

Biography Of

By Eugene E Collias
Volume Three—Oceanography



Biography of Eugene E. and Dorothy M. Collias

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Chapter 3-1

UW OCEANOGRAPHY (1903 – 1946)

Preface

Oceanography has played a significant role in my life. I first became involved in oceanography when I was looking for a Master of Science Thesis project. **Dr. Rex J. Robinson**, who had been my advisor during my undergraduate years, was one of the original faculty member of the **University of Washington Oceanographic Laboratories**. At that time, the Oceanographic Laboratories was a division of the Graduated School. His specialty was the chemical analysis of sea water. He suggested that I work on the *determination of sulfate in sea water*. This appealed to me so I agreed. Hence, my association with UW Oceanography began in January 1947 and continued through May 1981.

This chapter (3-1) is a brief history of the **Oceanographic Laboratories** from the initial conception in 1903 until just after World War II. Chapter 3-2 describes some of the events from 1947 up to August 1956 when I left to go to Scripps Institution of Oceanography. In Chapter 3-4, I tell what happened from January 1959 to May 1981 when I left the department for good.

The material in chapters 3-1,,3-2, and 3-4 come from several sources. *All three of these chapters are as I remember the many events I describe.* In addition, I have examined material found in the University of Washington (UW) Ocean-Fisheries Library, material from the Friday Harbor Laboratories archives, from publications in my personal files, and interviews with faculty and staff. Citations are given when appropriate.

Buildings south of NE Pacific Street

When I came to the University of Washington in the Fall of 1944, there were only four buildings south of **NE Pacific Street**. These were: the **Harris Hydraulics Laboratory**, the **ROTC Drill Shed**, the **Showboat Theater**, and the **Oceanography Building**. The remainder of the land on both sides of **Montlake Boulevard** was a nine-hole golf course. The golf pro shop was located on Montlake Boulevard about 300 feet north of the Montlake Bridge. It was torn down many years ago to make room for the **UW Health Sciences complex**.

The **School of Fisheries** was originally located on the north side of **Pacific** at the junction of **Montlake Boulevard**. These building were World War I barracks that served as the School of Mines before Fisheries occupied them. These buildings were torn down when the New Fisheries Building to the east of Oceanography was build. My father took his mine safety training in these buildings in 1920.

The **ROTC Drill Shed** was a large building with sufficient space to have at least 100 cadets drill at the same time. In the basement, was the rifle range where 22-

caliber rifles were used for target practice. The building was originally oriented north-south and in early 1950's was turned 90° clockwise. It was finally torn down in the late 1950's to make room for the ever expanding **School of Health Sciences**. A large outdoor drill field was just to the south. Often the drill field would be occupied by hundreds of sea gull. When they took off, you were advised not to stand under them or you would be decorated with white and black spots. For many years this field became a parking lot. Then about 1975, the **South Campus Center (South Hub)** was constructed on the south part of this lot.

The **Harris Hydraulics Laboratory** was and is still under the auspices of the Civil Engineering Department. Water for this laboratory is supplied by Frosh Pond. Water from Portage Bay is pumped into Frosh Pond to maintain a constant head.

The **Showboat Theater** was founded by Glen Hughes and built in 1938. The theater was designed to look like an old Mississippi River showboat but it was on piling and went no where. The building was 150 feet long, 48 feet wide and had a loft 50 feet high. It could seat 220 patrons. Its stage was unique in that it had a revolving center section to permit rapid scene change or a split scene. It was the site of many plays put on by students of the School of Drama. After Glen Hughes left the University, the Showboat deteriorated and was finally removed in 1994. Today a commemorative plaque is at its site and the bank has been turned into a mini-park.

From 1942 to 1946, it was nearly impossible to approach the **Oceanographic Laboratory** because of the war time research being conducted by the Applied Physics Laboratory. So, for many years this building remained off limits. We did not explore this area until mid-1946. More about this in chapter 3-2.

Friday Harbor Laboratories

The Oceanographic Laboratories did not exist until 1930. Prior to that time, the emphasis was on Marine Biology. In 1903, **Profs. Trevor Kincaid and T. C. Frye** wanted to have a field station where Marine Biology could be taught and the students have hand on experience.



For several years they searched for a suitable site and in 1903 decided that Friday Harbor on San Juan Island would be ideal. The first recorded use of the area was in the summer of 1903. Conditions were primitive and tents housed the students and faculty.

The name was changed to **Puget Sound Biological Station** in 1920. The last publication from this station was issued in 1931. The original laboratory building was located just south of the ferry dock at Friday Harbor. The present **Friday Harbor Laboratories** were developed largely through the efforts of **Prof. T. C. Frye** who secured a 480-acre tract with over two miles of shoreline.

Formation of the Oceanographic Laboratories

The **Oceanographic Laboratories** were formally created under the auspices of the Graduate School by action of the Board of Regents in March 1930. **Dr. Thomas Gordon Thompson** was appointed the director in 1931. At that time the Oceanographic Laboratories consisted of three units: the original Oceanographic Laboratory on the south end of the campus, the Puget Sound Biological Station, and the research motor ship **Catalyst**. In 1935, members of faculty were: **George H. Rigg** (plant physiology), **John E. Guberlet** (zoology), **Clinton Utterbach** (physics), **Robert C. Miller** (zoology), **Earl R. Norris** (biochemistry), **Rex J. Robinson** (Chemistry), **Bernard S. Henry** (bacteriology), **Lyman D. Phifer** (phytoplankton) and **Thomas G. Thompson** (Chemistry). Later additions included **Erling Ordal** (microbiology) and **Phillip Church** (meteorology). Details on the early history of the Oceanographic Laboratories will be found in the paper *The Oceanographic Laboratories of the University of Washington*, The Collecting Net, Vol. X, No. 10, Sept 7, 1935.

Oceanography Building

The original **Oceanography Building** was designed and built in 1932 with funds supplied by the Rockefeller Foundation and the State of Washington. The building was constructed with most of the laboratory spaces having no sunlight exposure. The hallways were the outside. This design allowed the placement of service shafts in the center of the building to provide power, tap water, seawater, gas and drains to the various laboratories. Special small rooms on the ground floor were made with their floors isolated from the main building structure. This provided chemists and physicists with a vibration free floor needed for very precise measurements. A dock was constructed to the south of this building to accommodate the **RV Catalyst**. Faculty office were on the east end of the building.

An unique and marvelous feature in the building was the seawater system. It had black rubber piping so that toxic ions, especially copper, could not leak into the seawater and harm the marine life that were kept in large aquaria on the third floor. The sea water was hauled in by barge and pumped from the barge to two

large underground storage chambers under the east end of the building. Surrounding the top of these storage tanks were more aquaria. The seawater was pumped up to the small tower on the southwest corner of the roof above room 324. This tower contained the machinery for the freight elevator and a large refrigeration unit, using ammonia as the refrigerant. Seawater was pumped into a tank with cooling coils to keep the seawater at about 10°C.



Southwest side of Oceanography Building

This cooled seawater flowed by gravity through the rubber piping system to the aquariums and returned to the storage tanks. Before reentering the storage tanks, it flowed through a large filtering system composed of wooden trays filled with sand. After the **Oceanography Building** was closed down during World War Two, the aquaria around the storage tanks were abandoned but the salt water system was maintained.

Much of this information on the old **Oceanography Building** was provided from the paper *The Oceanographic Laboratories of the University of Washington*, The Collecting Net, Vol. X, No. 10, Sept 7, 1935.

RV Catalyst

In addition to the **Oceanography Building**, the **Rockefeller Foundation** provided funds to have a 75-foot wooden vessel constructed named the **RV Catalyst**. It had a beam of 18 feet and a draft of 9 feet was propelled by a 175 hp Washington Estep direct drive, diesel engine. It had a cruising speed of about 8 knots. A detailed description of the Catalyst is presented in the *Journal of Chemical Education*, Vol. 13, No. 5, May 1936.

The **RV Catalyst** was designed especially for oceanographic research. It served the Oceanographic Laboratories from June 1932 to March 1942. During WWII, it was used by the navy as a patrol boat in the Aleutian Islands. The **Catalyst** was mainly used inside the Strait of Juan de Fuca but it did make a few cruises offshore and to Grays Harbor. In early 1933, **Dr. Thompson** established a number of stations (specific geographic sites) in the Puget Sound area where water samples were collected on a monthly basis and analyzed for a large suite of variables. This set of data, covering nearly ten years, proved to be a very valuable historic basis. This data is still being used today for comparison with present conditions in Puget Sound.

After much abuse from about 1950 to 2000, the Catalyst was purchased and restored by a private party living in Port Townsend. Today it is used as a charter boat.

Applied Physics Laboratory

During World War II, many of the original faculty members were in the armed services or their emphasis was changed to teaching future military officers. The **Oceanography Building** was given to war research performed by the Applied Physics Laboratory (APL) under the direction of **Dr. Joseph Henderson**. APL has its own building and a large staff at 1013 NE 40th Street..

Dr. Thompson

Dr. Thomas Gordon (Tommy) Thompson was the driving force behind **Oceanographic Laboratories**. It was under his leadership that the University of Washington earned a world wide reputation for oceanographic research. He had foresight and willingness to lead the University of Washington into unknown waters

Tommy was born in Rose Brook, Stanton Island, NY on Thursday, 28 November 1888. He received a BA degree in 1914 from Clark University and then went to the University of Washington Department of Chemistry. He received a MS in 1915 and his PhD in 1918. In 1918 he was an Acting Instructor. He became an Assistant professor in 1919, an Associated Professor in 1923 and a full Professor in 1929. He was awarded Emeritus status in 1959. During World War I, he was a First Lieutenant in the Chemical Warfare Service and was promoted to a Captain. During World War II he again served in the Army Chemical Warfare Service as a full colonel.

