Field Trip #1

WASHINGTON STATE, SAN JUAN ISLAND,
1. Jensen's Boat Yards (ca. 3 mi. E. Friday Harbor, near San Juan Boat Works).

Collections made on boat docks, wood & styrofoam. Scypha sp. present but not abundant. All very small (1-10 cm. tall). All individuals, no branching or colonies noticed.

Haliclona (permollis or rufescens?) - Abundant.
Metridium - extremely abundant
Obelia - abundant  HALICLONA - abundant.

2. Argyle Lagoon

Collections made on rocky outwash of lagoon into main bay - water flow good, clear. Hemigraphe, hatworms, Cancer productus, amphipods all abundant. In lagoon itself ribbon worms Paranemertes abundant on mud. Mud highly anaerobic (H₂S layer shallow).

Net Jane E. from Ug A.
Scypha

actual size \(-\)

Found clinging to boat docks (wood \& styrofoam) \& epifaunal on hydroid stems

Basal attachment in form of amorphous mass "wrapped" around substrate.

Halichondria \( \text{rufescens} \)

- brown encrusting form
- violet to pink erect form

Halichondria \( \text{sp.} \)

- feel: yellow; encrusting on or Nebelliid tubes

Note: Halichondra is more spongy than Halichondria \( \text{sp.} \) \& can be rolled between the fingers \& stay intact whereas Halichondria is more brittle \& crumbles.
"Hydah" cruise #1
San Juan Island, Friday Harbor Marine Laboratories, Research vessel "Hydah" cruise
0800 - 1230 Peavine Pass (60 mi. E. Friday Harbor)
Sunny, clear day - rocky bottom. Koelsch/Fontaine attending.
(Between Obstruction Is. & Blakely Is.).

Dredge 1 Rock, Dredge, rocky bottom, 6-12 ftms. (30 min. at depth)
Echinoderms: Eusterias tuberculata, Pycnopodia helianthoides
Crustacea: Grapsus grapsus: immature Cancer's, Petrolisthes chishingi
Numerous oxybryches, various hermits, Balanus nubius,
Cnidarians: Allopora, Acalyphea, Tubularia, Sertularia, Telia
Others: Cleiona (abundant), Calliastoma (w/crepulide), serpulids, Strongylocentroides stenostoma (8" across)

[Diagrams of marine life]
Drudge 2  Rock Drudge; sand/shell rubble/pebble Bottom

20 min. at 4-10 fths.

Many many Strongylocentrotus droebachiensis & single shells.

The galatheid Muniasis (one w/epicardid)
numerous shrimp (1-3" long) (one w/epicardid)
many gastropods including calyptraea, Tonicella, limpets
many polychaetes including scale-worms, nerids &
a "cirriformia-like" worm.

several small ophiuroids & a couple neuromasts
very few Balanophyllia & Paramichopus & Henricia lewisi
Cancer oregonensis (1-2") - prefer to live in Balanus
shells or other types of empty shells (isolated). One large
clam had 4 of these crabs spaced evenly about its empty inside.

The fauna is much newer to me than I had
expected. Even genera are difficult to place. I am
beginning to feel the warm-temperate fauna is more
closely related (at the generic level?) to the sub-tropical
than it is to the cold temperate fauna. I've
also been impressed with the small size of some
groups of animals here, for example, all the ophiuroids
seem to be less than an inch or two across. This
business of animals being larger in the more
northern latitudes seems to fail 100% here since
sub-tropical & tropical brittle stars average closer
to 2"-13" across. The gastropods may exhibit the
same phenomenon. I was also surprised to see
galatheids up here - perhaps this isn't a warm-water
group. The anemones, however, do exercise the size phenomenon - some of these coldwater fellows get really huge. Same for the barnacles. I am continually impressed w/ Kozloff. I feel like he is in the same league as Hegdahl insofar as knowing the fauna - perhaps even beyond him. I've yet to hear him tap on bionomy or biogeography though. Both Fontane & Kozloff seem to feel Paul D. is a bit hard to get along with. Liz is beginning to disprove my theory on red-heads.

