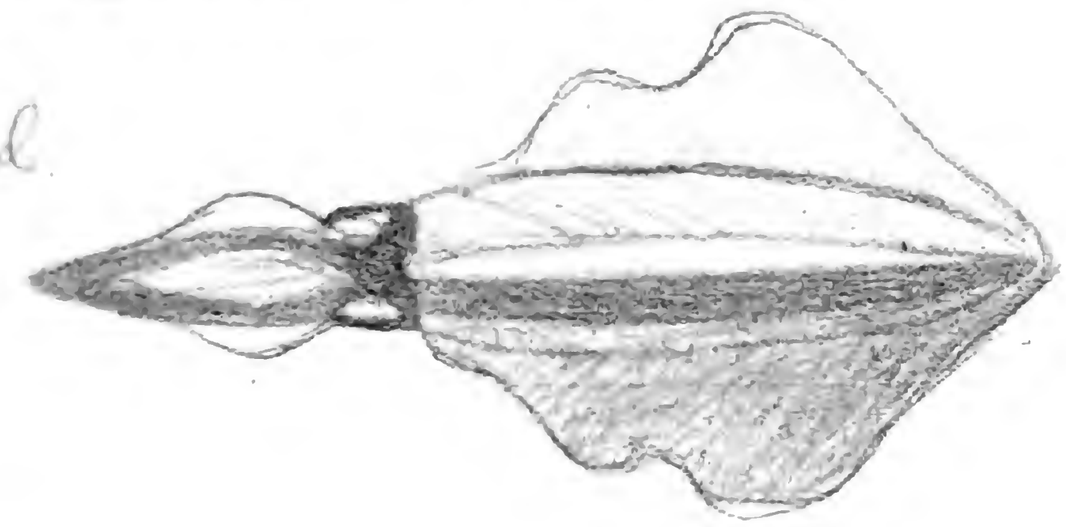
Upper arms (at least 2-3) flared together. Appear dark (Ord color). Tentacles also appear dark. Lower arms (5) appear light (probably simply because we see their inner surface).

Cepla., June 26, 1972, III

I suppose that this "flaring" probably signifies more than a low intensity "int. [illegible]" [illegible] by ritualized spread (+ Z etc.).

During the last "flare" performance the ♂1 had a trace of PH on back at [illegible] ♂2 [illegible] 7:15 a.m. still out, 3 weds Roll [illegible] 2 hrs. DM w. Ord + again ♂1 [illegible] pattern. "Unistreak". Obviously intermediate between Double Streak and Lateral Silver. And Ord +. Starting from Ord +, the side of the back toward the ♀ goes slightly pale [illegible], without becoming noticeably indescent or even shiny. At the same time, part of the other side of the back becomes darker than usual, in a faint "adumbration" of 1/2 of Double Streak. In diagrammatic form, more or less comme ça

Ocelli mountained



Then all relax again. For the first time this morning, ♂2 of the two is fleeing away from ♂1 and the ♀. ♀ suddenly does the ♀. ♂1 does not flare intensity, Lateral Silver. This may be provoked by approaching ♂2. ♂2 retreats (Lateral Sil. or apparently effective as threat!). All calm again.

COMMENT: ♂'s may use Lateral Silver once when I

or 2 mm. ♂s present. When and if males become more numerous, it may not be worth while, i.e. proportionately, much more to do.

♂1 does RL in Ord+. ♂2 comes closer again. He turns ♂s around, bringing them backward from in same direction. Both in Ord+ and RL. Then both spread, with Z marks on arms, without the rest of Ord+. Then both separate and relax. Relapse into Ord+ alone.

7:21. Now the 4th ind. has come back.

♀ does DM in Ord+. ♂1 does "Uniform".

A few seconds later, ♂2 tries to "get around" ♂1, apparently to approach ♀ more closely. ♀ immediately goes Pale (sic!), retreats. ♂1 assumes Double Streak and advances to intercept himself. ♂2 retreats. ♀ does DM in Ord+. All relax. Swim together for some seconds.

7:25. ♀ does DM in Ord again. No response.

It would seem that high intensity courtship to this some considerable time & leads to the morning. (NOTE: The 4th individual does not appear to be interested in sex at the moment. Too young? This is not a question.)

Both ♂1 and ♂2 do RL in Ord+ again.

♂1 suddenly turns Pale. Shoots downward, head and arms first, to look at bottom. Looking for food? (If so, this is, I think, the first indication of Sepia-like bottom feeding that I have seen.) Comes up again. Resumes Ord+.

Everything calm again. 7:31 a.m.

♀ does brief trace of RL-Pale. Then back to Ord+.

Ceph., June 28, 1972 V

Now I notice that the ♀ seems to have a [illegible] middle of undersides of body. A [illegible] white stripe or bar. Could this be a [illegible] just some internal organ showing through [illegible]

♀ suddenly starts writhing. Now [illegible] entire Bar (at least above), then Dun Purple Hindleg [illegible] shots away. Some or all of this may be [illegible] as soon as I retreat, ♀ returns to usual O.P.

Stop observations 7:48 a.m.

XXIV

Ogopogo Rip, San Blas
June 28 1972

6.58 AM, 30 m water. Spot 4 spinds at 700 AM in same place as yesterday. They are in usual formation and demonstrating in sign from dogs to real. First it is a obviously a ♀. The fourth is not integrated. It keeps swimming off and many breaks. Second and Third are probably males. They are both displaying a white spot on the tip of their mantle. ♀ displayed at noted a few days back among courting males.

♀ goes in pair stripe when a male approaches her and ♂1 goes PH-WS-Y. Then ♀ goes "Pie" & "RL" and ♂1 in double stroke ♂2 goes in cuddle Z. It remains in this pattern after ♂1 has gone back to ORP-WS-Y with spread arms. Then ♂2 approaches ♂1 in this pattern but ♂1 does not react. ♀ reacts to close proximity of ♂1 by going "pie" and "RL" suddenly ♀ is frightened and goes into a barrel dive ending end of observations at 7:45 AM.