Tommy had 16 doctoral students. Some of his doctoral students and their works are as follows. The original work on the salinity-temperature-conductivity relationship was done by **Bertram Thomas** under the guidance of Tommy and **Clinton Utterbach** (1935). Some refinements to his work have been made but his work is the basis for modern salinometers. **Clifford Adrian Barnes** received his PhD in 1937. His dissertation was on the Bering Sea and portions of the north Pacific Ocean (1936). **Francis A. (Dick) Richards** developed a method of determining **Chlorophyll** in sea water (1950). His method is used extensively. After serving in the Army, Dick returned to the University of Washington as a faculty member of the Department of Oceanography. Tommy's last doctoral student was **James Avery Gast** who worked on the boron determination (1959).

Jim taught at Humboldt State College in Eureka, CA for over 30 years. He is now retired.

Tommy married **Harriet Galbraith** on Friday, 3 February 1922. They had three children: Thomas G. junior (3 October 1923), John Souton (Jack) (8 September 1925) and Harriet (30 April 1931). **Harriet Galbraith** died on Tuesday, 31 July 1951. On Tuesday, 14 July 1954, Tommy married **Mrs. Isabell Harris Costigan** and adopted her two younger boys. Tommy died on Thursday, 10 August 1961.

A synopsis of Tommy's life was prepared by **Alfred Redfield**, **Clifford Barnes** and **Francis Richard**. It was published in the Biographic Memoirs of the National Academy of Science, Vol. XLIII, 1973 and printed by the Columbia University Press.



Design over west entrance



Dock house



Main entrance to Oceanography Building northeast side

Chapter 3-2

UW Oceanography (1947 – 1956)

Note- The information contained in this chapter is from my personal memory as well as other sources and individuals.

Oceanography Building

I first became acquainted with the original **Oceanography Building** in January 1947 when Dr Rex Robinson assigned room 213 to me as my laboratory while I was working on my masters degree. I had this room until 23 August 1948 when I became a full time employee of the Oceanographic Laboratories. The Applied Physics laboratory had control of this building during World War II. They reluctantly gave up the building in early 1947 after I had moved in.

Offices

My first desk, as a full time employee beginning in September 1948, was in room 201, the office of **Dr. Clifford A Barnes**. But this was not the best arrangement. In early 1950 I was assigned to room 324. This office was on the third floor in the southwest corner of the Old Oceanography Building and had a good view of Portage Bay. There were two desks and a large table in the middle of the room. I had this office until I left in 1956

Growth

After the Oceanographic Laboratories reopened in 1947, the growth was continuous for the next 20 years. Beginning in 1948 more faculty and staff were added and there were a few graduate students. Most of the graduated students were specializing in some phase of oceanography but received their degrees from other departments. During this growth phase, **Thomas G. Thompson** was director until 1951.

One of the early outstanding graduate students after World War II was **John Patrick Tully** of Nanaimo, BC. His education was interrupted by WW II and he lost part of his right leg in the war. But this did not slow him down. His dissertation was on the effects of the effluent from a pulp mill on Alberni Inlet. He became the director of the Pacific Biological Station in Nanaimo, BC and served in this position for many years. The Canadian government named a research ship after him.

Additions to the faculty included **Robert G. Paquette, Howard Gould, Richard Bader, Herbert Frolander, Joe Creager, Maurice Rattray** and **Wayne Burt**.

Wayne went to Oregon State University in 1955 as head of the Department of Oceanography.

Dr. Arthur Martin, zoology, had his laboratories on the third floor where most of the octopi were kept. Occasionally an octopus would escape and cause panic with Dr. Martin's staff. Sometimes the octopus would stick a tentacle into the outlet and cause the aquarium to overflow and flood the laboratory and the labs below it on the second floor. **John Stevens** wrote a short book titled *Octopus on the Third Floor* in which he describes many such incidents.,

Staff additions included **John Lincoln**, **Donald S. Hanson**, **Franklyn W. Princehouse**, **Peter McLelland**, **Don Doyle** and **Hewitt Jackson**. Don Hanson was in charge of the sampling equipment and had his office in the dock house. He was responsible for putting the required equipment for a project as requested by the Cruise Leader aboard the proper ship.

Later more staff additions included: **Eugene Scott** and **Jim Meredith** in the machine shop, **Marion Joiner** and **Esther (Chris) Jackson** in the chemistry laboratory and **John Stevens** in the stockroom.

Formation of the Department of Oceanography

The death in early 1951 of Dr. Thompson's wife Harriet's was a severe blow to **Tommy**. He wanted to be relieved of the administrative duties and return to teaching. He stepped down as director in late 1951. Dr. Thompson remained as a Professor of Chemistry with a strong interest in Oceanography.

Dr. Richard Howell Fleming (1909—1989) was wooed away from the US Navy Hydrographic Office in Washington DC. He and his family arrived in Seattle early 1951. The primary reason for **Dr. Fleming** to be invited to join the faculty of the University of Washington was to form the Department of Oceanography within the College of Arts and Sciences.

The new Department of Oceanography was approved by the UW Board of Regents and departmental status under the College of Arts and Science was granted and an undergraduate curriculum was approved in mid-1952. At the same time, the Oceanographic Laboratories were absorbed into this new department. As a result, the department could now grant undergraduate and graduate degrees in Oceanography. **Alyn Duxbury** was the first declared undergraduate. He graduated in 1955 and went to Texas A&M for his doctorate. By 1956 there



Richard Howell Fleming

were 3 undergraduates and 6 graduate students. Some of early the graduate students were ***Russell Harris, Michael Waldichuck, Charles Yench, Marcell Patrick Wennekens, Bruce McAlister, Tom Buddinger, Phil Seelinger, Molly Allan and Twiwa (Jim) Chow.***

RV Onchorhynchus

The first post-war research vessel used extensively by the Oceanographic Laboratories was the **RV Onchorhynchus**. It was owned by the College of Fisheries and operated by the Oceanographic Laboratories using funds supplied by the Office of Naval research. This boat was a converted 50 foot Navy tender. Living quarters, a winch with 5/23" wire rope, and an A-frame were added to make this a working scientific vessel. There were usually only three of us aboard (skipper, deck hand and me). I was Cruise Leader



RV Onchorhynchus

on all the cruises I made on the **Onchorhynchus**. For the first six months, ***Al Laster*** was the skipper. Then ***Franklyn Wallace Princehouse*** took over.

The Brown Bear

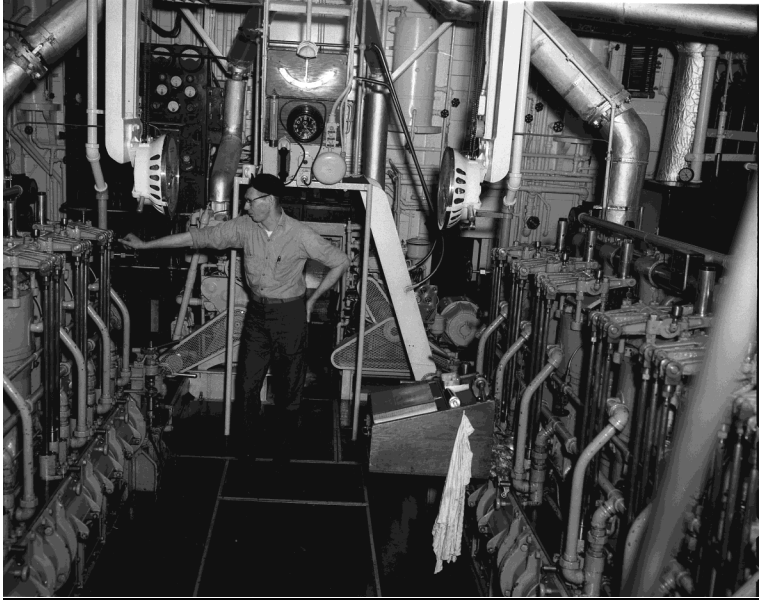
It had been the desire of the Oceanographic Laboratories to have a larger ship for both Puget Sound and offshore work. The 114 foot wooden vessel the **Brown Bear** became available in late 1951. Originally this H. C. (Harold Cornelius) Hanson designed ship was created for the US Fish and Wildlife Service to be a freighter resupplying bases in the Aleutian Island Chain. During WW II, the **Brown Bear** was used as a supply ship for military installations in Alaska.



RV Brown Bear

The **Brown Bear** was refitted to do oceanographic research for a cost of \$35,000 supplied by the **Office of Naval Research (ONR)**. A two-drum heavy duty winch was installed on the lowest deck (cargo hold) just aft of the main mast. The remainder of the cargo hold was used for storage of equipment to be used later in a cruise. The drums operated one at a time and were connected to a 20

horsepower variable speed electric motor through a heavy duty truck transmission. The two stainless steel lines were brought through the deck in long tubes designed to keep most of the water from entering the bilge. One drum had 6,000 meters of 5/32 inch 7x19 aircraft stainless steel line. This line, called the **Hydro Line**, was on the port side. The other drum, on the starboard side, had about 2,000 meters of 3/8 inch



Dennis Chipman in engine room of Brown Bear

line for trawling, coring and other heavy work. A special removable bracket was installed at deck level on the starboard side to hold a piston corer when it was aboard.