Note: The Hydra is a private vessel operated by Cleve Vandervloet. He has owned the boat since the early 40's. Used to use it for fishing (double stern trawler) but now just rents it out (fishing) to Ft. L. She's a beautiful vessel - immaculate, about 40', shallow.

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Dredge 2 (cont.)

Corophium tubes collected - discrete mud tubes, en masse! (soft & muscular but intact)

Balanus nubilus on rocks (5" tall)

Cliona on west larger shells & Balanus.

Laqueus - a brachiopod resembling Terebratulina, attached to rocks, differs: Oth in opposite shell & longer than wide

Jingles - abundant on larger clam valves (living clams!)

Cross aster pappusus - A really neat sea star

Eupentacta pseudochinquesos - white cucumber (3"

Henricia leviuscula - bright orange sea stars

Allepora - common, encrusting on rocks

Pandalus jordani
Crossaster

Henricia leviuscula

an endoproct:
Hetropora pelluculata

Crepidium tubes (mud), amphipoda

Terebratula

(thi brachiopod)
Dr. Fontaine showed the opercular muscles of Balanus nubilus and remarked that each muscle strand was actually a single muscle cell (± 2-3 mm thick) and that these were some of the largest muscle cells in the animal kingdom. This particular species has the base permeated by pores or “parietal tubes” as do the plates of many other species of barnacles.

- Balanus nubilus - large; ribs thin & uniform; not heavy or robust themselves
- Balanus cariosus - downward pointing spines
- Balanus glandula - heavy ribbing but not downward directed spines

Note: The Aquatic Oligochaeta of the World by Brinkhurst
"Hydah" cruise #2

Buck Bay (mouth of East Sound), Orcas Is., San Juan Archipelago, Washington.

Attendees: Dr. A. Fontaine, Anna Clark, Steve Bloom, Ken Sebens, Liz, Mary & Pat Schoeneck, Ted & Ruth Hatfield, etc.

Took snap #3 of in situ rock face in front of marine station - low tide shows excellent zonation: black layer on top (kelp & blue green algae mixed), white layer, Ulva (green algae) layer.

Water. Foudaine guesses 9' tidal fluctuation here.

DREDGE #1

Mud Dredge - 10 min, ± 30'. 3' blades dredge 4' chicken wire net. Very silty, fine mud bottom.

Cuspida ria californiana - a carnivorous pulchoped (Septibranchia). Many, many Cuspida ria piperata (Stimpson)

Telepapsas (a chaetopod polychaete)
DREDGE #2. Same type of fine sand but no Cereanthes. Instead a few sweet potatoes Malpavia intermedia; one Dendraria (about 3" long but very slender); the sea pens Virgulaia sp.; lots of polychaetes, including nekeds & terribilis; many tubes of the burrowing "Ma anemone" Cereanthes; 1 Priapus caudatus, about 1" long, with the caudal appendages missing or retracted.

The tubes of this Cereanthes are identical to the tubes of the burrowing "Anemone" that is so common in the inner bay of Muriarau (Drayman). I only collected one specimen of the "Anemone" & lost it but now feel certain it is Cereanthes or a close relative.

The weather really sunny today, ± 65°F, sunny. Waters cold, ± 45°F. The water's deep green in color (probably diatoms & tree reflection), the islands green. Upright Head stands majestically like a solitary guardian, overlooking the shining straits to San Juan. A great bald eagle soars high overhead, silent.
The interesting show some animals, echinoderms in particular, show clumped distributional patterns. These aren't nearly as evident in the littoral as in the subtidal & deeper benthos. These Cucumaria piperata we collected today must have been incredibly dense - the trawl was on bottom no more than 5 minutes & brought up ± 1000 animals (cucumbers). Yet, the 2nd trawl was in identical substrate (as per as I could tell - which wasn't much visually & by feel) but contained no Cucumaria. Some dollars do this, so do sea pens and ophiuroids. Why? It's an obvious advantage at mating time for sure - but why crowd together when the whole ocean floor awaits their larval. There is certainly some critical factors either in the ecology or the individual life history of these beasts that is yet to be determined. I think it isn't analogous to clumping seen in highly mobile land animals. The yet to have what I consider an adequate Marine Ecology course. The only people I've met that I would think capable of teaching such a course are Joel Hedgpeth, Coney Montgomery, Sir Maurice Yonge, & Eugene Kozloff. Would a really good course of this nature have to be restricted to our local region I wonder??
0830-1200  June 29, 1973