The **Brown Bear** was designed to fit in the Crittenden small locks. Its beam was 28 feet and drew 13 feet of water at the stern. Two 200 horse power Washington Iron Works direct drive, reversible, two-stroke diesel engines producing a maximum speed of $8\frac{3}{4}$ knots. Our usual cruising speed was 8 knots. This was rather slow but it gave us enough time between stations to finish the sampling before the next station. There was sufficient fuel for a range of 5,400 nautical miles. Fresh water was stored in two 2,000 gallon tanks. This required all hands to conserve water. The heads, toilets to the landlubber, used salt water for flushing. In order to prevent flushing of undesirable objects a sign was posted in each head that read “**if you cannot eat it, do not flush it!!!**.” This worked.

The Brown Bear had an eleven man crew: three deck officers, three engineers, three deck hands, a cook and a radio operator/electrician. There were accommodations for 16 scientists. Living accommodations were not luxurious but were adequate. A bunk room holding four scientists was located under the afterdeck. Sometimes during heavy weather, the deck would leak and water would drip from the overhead and get the bedding wet. The cruise leader's cabin was on the port side and could accommodate three persons. One double stateroom for scientists, two double staterooms for the engineers and deck officers and one head completed the lower aft quarters. There was a large bunk room in the forecabin on the lower deck that had nine bunks for the scientific crew. Being in the bow, any heave (up and down motion) was

exaggerated. I never stayed in this area. My quarters were either the after cabin or the cruise leaders cabin,

The captain's stateroom was on the main deck just aft of the dry lab. The radio operator had his quarters on the bridge deck. There was a bunk room for four deck hands on the after port side of the main deck. The starboard side of the after main deck was the salon. The galley area had a small table to accommodate the crew during mess. The cook, **George Becker**, was very good and always served good meals. He was the only person on board who *did not* succumb to sea sickness.

The first captain of the **Brown Bear** was **Franklin Wallace Princehouse (1920?-1970)**. He had been the skipper of the **Oncorhynchus**. **Frank** studied for his captain's license and received it just before assuming command of the Brown Bear. He was a superb skipper and was very appreciative of the science being conducted.

His original background was in forestry and he had commercially fished for shrimp on Hood Canal. Frank was promoted to the skipper of the first **Thomas G. Thompson** in January 1966. Frank served as the skipper until his health no longer permitted this activity. He became Port Captain for about three years until he had to take medical retirement.

The First Mate for many years was **Woodrow Wilson (Buck) Ethier**. When he left the Brown Bear, he worked in the men's locker room at Heck Edmonson Pavilion.



George Becker the ship's cook



Frank Princehouse on bridge of Brown Bear



Leo Seiner, AB

The best Able Bodied Seaman (AB) we had was **Leo Sener**. He was the AB from cruise 1 through 381. **Arnold Cruickshank**, chief engineer, came with the ship and stayed through the last cruise. Arnold was promoted to Chief Engineer of the first **Thomas G. Thompson** in January 1966. He served in this capacity until his retirement.

Our scientific work area on the Brown Bear was forward portion of both the main deck and the lower decks. Since the hydro line was our primary line, a moveable platform was installed on the port side so the scientist could attach the necessary equipment to this line. We called this platform “the cage or the pulpit”. It was about 36 inches square and permitted the scientist to stand over the water and outside of the railing.

In rough seas, a safety line was used to close off the inboard side of the cage thus keeping the scientist in the pulpit when the ship rolled severely. We attached many types of deep sea water equipment to the hydro line. This included deep sea water sampling bottles of many types, Clarke-Bumpus plankton samplers, plankton nets and light coring devices. When not in use, the cage was pulled inboard so nothing was detruding outside the railing.

Because the water sampling bottles required being placed at exact depths, it was necessary to accurately measure the amount of line being paid out. A metering block was attached to the end of the boom and the hydro line was fed over this block. The metering block had a long flexible speedometer cable attached to the readout mounted on the winch control. The variable speed electric motor on the winch was remotely controlled from a pedestal on the deck about six feet aft of the mast. When the control handle was in the neutral position, an electric brake stopped the rotation of the drum. One of the ship’s deck hands operated the winch under the direction of the scientific watch chief. There was excellent cooperation between the ship’s crew and scientists.

Our sea water sampling bottles were kept in the wet lab was on the port side of the main deck. This location was convenient being about ten feet from the hydro line. We could put up to 15 deep-sea water sampling bottles on the rack depending upon the type. Under this rack was another rack with holes cut out in it to accommodate the salinity, oxygen, and special chemistry bottles. Under this was a stainless steel trough to catch the overflow seawater.

The oxygen reagent dispensers were mounted on the port outboard wall forward the door. A small sink was located under the reagent holder. Because much of



Technician in the cage
with a bottom coring device

the scientific equipment was full of water and dripped on the floor, the floor was covered with a waterproofing material and adequate drains were installed. Sea water from the outside was kept out by a 10 inch high sill in the doorway. This meant that you had to step over the sill upon entering or leaving.

A dry lab was located on the starboard side adjacent to the wet lab. There was a small desk in the dry lab on the forward starboard side. There

was room for electronic rack in the back of this lab. When water sampling, the field logs were prepared in the dry lab. The person working in the wet lab could call out the sample bottle numbers and another person would record them. When the reversing thermometers were read, the recorder could be away from all the water associated with the wet lab. Hopefully the records would remain dry. The door to the skipper's cabin was in the after wall of the dry lab.

The analytical chemistry space and storage racks for the sample bottles were on the lower deck. A steep thwartship stairway led down from the dry lab to the analytical lab on the lower deck. A small dumb waiter was installed between the two decks to permit delivery of sample cases without having to carry them up the stairway. The master gyro compass was under the stairway.

A long bench, on the starboard side, accommodated much of our analytical equipment. For nutrient determination, we first used Nessler Tubes that required setting up a series of standards, such as phosphate,



Treating oxygen samples
with Nansen bottles on right.



Alan Duxbury with Beckman DU
running phosphate analyses

and the visually comparing the unknown against the standards and estimating the quantity of nutrient against the standards. This was a time consuming and not too accurate a method but it did work. This method was not often used at sea. In 1949 we used an Electric Eye Photometer (EEP), developed by **William Ford** of Woods Hole, to determine the concentration of a nutrient. In 1953, we changed to a Beckman spectrophotometer Model DU. I designed a water bath (See **Appendix 27**) to keep the seawater samples at a constant temperature. We also devised a dispenser for the phosphate reagents using 25-ml glass hypodermic syringes to dispense an exact quantity of reagents. This improved the accuracy of the phosphate determination. Often other analytical gear was placed on this bench.

A salinometer (an electronic instrument to measure salinity) was designed by **Robert Paquette** and installed just forward of the mast. The oxygen titration bench was on the forward port side. A shower was located just aft of the oxygen bench and a head aft of the shower. Racks just aft of the mast held about 24 cases of salinity and/or oxygen sample bottles. Each case held 24 sample bottles. Extra salinity bottles and oxygen bottles were stored in the cargo hold.

One time one of our chemists, **Roberta Toner**, was refilling the oxygen reagent bottles and mistakenly poured sulphuric acid in to the basic solution resulting in an explosion getting the regents onto herself. We unceremoniously shoved her into the shower and rinsed off the acid. She was not pleased with our action but she acknowledged the fact that this prevented serious burns.

Scientific cruises of the Brown Bear

The first scientific cruise, **BB-1**, was made from 11 to 15 March 1952 to explore the Juan de Fuca canyon. The last cruise, **BB-381**, 28-30 December 1965, was made in Hood Canal and the Strait of Juan de Fuca. Cruises were made as far north as the Bering Sea, as far south as San Diego, and as far west as 180° west longitude. Some cruises were one day trips while a few lasted nearly three months. A typical Puget Sound Survey lasted five days. Offshore cruises were from two to eight weeks.

The first cruise I made, **BB-2**, 31 March to 2 April 1952. I was a scientific deckhand. On the last cruise, **BB-381**, I was the Cruise Leader. I made a total of 87 cruises on the Brown Bear for 539 days at sea. I was Cruise Leader on 65 of these cruises.

Puget Sound Surveys

One of the most important series of cruises conducted by the Department of Oceanography were the surveys of the chemical and physical properties of the waters of Puget Sound and approaches. These surveys were made on a monthly basis from June 1952 to November 1954 and then aperiodically until April 1961.

A total of 46 such cruises were made. The Puget Sound Surveys consisted of 55 stations from the head of Carr Inlet, through The Narrows, up East Passage, through Admiralty Inlet and to Pillar Point in the Strait of Juan de Fuca. The waters of Port Susan, Possession Sound, Saratoga Passage and Hood Canal were also studied.

These cruises were planned so the same stations would be occupied on each cruise. Many of the stations were at the same location as the Catalyst stations taken from 1932 to 1942. By so doing, long term records at a given station could be constructed.

The data derived from these cruises have been published in a series of Technical Reports and in a major graphical atlas (see chapter **XX**). It has been used by many outside groups who are interested in Puget Sound. This “old” data serves as a baseline for the newer data.