False Bay (sw coast), San Juan Island, Washington

**Observations**

- **Rocks:** Balanus glandula, Balanus cariosus
- **Substrate:** Macoma sertulata, Clinocardium sp., Macoma nasuta, Arincola, Verbas bendti, Mytilus edulis, Nga, Protoblaea caliannassa

**Observations**

- **Substrate:** Demostate, decembrinus, Paramenetes gorgonum, Leptosaptae (clumped again) - very sunny, Arincola (very abundant)
- **Eelgrass Beds:** Zostera marina, Polinica, Membranacea, Hemigrass argos, Macrorus common in fresh-water dilutions, 1:10.
- **Eelgrass Beds:** Zostera, Halicystis (in eelgrass), Zostera (in eel grass), Arenicola (mostly abundant)

**Weather:** Cool, cloudy, but not heavily overcast.

**False Bay:** At today's low (2.0 ft.) the bay appeared approx. 1/2 mile wide by 1/2 mile long. Uppermost beach mud - grades into sandy mud, then muddy sand & finally (at the mouth) pretty much pure sand. Many large eelgrass beds (rich) & at mouth on either side beautiful low-intertidal rocky head w/ extremely thick algae cover (laminarios, etc.).
Kozloff Comments

1. Clinton Westervelt was Kozloff's undergrad student now teaching at Chapman.
2. Haloclystis feeds on eelgrass in beds below 6' tide.
3. Lingottia products: smooth clean clamspace (large) gracilis - remnant of a reactor (shell).
4. Mytilus Californiensis - rough ribbed shell - only found on your coast.
   Mytilus californianus - smooth, common in bays & tubs.
5. Amphibolus - highest occurring barnacle.
6. Nerites (broadly) - nocturnal organ, feeds used to tear algae - not carnivorous, spawn but individuals die on beach.
7. Macoma feeds by using one sip to sweep the surface (kelp, shells).
8. Mya arenaria - introduced; prefers backwash H2O (soft shell clams).
10. Actaea digita - low, flat, small.
11. Petrose - very high shell - large.
12. Mya arenaria is only common penumbral.
13. Scutella.
Pseudophithina (squirt?) - The commonest clam on
side of echinoderm, belly of aphrodite, &
tail of ophiogobius.

False Bay is nice. I was at first surprised
however by its apparent paucity of epibiota.
The only really rich regions of epifauna
were in the seagrass beds, and even the
dendroaster clumps were most abundant
in # around the Elghans. The importance
of this epizoanophyte cannot be overempha-
sized in terms of habitat. The beds
are extremely rich in Epistoma prolifer,
encrusting Bryozoa (Membranipora?), Polyzoa,
Halsclastia (the naide scyphozoan), and
phymella. They also appeared to be serving
as nursery grounds for many species
of juvenile fishes including flounder.
I ate a small flounder -
it was very tasty - no bones - good
flavor. I wonder to what extent the
seagrass contributes to local detritus?
Leager (Victoria Museum Handbook #27) places it at
Zostera marina var. latifolia. Dr. Fontaine
mentioned Phyllophron, is usually common
on the Zostera; also, but we found none.
The tidal flat itself was populated principally by polychaetes (Marincola, Nereis, etc.). The higher reaches had Callianassa & Uropoda; the lower reaches Lepas (although there were no large abundant under rocks set into the substrate). Of course clams were everywhere. Occasionally a Nereis (branisti) could be found lying still on the very surface—were these spawned-out individuals? Marincola were spread throughout the bog but increased in abundance as one approached the lower tide lines. Its distribution was apparently unaffected by O2 in the substrate as it occurred just as readily in anoxic (H2S) conditions near the head of the bog as in the highly porous (O2) conditions near low tide. A couple of burrowing anemones were collected also (Halocampa? & Peaania?) as well as some tent branches of the genus Aglaja. However, our Aglaja looks nothing like A. demedea, which is the only species listed in Mac farland & the Ehr keep. Our beast is solid in color (dark purple to smoky black).