Offshore cruises

From 1952 to December 1956, twenty offshore cruises were made on the **Brown Bear**. I participated in six of these cruises. The first and most memorable offshore cruise I participated in was **BB-4** from 28 April to 8 May 1952 with **Robert Paquette** as Cruise Leader. We were planning to make a line of stations, 100 miles long, beginning west of Cape Flattery and then return making a line further south. The weather turned ugly and we had several days of very difficult sailing. At that time, the Brown Bear had no bilge keels to dampen the roll so the rolling and pitching was violent. Everyone, except the cook, **George Becker**, was sea sick. We finally gave up, ran with the weather to the north end of Vancouver Island and back to Seattle through the Seymour Narrows and Georgia Strait. A write up of this trip is in **Appendix 28**.

Shortly after this cruise, Frank Princehouse designed bilge keels to be installed on the Brown Bear. With the approval of H. C. Hanson, the ship’s designer, and with money supplied by ONR, the bilge keels were installed. This substantially reduced the roll and made the Brown Bear a much more desirable sea going ship.

Swimming sea anemone

Sea anemones are supposed to be attached to the sea floor and remain in one place for their entire life. But **Charles Yentch** and **Donald Pierce** discovered one anemone (*Stomphia coccinea*) that refused to remain in one place. It was a surprise to view the aquaria and find the anemone had moved. This provoked a much closer



watch. Sure enough when a small sea staapproaced, the anemone detached itself from the bottom and swam in a contorted manner. This was probably an escape mechanism. We took movies and still photographs of this strange behavior. This was reported in *Science*, December 23, 1955, pp. 1231-33

Arctic trips

Dr. Barnes had secured a contract from ONR to study the Beaufort Sea north of Point Barrow for potential military use. This study was a cooperative venture with Scripps Institution of Oceanography (SIO). **Dr. Waldo Lion**, of NEL (Naval Electronic Laboratories, San Diego, was the liaison with SIO. The purpose of these trips was to study water properties and movement, the bathymetry of the Beaufort Sea, and the biological aspects mainly plankton. The study covered a period of four years from 1950 to 1953. I had the opportunity to go to the Arctic in 1951 and 1952. In 1951, our group flew to Anchorage on a military transport cargo plane and then to Barrow Village, by rail road to Fairbanks and by airplane (a DC-3), to meet the **USS Burton Island (AGB-1)**, a 265 foot ice breaker. On the first trip we got within 700 miles of the North Pole. The 1952 trip was cut short because of damage to one of the three propellers. Our work was a great aid to the **USS Nautilus** when this nuclear powered submarine made its record breaking voyage under the ice, under the North Pole, and then to the Atlantic Ocean. Working in a blizzard in September was interesting. Detailed write-ups are in a separate journal titled ***“Trips to the Arctic”***.

NORACP

NORPAC was a multi-national, multi-ship study of the **NORTH PACIFIC** Ocean. Oceanographers from Canada, Japan and the United States. Nineteen ships from 14 institutions were used to make this study. The study was conducted between May and November 1955. Chemical, physical and biological data were collected in the Pacific Ocean between 20° and 60° North latitude. In all, the institutions in NORPAC occupied 1,002 hydrographic stations. More than 2,000 plankton samples were collected. Our contribution was made on **Brown Bear Cruise 110** from 1 August 1955 to 19 September 1955. **Robert Paquette** was the cruise leader and I was the chemist. We occupied 69 stations, four of which the deepest sampling depth was in excess of 4,000 meters. The results from this study are published in *OCEANIC OBSERVATIONS OF THE PACIFIC 1955: NORPAC* (UW library call 551.46058, OC21,1955a).

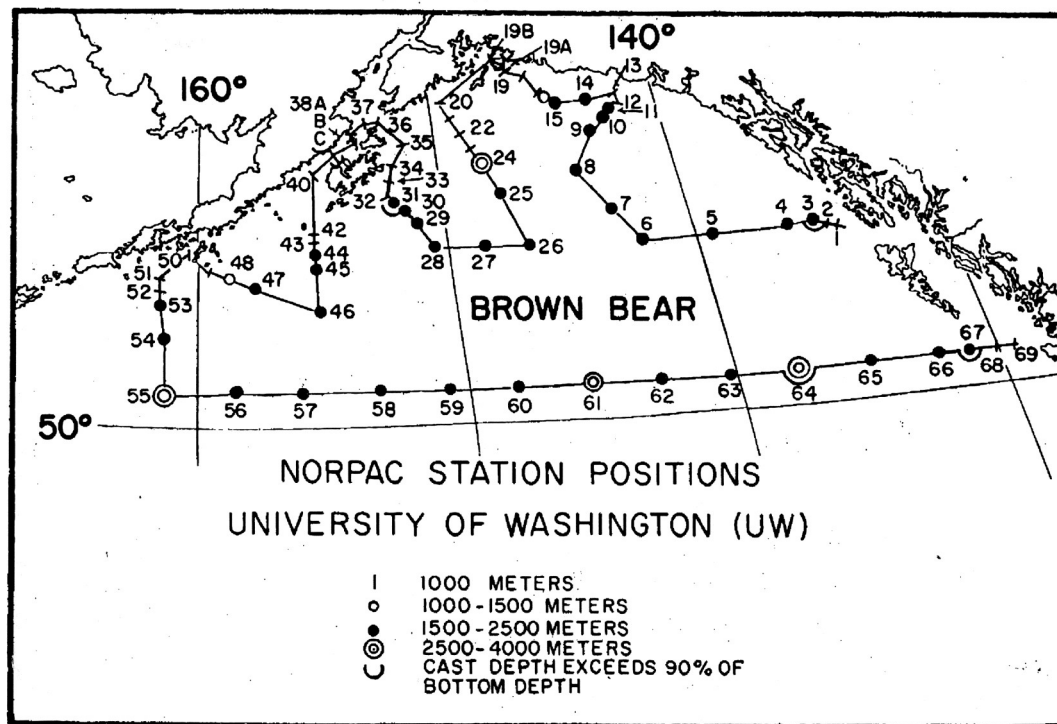
For the first seven days of our cruise, the wind was from the southwest from 10 to 20 knots and the sea was rough. On 13 August, we put into Cordova, AK for a few days. **Donald S. Hanson** went to Anchorage to visit his family. I collected fresh water plankton from a near by lake for **Rufus Kiser** of **Centralia College**. While in the Cordova area, we did a lot of fishing. I borrowed a fishing outfit

from the skipper, **Franklin Princehouse**, and caught a 22½ pound King Salmon. I cleaned the fish with aid from **Arnold Cruickshank**, the chief engineer, and put into the freezer.

From 25 to 26 August, we went southwest through the Shilikof Strait. The wind blew from 20 to 40 knots and the sea was very rough. But it was clear and sunny and the mountains were impressive. We were all glad to get through these waters.

On 27 August, we put into Kodiak, tied up at the Libby-McNeil-Libby dock to refuel and take on provisions. Several of us went to the Russian Orthodox Church and met the priest, **Rev. Dr. Roman Strummer**. He showed us the building and apologized for his English. He was concerned because English was his seventh language and he was still learning. We told him he did not need to apologize as his English was perfect.

After leaving Kodiak, we went to Sand Point, on Popoff Island in the Shumigan group and tied up to the Wakefield Fisheries dock on 1 September. Wakefield Fisheries has its headquarters in Bellingham, WA. There was a large King Crab processing plant near the dock. We talked the manager into giving us a crab leg. We tried the meat. I think Dungeness meat crab is much better. We walked around the town on board sidewalks. These were necessary because most of the ground was tundra and very water logged. There were many board side walks



because the ground was very soggy. On 2 September, we received news that five fishing boats had been lost at sea.

On the way back to Seattle, the refrigeration unit for the walk-in freezer broke down. We told the chief engineer to get the system working because we had nearly one ton of salmon in the deep freeze. Since part of the fish was his, he did get the system back on line.

Several years later, **Warren Wooster** at SIO, told me that our ship had produced the best suite of data making up the total NORPAC data base.

Bonneville crossing

The Bonneville Power Administration (BPA) wanted to put a high voltage (230 KV) cable across from about Richmond Beach to Apple Cove Point. The cable was to be 11¾ inch in diameter and was to lay on the sea floor. BPA contracted with Oceanography to determine the feasibility of the selected route. We made detailed bathymetric charts of the proposed crossing, examined the sedimentary structure and photographed the bottom. This work was done between 11 January and 24 July 1953 and was published in December 1953.

Carr Inlet

The US Navy had established an acoustic range in Carr Inlet and needed to have supporting information on the water properties and how changes in these properties affected sound velocity and the dispersion of sound. Sixteen cruises were made to Carr Inlet from February 1954 to January 1955. On some the Carr Inlet surveys were combined with the Puget Sound Surveys. The acoustic range was used for about ten years and is now abandoned. The data were submitted monthly to the Navy in 16 separate reports (Special Reports 3 through 19).

Magna Pipeline

The **Magna Pipe Line Company** proposed putting a natural gas pipeline from the mainland near Anacortes, across Rosario Strait to Fidalgo Island, across Haro Strait and ending on Vancouver Island. The diameter of the pipe was to be 15 inches. The **B. D. Bohna and Co., Ltd.** company contracted with the Department of Oceanography to determine the near bottom currents, the bathymetry and what type of organisms might attach the pipeline. The work was done between July and December 1955 using the **FV Hydah** owned by **Cleave Vandersluys**. The highest bottom currents were observed in Haro Strait where currents of 2.6 knots were measured 16 inches above to sea floor. There were other hazards discovered such as a very rapid falloff of the sea floor on San Juan Island into Haro Strait. This falloff exceeded the bending radius of the pipeline. The final results were published in Special Report No. 21 titled *Preliminary*

oceanographic report of channels through the San Juan Islands between Fidalgo and Vancouver Island.

Silver Bay

The **Silver Bay Study** was conducted in two parts. The purpose of this study was to determine the circulation of the waters in Silver Bay near Sitka, AK so that the optimal placement of an outfall for a proposed pulp mill could be determined.

The first survey was conducted from 29 June to 11 July 1956 on cruise **BB-143**. **Clifford Barnes** was the cruise leader. **Cuthbert Love** and **I** were assistant cruise leaders. We cruised to Sitka via the Inside Passage. During this time we made sure our equipment was working properly and we were ready to start our studies when we arrived. In Silver Bay, we measured water properties and currents. Current measurements were made with several different types of current meters suspended from the **Brown Bear**. We also used drogues and drift poles. Several small boats were used to chase the drift objects. We used horizontal sextant angles to determine their positions. We could not work from midnight to 3:00 AM because it was too dark to see our targets. We put fluorescence dye in the water and used an aircraft (a Grumond Goose) provided by the Alaska Fisheries Service to photograph the dye's movement. I was the photographer. We spent seven day of intense work and then had one afternoon to explore Sitka. We worked long hours and accomplished all our work. The day after we left Sitka, the ship was very quiet. We were all to tired to do anything except sleep and eat.

The second survey (**BB-163**), was made conducted from 19 March to 6 April 1957. By this time, I was at Scripps Institution of Oceanography. These two cruises were paid mostly by the **Alaska Lumber and Pulp Company**. The results of these cruises were the basis of the doctoral dissertation by **William Bruce McAlister** titled **The dynamics of a fiord estuary, Silver Bay, Alaska** (UW call GC1.W25 no. 60-65) (TR. 62). The pulp mill was built in 1958 and continue operation for over 30 years.

Field Manual

In early1955, the Department of Oceanography received a grant from the US Fish and Wild Service to conduct a study of the Pacific Salmon (genus ***Oncorhynchus***) in habitat. Observers were placed on several fishing boats that fished the NE Pacific ocean and the waters of Alaska. Many of these observers were not oceanographers and needed considerable training. Dr. Fleming asked me to prepare a field manual describing in detail all the procedures the observer was to use. I though this would take about three weeks. Actually, it took three months. The results were published in Special Report 23 titled **A MANUAL**

FOR OCEANOGRAPHIC OBSERVERS ABOARD U. S. FISH AND WILDLIFE SERVICE EXPLORATORY FISHERIES VESSELS.

While I was at Scripps, this manual was required reading for the Physical Oceanography class. Some of my fellow students did not think this was fair. But they read it and hopefully learned something about field observations.

Donald S. Hanson was the observer on the **FV Torganskol**. **Don** quit oceanography in 1957 and went to the University of Puget Sound to get a teaching certificate. He married **Sandra Parsons** on Saturday, 13 June 1959. They moved to Anchorage, AK where they taught school for more than 30 years. Another observer was **Robert Dursch**. Bob completed his degree in Oceanography and taught at Skagit Valley College in Mt. Vernon, WA for many years.

Seminars

From about 1951 to 1953, **Maurice Rattray** made it mandatory that every one on the research staff attend and participate in Wednesday seminars. Subjects were chosen at random and assigned to a person to prepare a discussion on that topic. Many of the staff thought it was not necessary for us to be forced into talking about something in which we were not interested. One time I was supposed to prepare a discussion about the Gulf of Alaska. I refused. This made the seminars voluntary and we could speak on any subject we desired.

Department Parties

From 1954 to 1956, the size of the staff of the Department of Oceanography, was small enough that we could all assemble in Dr Thompson's office. In 1951, this became Dr. Fleming's office and the parties continued until the department became too large to meet here. We had many conferences and parties that were enjoyed by all. But as the department grew, much of this comradery was lost.

Leaving Oceanography

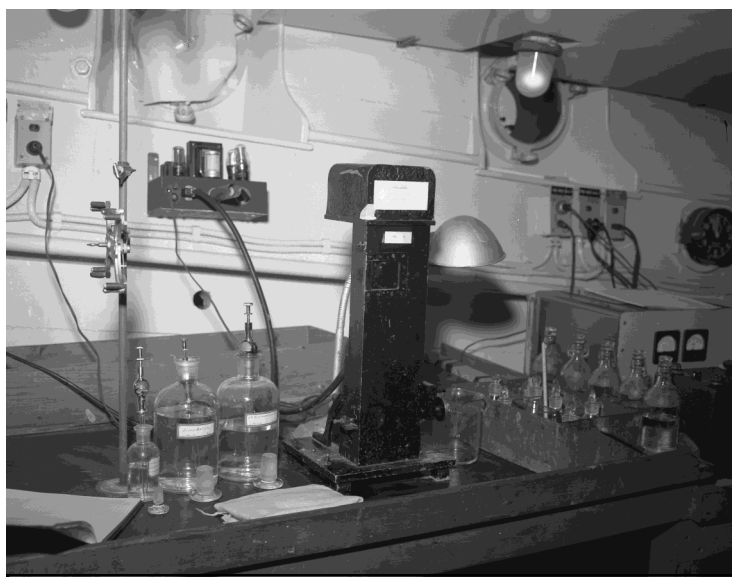
For a long time I had a desire to get a PhD. I applied to **Scripps Institution of Oceanography** and was accepted as a graduate student beginning in the Fall Semester of 1956. I formally left the University of Washington on 19 August 1956 and we moved to La Jolla, CA. **Dr. Barnes** kept me on the Oceanography payroll through 31 October 1956. A detailed account of time in La Jolla is in chapter 2-2 and 3-3.



Cuthbert Love servicing
an Ekman current meter.



Don Hanson putting a
Nansen bottle on the hydro line.



Electric eye photometer on the Brown Bear



Don Hanson getting
a hair cut



Eugene with his 22.5 pound king salmon. caught in Prince William Sound



Richard Bader putting a Clarke-Bumpus plankton sampler on line.



Scientific Party on the NORPAC cruise

Front Row: Tom Budinger, Don Hanson, ??
Back Row ??, Eugene, ???, ??, ??, Bob Paquette, Hewitt Jackson



Bob Paquette with current meter

Chapter 3-3

SCRIPPS INSTITUTION OF OCEANOGRAPHY

(1956 – 1958)

Much of the following information was obtained from my diary and correspondence to family and friends during our stay in La Jolla.

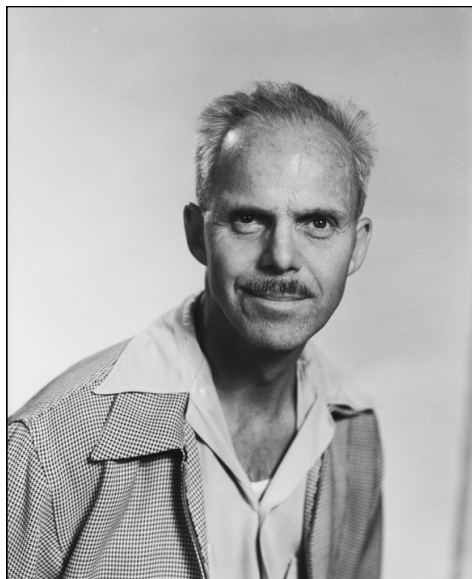
Applying for graduate status

In consultation with *my family, Drs. Clifford Barnes, Richard Fleming, and Thomas G Thompson* and friends, I decided to go back to graduate school. I checked several schools and decided upon **Scripps Institution of Oceanography (SIO)** in La Jolla, California. I wrote to **Dr. Roger Randall Dougan Revelle (1909-1991)**, then the Director of Scripps, on Wednesday, 18 January 1956, and asked how to apply to their graduate program. **Dr. Norris Watson Rakestraw (1895-1982)** replied on Tuesday 31 January 1956 and sent the necessary registration forms. At that time Scripps was part of the **University of California at Los Angeles (UCLA)**. Final approval came from Los Angeles. After much correspondence, I received notification on Thursday 19 April 1956 that I had been accepted as a graduate student at Scripps with emphasis in chemical oceanography.

Research Assistantship

While in the process of applying to Scripps, I inquired about the possibility of a Research Assistantship (RA). After several letters between Dr. Norris Rakestraw and myself, I was awarded a Research Assistantship (RA) on Wednesday 16 May 1956 with the title *Curator of Marine Chemistry*. The RA paid \$167.00 per month with full time during the summer break. Tuition was not paid as I needed to be a resident of California to have the tuition waived. At that time tuition was \$150.00 per semester plus \$42.00 for incidental expenses.

For an office, I was assigned room 307 in Ritter hall. This was a laboratory with a desk and had been previously occupied by **Sayed el Wardani**. Dr. Rakestraw's office was directly opposite. At the end of the hall, **Margaret King Robinson (1906-2006)** had a large office where she processed all the BT (bathythermograph) data for Scripps and other institutions. I had known Margaret for some time prior to coming to Scripps.