Robert also collected one Chaetopterus in an odd, woody tube—not at all membranous or leathery like every other Chaetopterus tube he's ever seen.
June 30, 1973
Snug Harbor, north end
San Juan Island, Washington
0800-1200
Clear, no clouds, no breeze,
air temp. ± 65; H2O temp. ± 50

Limestone boulder beach/muddy sand substrate/sedgum muskeg
Limestone boulders are rare on the Pacific coast of WA. This is one of the few beaches on this coast that are limestone.

Zone 2
Petrocyclus (stage of Digartina) just below
lichen & Halophila (brown algae) of splash zone.
Petrocyclus is a "fear spot" algae, thick, black, of raised, smooth. (Digartina is "turban to towel" algae)

Zone 3
Petroclusia binominus - identical to 1st glance to P. gracilis, but w/ wider chela & pale, sky-blue chela margins.

Haplogaster (animal - eyes inside external)

Sonicella

Carpenteria quinquemitalis - straight; long feft

Pugoffia gracilis

Radiolaria - the spider crab - blue chromatophore margins

Evactensia tesselli: Strongielloclastites formosus

Zone 4
Gonionemus adults of brilliant red or brown gonads.
Halicyclistes - on eel grass again
Hemiechinus leviusculus - juveniles not red-orange but tan w/ purple outer arms. Very attractive & a splendid color metamorphosis into the adult form. It would be really nice to collect a series & culture them to record (color film) the changes.

Eelgrass Beds

Paracentrotus & Haliotis & Mercenaria
Leptostreon (Nebalia)
Tangieros
Pedarke pygmaeus

This is an extremely rich area - because of its habitat diversity - not because it appears to be particularly abundant in life. I keep getting this impression that we've yet to locate the really good collecting sites but I suppose I'm just spoiled - it really is true that diversity increases in lower latitudes. Southern California, in the old days, much has been much richer than this. Even now places like Dana Point have a much greater diversity than anything I've seen my here yet. And subtropical waters are of course way ahead of California's warm temperate found in terms of diversity.
Epinebaliopsis parvotennis
(the leptostracan)

Mecuna verrilli
(the nemertean)

- Egg
- Ventricle
- Dorsum
- Egg membrane
- Yolk
- Nucleus (germinal vesicle)
- Egg with germinal vesicle

Sample preparation:
- Stained with 0.5% methylene blue

Habitat
- Particularly in muddy bottom
- Southern California coastal waters

Even in a small stream...
But - this "Snug Harbor" region is really nice. The limestone beach (rocky) grades
slowly into a mud flat, heavily overgrown with seagrass & Cestaria costata.
This eventually grades into a slightly muddy sand/pebble bottom with similar
flora. The seagrass here may be Zostera
marina var. latifolia.

The rocky shore harbored high crab fauna:
Cancer borengrensis (the small secretive crab);
Cancer productus (the larger crab); Petrolisthes
of at least 2 or 3 species; Triops & zoeae Acetes resembling Heneriods, but
with different coloring; Hoplopinga sp.;
Euvasterias; Heuricia, levinacula; and others
(see 1st page of notes).

The seagrass/Cestaria beds harbored many
tanaidacea; leptos trachon (Epinebalia); several
tentaculata (Paramecium, peripatra, Hiscara,
vacilli, & Tubulana sp.); the ophiuroid
which we collected a great many of to
look for parasitic crustaceans - Kozloff estimates a
few injected in this brittle star at this area);
Koehnke pugetensis (in great abundance, free living);
Halsigetes; & a great many ground
gonionemus; Anchideris (?)
I ventured to chew up and eat a pycnogonid.
It was nearly flavorless but its nematocysts did a good job on my tongue. The sting was severe but at all intolerable. The pain lasted about 2 hours then tapered off for another 2 or 3 hours. No swelling occurred. I am convinced one builds up a resistance to nematocyst toxin (while others may build up a severe allergy to it!!). I recall well the winter of 1964 aboard USRV Eltanin in Antarctic waters. During the 6 months onboard I went from a point of being mildly stung by large Atolla & Periphylla sp. to getting no reaction whatsoever from them. Since that time I have made a point of allowing my self to come into contact with every hydrozoan & scyphozoan I happened to meet. This includes small Cyanea (the lion's mane) from Friday Harbor, Physalia (from the Sea of Cortez) and Pelagia (from S. California). I received no reaction to any of these. Perhaps my skin is simply thicker than normal??
Mericae, spawned as soon as I dumped her into my table-top aquarium. Probably due to the rapid increase in temperature, it was a beautiful sight to witness. The egg strings came right out the side of the body, from many many gonads, very close together so it looked like a single sheet until it hit the bottom & all the eggs dispersed. The length of a worm-bearing gonad was about 1/2 his total length, beginning about 1/4 of the way back from the head.

I don't understand these people who are surprised at one who tasters an animal at the seashore. We have but a few limited senses—why restrict ourselves to sight & touch alone. One must smell & taste & if possible listen to the life he sees around him. One must truly attempt to grok nature in its fulness. The juvenile halibut I ate yesterday was delicious. A plate-full of washed, 1/4" halibut would be a gourmet's delight, for sure. I don't, however, recommend Limonèus. I have even learned to recognize the encrusting sponge _Halicentrina_ by its smell, rather like "garlic, or perhaps closer to gunpowder..."
Tubulanus polymorphus  
(the nemertean)

Castaria costata

Paranemertes perigrina  
(the nemertine)
July 11, 1973  "Hydah" cruise #3

1/2 mile sw "Upright Head", near San Juan Island, San Juan Islands, Washington State

Attending: Red & Patty Hatfield, Arthur Fontaine, Anna Mary, Jonie, Karston, Linda Prie, Andy, etc.

Travel #1 - Small beam dredge w/chicken wire net (15' wide); 30-40 fathoms; 20 minutes. Pulled bottom (on mud) | 2 fathoms at end |

Many scallops, nearly all covered with yellow, interesting demersal...

Many Fusitriton & many small gastropods
One huge Synapidea (∼30" across)
Small crabs abundant, including many coral crinolines & many spider crabs, including one Logarithmia species

Large weird tunicate
Large branching sponge

Aplys chilensis; Pat fluid egg cases; chorula, the clear tunicate; Many, Many shrimp of all types (but all small); Immature Parastichopus (∼1/2"), clear or whitish w/few red spots [like teakie] & a few papillae; Many, Many Polychaetae

Fusitriton, Trichelopis cancellata
TRAWL # 2

20-26 ftms.; 20 min. at depth; Semitropical; Pewtwo Pass

Strongyliscoelites pallidus "in masse" (+ 1 D. perissus)

Fine scallops; many jingles (rock scallops); spider crabs; common crabs; many houtchkins;
small shrimps; Allaphora; Pleraster;
Sertulariid hydrozoa; Ctenaster; large
hermit crabs; annelids, including a
beautiful red-orange polypoid; Thais; cop-creeleid;
a R. egamoroid; Eteobium tubes

A beautiful day of 75° or so, sunny, clear
and friendly. I was pleased to see my old
friend from Mexico Calyptraea (ferrugineo)
and my old friend from So. California
Callistoma (Annulatum). I am impressed by
the variety of small shrimps around
here. Kozlofs lists (Beuppoint) at least 55 species
of natutant shrimps in his FHL keys.
It is interesting to see an Axiid occurs
here also, Axiasia (deep waters of Puget Sound
This Pleraster that puts out such copious amounts
of mucus blow my mind. This guy easily, and
its weight of mucus equal to his own weight, why
may indicate the mucus is a gel-like milieu
Trichatopsis cancellata
(x 4)

yellow demosponge

Callioptoma annulatum

Pandalus danae

Ceratidae;

foveacaeus)
Gallaya;
Stichopus;

long, cleary, clear
old
California
used by
sound
species
eyes.

occurs
just sound).
This amounts
to a very acute
light, which
acts mixture
I think the mucus somehow had some antagonistic effect on animals as it appeared to kill, or at least completely immobilize many types of animals in a tank with it, especially shrimp. The effect is possibly more than simply mechanical, as a quick death would seem to indicate.
Bastille Day