Norris Watson Rakestraw

The duties of this RA were quite vague at first. In early September 1956 an agreement was reached. I was to report to both **Dr. Norris Rakestraw** and **Dr. Edward Goldberg (1921-2008)**. The duties of the assignment were to:

- 1) Assist in planning the chemical oceanography on any SIO cruises (except Marine Life Research cruises);
- 2) Have the necessary equipment and reagents aboard the vessel prior to sailing;
- 3) Have properly trained personnel aboard to perform the analyses;
- 4) Upon return of the vessel to home port, remove the chemical equipment and put it in working order;
- 5) Be in charge of the sea-going chemical equipment stockroom;
- 6) Reduce the data and verify the results and
- 7) Analyses the reduced data.

Quite a tall order for a half-time person. Many of these details could not be started until **Minoru Koide (1926-2008)** returned from his vacation. Min returned from vacation on Monday, 1 October 1956. Min and I had first met on the **USS Burton Island** in the summer of 1951. I began the assigned tasks by checking the chemistry stockroom. It was in good order.

On Friday, 21 September 1956, I received my official pass from NEL (Naval Electronic Laboratories) so I could go to the Scripps ships that were docked at NEL. In order to get to the ships, you had to stop at the gate, identify yourself, show your badge and then you were permitted to go to the ships.

On Friday 5 October 1956, the **RV STRANGER** returned from the EQUAPAC (Equatorial Pacific) cruise. I removed all the chemical equipment, cleaned it and stored it for later use. The **STRANGER** was going to Panama the next month as part of the SCOPE (Scripps Oceanic Productivity Expedition) investigation so there were preparations connected with that cruise.

In addition to this work, the **USS BURTON ISLAND** data has been recently downgraded to UNCLASSIFIED. **Dr. Warren Wooster** asked me to work up the chemistry for the 1951 and 1952 cruises.

I assisted with several other cruises including the one I took on the **RV Horizon** to Alaska in the summer of 1957. But in general, there was not that much work to be done so I was assigned to help **Dr. Charles David Keeling (1928-2008)** with his carbon dioxide research.

Invitation to Revelle's house for incoming students

Each year, **Dr. Roger Revelle** had a reception for new students in his home facing the Pacific Ocean. This was an evening event so spouses could attend and permitted the new students to get to know each other and to meet the faculty. Dr. Revelle told us that on one winter morning, about one year prior, he woke up and

looked towards the ocean. To his amazement, about 20 feet of his land disappear into the Pacific Ocean as he watched. Strong wave action over many days had eroded the bank in front of his home.

I was surprised to find a wedding picture of **Betsy Fleming**, daughter of **Richard Fleming**, sitting on the piano. I had photographed her wedding. Then I remembered that the Fleming's and Revelle's had been close friends since Roger and Richard were students at Scripps.



Roger Revelle, Director of Scripps

Fall Semester, 1956

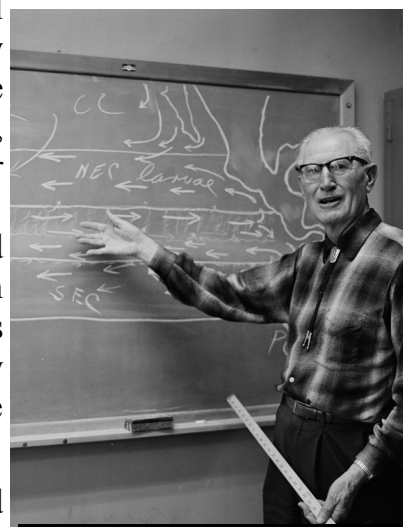
For many years there was only classroom and that was in Scripps Hall. It was on the second floor and had an exit to the outside at the back of the room. This room held about 50 students and all our classes were in this room. As students, we spent many hours in this room. Since 1959, several more classrooms have been added.

I started my formal classes at 0800 on Monday, 17 September 1956. There were 14 of us in this class of new graduate students. This semester ended on Friday, 18 January 1957. The classes met three times a week, Monday, Wednesday, and Friday. The classes in which I registered were:

Ocean 110 Introduction to Physical Oceanography	Arthur & Revelle
Ocean 111 Submarine Geology	Sheppard & Inman
Ocean 112 Biology of the Sea	Johnson
Ocean 251 Problems in General Oceanography	Wooster

Ocean 110, 111, 112 and 113 were required of all entering students. Since I had a MS in Chemistry and had taken Chemical Oceanography at the University of Washington, I audited, Ocean 113, taught by Dr. Rakestraw. He brought in other faculty members to describe their specific projects. One of the major assignments he gave us to read was his translation of the original work of Knudsen on the chlorinity-salinity ratio of sea water. This gave us an insight as to how so few samples (only seven) were used to define salinity based upon the chlorinity of sea water.

I kept extensive notes of each class and worked hard to make good grades. ***Dr Martin Wiggon Johnson***



Martin W. Johnson

(1893-1984) taught the Biology directly from his section of *The Oceans*. I carefully took class notes and notes from *The Oceans*. One time these two sets of notes became mixed and I could not tell them apart so I quit taking notes in *The Oceans*. Dr. Johnson had several guest lecturers who described their recent research.

Some of the guest lectures this semester included:

Dr. George Wüst director of the Institut für Merreskund, Kiel Germany.

Dr. Alfred Redfield from Woods Hole. He was at Friday Harbor in 1947.

Dr. John Swallow from the Institute of Oceanography in England.

Mr. Jaques Cousteau from France.

Dr. Yoshio Hiyama, delegate to the United Nations on radioactivity.

Dr. Ken Sugawari, Professor Chemistry at Nagoya University.

My grades were good. I received an A from Dr. Arthur (Physical oceanography) and this was no gift as there were only 4 A's in a class of 14. Dr. Shepard gave me an A, there were only 3 A's out of 14 students. I received an A from Dr. Wooster and a B+ from Dr. Johnson. As I stated in a letter to Dr. Barnes, "*This semester has seen more of my time spent on studying that than in my pervious academic career.*"

At the end of the Fall quarter, my guidance committee was set up and consisted of:

Dr. Norris Rakestraw, Chairman

Dr. Martin Johnson and

Dr. Edward Goldberg.

Winter Semester 1957

The winter semester ran from Monday, 4 February 1958 to Wednesday, 22 May 1958. Again classes met Monday, Wednesday, and Friday. I registered for:

Ocean 210 – Advanced Physical Oceanography	Dr. Arthur
Ocean 123 – Geochemistry	Dr. Goldberg
Ocean 223 – Beach and Near shore Processes	Dr. Inman
Ocean 220A – Seminar on marine Geophysics	Dr. Raitt

After two weeks, I dropped Ocean 210 because my mathematics was very rusty but continued to audit the class. I added Ocean 223 for credit.

In Ocean 223, we had an unexpected treat. **Dr. Gifford Cochran Ewing (1904-1988)** owned a Grumman Widgeon that could take six passengers plus the pilot and copilot. The Widgeon is an amphibian but we stayed on land. So one very nice day, Tuesday 21 May 1957, he flew six members of the class from San Diego to Santa Barbara going just off shore and at about 500 feet altitude so we could have a good view of the coast line. I took 22 pictures with my 4x5 Speed Graphic and 60 color slides. The second group drove to Santa Barbara and we

drove back to Scripps. This was a fun day as well as being very educational. Dr. Ewing also owned the **La Valencia Hotel** at 1132 Prospect Street at Girard I La Jolla.

Another project of this class was to study the currents in Mission Bay. We used five rowboats, without motors, to set drogues, current meters, and to measure the water level. We used the results for term papers.



A Grumman Widgeon

I received an **A** in geochemistry, a **B** in the beach process and an **A** in the seminar. This gave me a grade point average of 3.7 for the year.

General exam

The general exam is the first of five examinations leading to the PhD. After passing the general exam, the student is a candidate for the PhD. The student must also pass two language examinations; usually French and German. Then after completing the required course work, the student will take the qualifying examination which will determine whether or not the student can begin work on his/her dissertation. The last examination is thesis defense. I passed the German Language examination on 27 January 1958. I took the French examination on 19 February 1958 and passed.

The committee for my general examination consisted of

Dr. Norris Rakestraw (Chairman),
Dr. Martin Johnson,
Dr. Edward Goldberg,
Dr. Robert Siple Arthur (1916-1995), and
Dr. Francis Shepherd (1897-1985)

My general exam was in the afternoon of Thursday, 6 February 1958. Dr. Rakestraw was in Hawaii at that time so Dr. Martin Johnson chaired the committee. For two hours, they grilled me on many subjects. Dr. Robert Arthur asked me one final question “how many meters are there in a fathom”. Since I had been doing this conversion for over ten years, I answered 1.8288 meters without hesitation. The committee told me to leave but stay close to the door. Finally, Dr. Johnson came out and congratulated me. I passed this hurdle.

RA Duties

Part of my work as a Research Assistant was to help **Dr. Charles David (Dave) Keeling** with his atmospheric carbon dioxide studies. Starting in January 1957, I helped develop an equilibrator for measuring gaseous carbon dioxide in sea

water. The gaseous carbon dioxide analyzer was made by Applied Physics in Pasadena. It used a beam of infrared light that passed through the gas. A chopper interrupted the light beam which then struck a microphone. The amplitude of the signal was a measure of the carbon dioxide content in the gas. With proper calibration, this was a very good instrument.

On Thursday, 9 May 1957, I went to Shambam Engineering Corporation in Culver City to see about Kel-F for sealing a sea water sampler. Then I went to Western Plastics to see about heat sealing equipment. And finally to Applied Physics in Pasadena. In the evening, I went to Cal Tech and saw **Dr. Tsai Wah (Jim) Chow**. We had supper at the Actenea in Pasadena. I drove 295 miles and got home at 2230. Driving in Los Angeles traffic was very interesting.