Known locally as "Orthopedic Day"

It was this day, 6 years ago, that the old master himself found, after more than 5 years of diligent searching, his 1st Orthopedist. In honor of this memorable occasion a surprise party was gotten together for dinner (O.A.F.) at Cattle Point, San Juan Island, Washington. Linda Price did most of the logistical shit, including talking our delightful chef Vivian into some of her Gears homergen" con frijoles. The day was warm & sunny & the wine flowed freely. The old master got a little juiced & the rest of us got quite a little juiced. It was a sentimental sight indeed to see Dr. K. standing at the water's edge, lost in thought, swiming out, alone, to the sea as the tide came in and unknowingly washed about his old leather oxfords and his prized pants cuffs. Tom & Nancy got close, Jonie got homesick and Mary Lou got horny.

A nice day all around and a record for the Volksjodel with 11 peoples riding, home singing & letting the hormones take their course.
A field trip was made this morning to the cove at "Mar Vista" resort on Sun Juan Island. This day is littered with trash (old tires, car batteries, bottles, etc.) but produced an abundance of marine life of this type normally overlooked by visitors to the shoreline. In fact it is, as Dr. X. pointed out, the hectococan capitol of the world and epinesthesia was taken in abundance.

Also taken were crabs, Ulysses, Callianassa (with a parasite by pyrid on the pleopod), and shrimps in the pelvigs of a now-gone pier.
July 18, 1973  "Hydah" cruise # 4

The final "Hydah" cruise for me. I opted to go on the afternoon trip as all previous trips I had chosen to go in the morning trip. We headed for the vicinity of "Flat-top" island and a nearby gorge that drops to about 170 fms. We're after Crustacea today as that is the concern of this week's lab and lecture. Dr. Fontaine delivered some of the most excellent Crustacea lectures (basic Arthropodian trends, etc.) I've ever heard this week. For the first time ever I am clear on what "green glads", "maxillary glads", "antennal glads", and "oral glads" are — they're all honey colemoducts!

Plankton Tow #1

20 minutes at 100 + fms. (1400-1420). Very coarse mesh, 1m plankton net.

Rich tow for this depth: Mysids, Euphausiids, hyperiid amphipods, much arrowworms, a few clioneids (heartbrothes) and a single, large, red cumaceon. Also a single eolid mudbranch, a few aggles
Plankton tow #2

Same net, same depth (1430-1500). Same fauna but with more megabits than before & with Aplantha and an immature, planktonic Lobates w/ the sucker already developed.

Today is warm and sunny. You can see the effects of the warming weather on the people, as they wear less & their skin begins to glow with those good old chromatophores. Karen is getting especially tan - she looks very nice today. I spoke with Dr. K today about the AQW hiring me to come up here for a summer & put together a reproductive collection. He liked the idea very much but felt if the money was ever made available that internal pressure would probably force the job to be given to a AQW grad student.

This business of getting a Mytilus from a Cephalopod is beginning to get clear - the fog is rising. Below is a list of differences, the one
checked with red being visible in the field (w/o a scope) usually.

**Mysids**

- with a brood pouch
- w/ statocyst at base of uropod
- carapace covers gills (or gills)
- w/o reflective photophores
- carapace not fused w/ last 4 thoracic segments

**Euphausiids**

- w/o a brood pouch
- w/o statocyst
- gills stick out of carapace
- w/ reflective photophores
- carapace fused with all thoracic segments

The reflective photophores are visible as a row of red spots along the side; the gills are visible as a short row of little finger-like clumps coming up from the sides of the carapace. Please claims you can tell these apart by watching the eyes for awhile - soon or later the Euphausiid will bring his eyes together & touch them to one another - a mysid will not (or cannot) do this. It's not clear about this though.
FRIDAY HARBOR POLYCHAETES

Halosyndra brevisetosa (Polynoidae)

Stenopis fuscus
(Sternoptychiidae)

(posterior)

Thelepus sp.
(Terebellidae)

the unusual Sabellid
Myxicola infundibulum (Renier, 1804)

Eunice longicirrata?

Pectinaria (Sisteridae)
granulata

from dredge hauls off Umpqua