Mukluk

I was asked to go on a geophysical exploration cruise aboard the **RV Horizon**, code named **MUKLUK**. The **RV Spencer F. Baird** was the second ship. I was to be the lead chemist on the trip. **Dr. George Shor (1923-2009)** was the senior scientist.

The purpose of this expedition was to complete some geophysical exploration that had started in 1956. Most of the work was seismic profiling. One ship (the shooting ship) would set off an explosive charge and the other ship (the receiving ship) would receive the signal by a hydrophone array strung far enough aft of the ship's propeller wash to avoid extra noise caused by the propeller. The shooting ship put a hydrophone into the water to listen for the detonation. The receiving ship started a PDR (precision depth recorder). The signal from explosive charge was sent to the receiving ship by radio and a mark was placed on the PDR chart. Time ticks at one second intervals, obtained from WWVH, were put on the edge of the chart. This permitted exact time of initial arrival of all the signals to be determined with an accuracy of 0.01 second. The signal from the explosion would travel through the various layers of the ocean floor and the receiving ship would be recorded this information on the PDR. The time delay between the explosion and arrival time of the seismic signals depended upon the distance between the two ships and the density of the bottom layers. The starting distance was usually about one hundred nautical miles. At this distance, about 300 pounds of TNT were used for the explosion. As the distance between ships decreased, the explosive charge was lessened until only about a five pound charge was needed. The shooting ship was then went past the receiving ship to a predetermined distance. At this point, the rolls were reversed with the receiving ship becoming the shooting ship.

Occasional hydrographic stations would be obtained to determine the sound velocity and well as other chemical data. The water sampling results were published in the *Oceanic Observations of the Pacific - 1957*.

The week before the cruise, I prepared the chemistry laboratory so we could run all the necessary analyses aboard ship. I instructed **Bob Rewich** in both the oxygen determination and salinity determination. I put a Beckman DU on board and set up for silicate and phosphate determination. I helped **Dave Keeling** set up the carbon dioxide analyzer and associated equipment. I was to watch this analyzer during the cruise. **Robert (Bob) Rex** ran the pH and alkalinity determinations.

We departed San Diego on Wednesday, 8 July 1957, and returned on Monday, 26 August 1957. The **Horizon** was larger than the **Brown Bear** and carried a larger ship's crew and scientific crew. But the available laboratory space was about the same. Our first stop was at a naval ammunition pier where 22 tons of TNT were put into the power magazine. We stopped at several places in the Aleutian chain and went as far north as latitude 55° 59.0' N. We made 18 hydro stations. All the chemistry was run aboard ship including salinity. When we arrived, back in San Diego all the water sampling data had been reduced and was ready for publication. I am glad I had this experience of seismic exploration. A copy of my shipboard diary for this trip is in **Appendix 29**.

There were marine technicians aboard who actually put the Nansen bottles on the line and handled the winch. When the Nansen bottles had been retrieved, I would drain the sea water into the necessary sample bottles for analysis. One time while I was reading the reversing thermometers, the lead marine technician, Dougal Reith, challenged my accuracy because of the speed I could read the thermometers. So he read them and found that I was very accurate. I had to explain to him that I had ten years of experience in reading reversing thermometers and had taught others how to read thermometers. He never again challenged my accuracy.

Fall and Spring Semesters 1957-58

During the Fall Semester 1957, I took three hours of research (Oceanography 299) and spent a considerable amount of time studying for the qualifying examination. The research was partly on the polarographic determination of nitrate in sea water; I continued working with David Keeling on the development of an gaseous equilibrator for the determination of dissolved carbon dioxide in sea water. This was quite successful.

In the Spring Semester 1958, I took
Ocean 121 Maine Microbiology by Dr. Dennis Fox
Ocean 299 Research project

SIO Ships

In 1957, the SIO fleet consisted of the **RV Horizon**, **RV Spencer F. Baird** and the **RV Stranger**. These ships were moored at the dock at the Naval Electronic Laboratories at Point Loma. This provided a well sheltered area for the ships but

it was inconvenient to get to the ships. It was a 14 mile one-way drive through city streets. And there was the guard at the entrance to NEL that sometimes challenged you and your need for admission to the ships. Even with this inconvenience, we survived and were able to accomplish the necessary field work.

Sometimes, Scripps sponsored a High School Science Fair Exhibitors with a day trip on one of the ships. On Monday, 8 April 1957, I participated in such a cruise. It was part of my job to explain the duties of a sea going chemist and oceanography in general.

Correspondence with the UW

During my stay at Scripps, I kept in contact with **Dr. Barnes** and **Dr. Fleming** at the University of Washington. I did this because of friendship and the desire to eventually return to the Department of Oceanography. These letters described the events at Scripps and at our home. A separate notebook contains these letters. I sent Dr. Barnes copies of my class notes

Pier observer

Records of the water characteristics have been taken at the end of the Scripps Pier for over 50 years. On Wednesday, 11 September 1957, I became the official Pier Observer and reported to Dr. Arthur. I replaced **Gaylord Miller** who was working on a project with **Dr. Walter Munk**. My duties were to go to the end of the pier each week day, take water samples for chlorinity and dissolved oxygen, a secchi disk reading, and tend the tide gage. Occasionally I had to repair broken parts. In August 1958, I prepared a pier observers manual for my successors to use.

The **International Geophysical Year (IGY)** office sent two cinematographers, **Tony Gullee** and **Roy Brubaker**, from TV station WGBH, 84 Massachusetts Avenue, Cambridge, Mass. to film many of the research projects going on at Scripps,

especially the projects connected with IGY. They were preparing a movie promote oceanography. The photographers wanted movies of the pier observer at work so I was drafted to fulfill this daunting job. It turned out that this sequence was the opening sequence of the movie. I used this movie many times when I was teaching Oceanography 101 at the University of Washington. The students were often surprised to see their instructor as one of the stars of the movie.

Glass blowing

A fisheries faculty member needed some special laboratory equipment that had to be constructed. It involved considerable scientific glass blowing. This was not a difficult task so I did about a weeks worth of scientific glass blowing. I also

prepared equipment for shipboard use. I enjoyed the glass blowing but I would never want to do this as a profession.

Elizabeth Taylor (1932—2011)

The brother of Elizabeth Taylor, the movie star, was a draftsman at Scripps. Occasionally she would visit the campus to see her brother. At this time, she was not the most attractive woman having put on a lot of weight. I found her automobile to be more intriguing.

Whale spotting scope

On the roof of Ritter Hall, the group of biological oceanographers studying whale migration had set up a 40 power binocular telescope. They would often sit for hours counting and identifying passing whales. But when this spotting scope was not in use, students would often make carefully observations of the beaches on either side of the pier. As interesting as the observations proved to be, the results were never recorded.

Antioch Student

Occasionally, Dr Rakestraw would invite students from Antioch College in Yellow Springs, Ohio to come to Scripps for a semester and work on various projects. Antioch required a student to have at least two coop work programs before they could graduate. **Robert (Bob) Wheeler** was assigned to me starting in April 1957. He turned out to be a quick learner and was very helpful. He went on the **Mukluk** cruise as an assistant chemist. I was glad to help him during this time. Bob wrote me a letter of thanks when he left. When I returned to the University of Washington, I had several Antioch students work for me. Most of them were very good but I did have one who was less than satisfactory.

Red tide and phosphorescence

The summer of 1958 was exceptionally warm and many luminescent species of phytoplankton bloomed. In the evening, we would take our daughters to Scripps beach and play in the water. At first, Rebecca was frightened of the luminescent but when she saw how it was happening, she had fun causing the organisms to glow. Many people were on this beach having fun with these glowing phytoplankton.

Qualifying exam

Before taking the qualifying examination, the student must have proficiency in two Foreign Languages. I chose French and German. To assist my preparation in French, I had a tutor in Pacific Beach. One evening while driving home from the tutor, I was driving north on La Jolla Boulevard and crossed Pearl. I was

wondering if the stop light was red or green. Very soon a flashing red light appeared in my mirror. I pulled over and asked the policeman if the light was green. He wrote out a ticket for running a red light.

For the German examination, **Dr. Dennis Fox** gave me a reading to translate. I passed the German exam on Tuesday 31 December 1957 and the French exam on Monday 10 February 1958. With this requirement out of the way, I then concentrated on the Qualifying Examination.

In the late spring of 1958, from 17 to 20 March 1958, I got conjunctivitis (pink eye). This made studying difficult because my eyes were very light sensitive and required the use of sun glasses even in low light. I went to a doctor in La Jolla who had been a navy doctor. He said that everyone on his small ship had come down with conjunctivitis. He used the recommended treatment on the enlisted men and his own treatment on the officers. The officers were cured in a few days but the enlisted men took much longer. So he now uses his own treatment, one shot in the rear and eye drops, which cured my case in about three days.

In late June 1958, my doctoral committee was set up. Members were:

Dr. Norris W. Rakestraw, chairman,
Dr. Edward Goldberg (chemistry oceanography),
Dr. Robert S. Arthur (physical oceanography),
Dr. Warren S. Wooster (descriptive oceanography),
Dr. William Feger (biological oceanography) and
Dr. James N Pitts (UC Riverside campus, chemistry)

Since I had not met **Dr. James N. Pitts**, Dr. Rakestraw set up an appointment for me to meet him on the UC Riverside campus. I had the use of a company car to drive to Riverside. My family went with me. After this meeting I spent considerable time studying all sorts of oceanography.

The date for my qualifying examination was set for 1330, Monday, August 18, 1958 and held in Room 202 Scripps Hall. This was a four hour oral exam and consisted of all of all types of questions. Some I could answer directly and others were so poorly worded that it was nearly impossible to determine what the examiner wanted. After the questions were finished, I was sent out of the room to wait. When I was called back, I was informed that I did not pass.

My committee felt that I was weak in the fundamentals of chemistry, largely due to the fact that it had been over ten years since I have had any formal classes in chemistry. They did feel that I had an adequate grasp of the supporting subjects in oceanography and was a very competent oceanographic observer. Also they felt that I should stay in the field of oceanography. Hence, they gave me two alternatives:

(1) go back to work or

(2) go to UCLA or Berkley or some other university offering chemistry and bring my chemistry up to an adequate working level. This would take at least until June 1959. After much discussion with the faculty and my family, I decided that I would go back to work while retaining the option of retaking the qualifying examination at a later date. I never took this option as work at UW was very intense and permitted little time for studying or taking formal classes.

During this period, I was not the only one to fail the qualifying examination. **Louis Gordon** (chemistry) and several biological majors were on the hit list. Lou finally went to Oregon State University and did get his PhD from OSU.

Looking for work

I asked Dr. Barnes, in a letter of 26 August 1958, if there was an opening at the University of Washington. I also checked for job opportunities at Scripps (\$598 per month), and Woods Hole (\$410 per month) and Amherst (\$500 per month). On 29 September 1958, Dr. Barnes replied that he would indeed like me to return to the University of Washington. He presented a list of duties and a salary of \$575.00 per month with the title of *Senior Oceanographer*. After looking at all the options, I chose to return to Seattle. This had been my original plan and my family was glad to return home. I formally accepted this offer on 29 October 1958 with the understanding that I had to complete some duties here at Scripps and at our church, and to finish a Master of Science degree. We set the return date as the second week of January 1959.

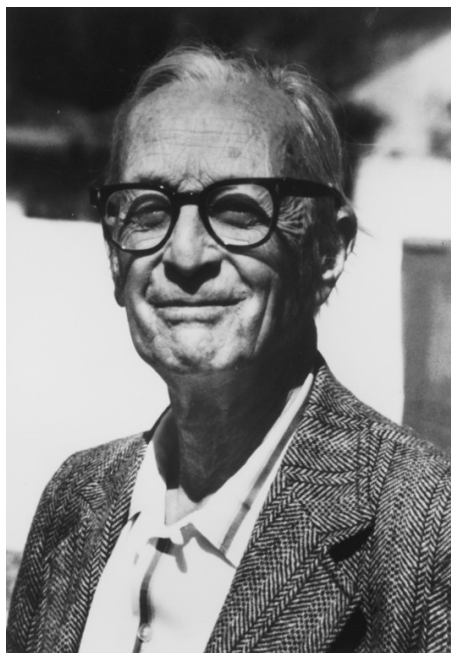
In early December, I took the oral examination for the Master of Science degree with Dr. Rakestraw being the chair of the committee. I passed and was formally awarded the MS degree on 29 January 1959.

Worked until mid-December 1958

After failing the qualifying examination, Dr. Rakestraw offered me a full time job at \$505 per month until I decided where to work. I was assigned to assist Dave Keeling with his carbon dioxide project. This was a continuation of what I had been doing.

I also had a short consulting job with the **Marine Advisors** where **Paul Horer** was the principal. I worked on a potential sewer outfall being proposed to discharge off Point Loma I looked at the density structure of the water and made a determination whether or not the discharged sewage would come to the surface. This report took about one month to prepare.

On Saturday, 27 December 1958, we left La Jolla and headed back to Seattle.



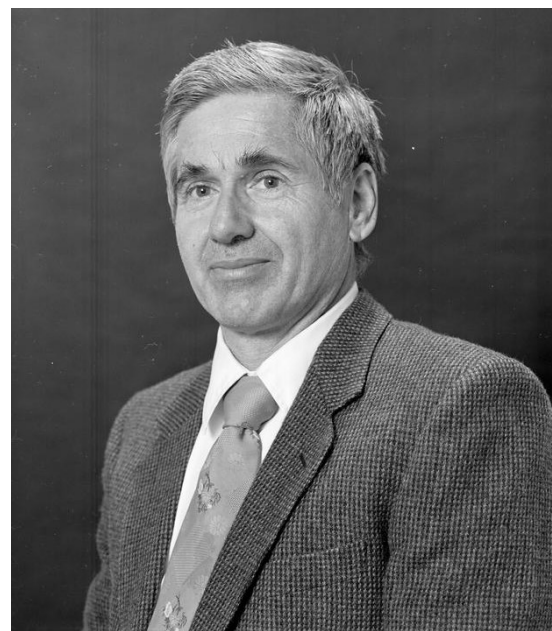
Francis Shepard,
geologist



Warren Wooster,
descriptive oceanography



Dr. Edward Goldberg
Chemist and member of my committee



Charles David (Dave) Keeling
Carbon Dioxide



RV Horizon



RV Spencer F Baird



Geology class on pier observing waves.



Biology class looking tat growth on pier



Geology class along Torrey Pines trail



Scripps hall 1957



Scripps Pier 1958



Aquarium 1957



Ritter Hall 1957



Scripps Campus looking NE from end of pier 1958



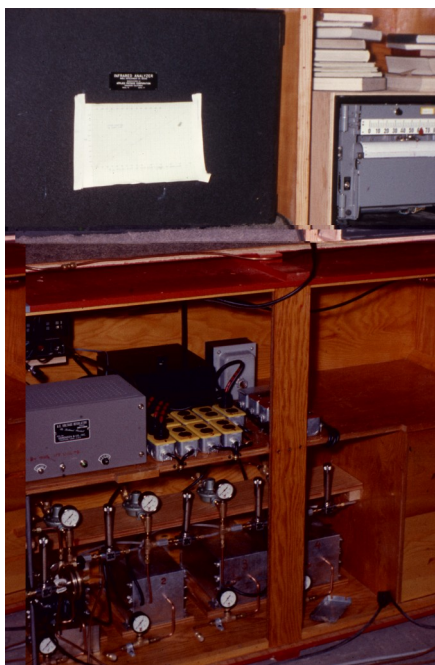
Scripps Campus looking SE from end of pier 1958



Flag Pole



Ritter Hall 1957



CO2 analyzer on pier 1957



Addition to Ritter Hall 1958



Dave Keeling's CO2 measuring apparatus



Aerial photo of Scripps in 1956



Ritter Hall in the 1940's

Chapter 3-4

UW OCEANOGRAPHY (1959 – 1981)

1959 – Return to UW

It was my intention to return to the University of Washington when I had completed my second round of Graduate School. This is one reason why we rented our house rather than sell. Before leaving Scripps, I had offers from four groups: Scripps, Amherst, Woods Hole and the University of Washington.

On 26 August 1958, I wrote to **Dr. Clifford Barnes** stating that I was interested in returning to the Department of Oceanography. He responded and said that if I wanted to move back to the University of Washington, I would be appointed **Senior Oceanography** with a salary of \$575 per month beginning 15 January 1959. Overall, this was the best and most exciting offer. I was to be in charge of the routine chemistry laboratory and work on the accumulated Puget Sound Data. I accepted this position in November 1958.

Edith Hazelwood was the administrative assistant that handled my employment. We became friends and she was a good administrator. She left the department in 1963 when her husband accepted a position with the University of Hawaii as a professor of engineering.

Dr. Richard Fleming was still the department chairman when I returned. **John Dermody** was Dr. Fleming's assistant. Again my immediate supervisor was **Dr. Clifford Barnes**.

Dr. Clifford Barnes

Clifford Adrian Barnes received his undergraduate and graduated degrees from the University of Washington Department of Chemistry. His PhD dissertation was under the direction of Dr. Thompson. The title of his dissertation was **Review of dynamical consideration of ocean currents and physical and chemical in Bearing Sea and portions of the North Pacific Ocean (1936)**. After receiving his PhD he moved to Columbus, Ohio and worked on coal products for the Battelle Laboratories.

During World War II, he enlisted in the US Coast Guard at a Lt. Commander and served as head of the International Ice Patrol. The Ice Patrol was based at the Woods Hole Oceanographic Institution. Under this guidance, no ships were lost due to sinking by ice burgs. He told us that one time, he saw a ship approaching an ice berg. It was a dark moonless night. His ship was equipped with radar and the other ship was not. He broke radio silence to warn the other ship to steer away from the ice berg. The skipper was shocked to hear a voice come over his radio with such a warning. But he steered away from the berg and no damage was done.

Dr. Barnes joined the faculty in late 1947 as an Associate professor. He was promoted to Full Professor in 1955. During the 1968-69 academic year, he served as Acting Chairman of the Oceanography Department while Dr Fleming was on sabbatical leave in Turkey. Cliff retired in 1973 as Professor Emeritus. Cliff kept his office (room 201) in Old Oceanography building until 1980. His wife, Marjorie, died in about 1978. This devastated Cliff. He became the victim of dementia and after about two years he left his office. He was cared for by his children until his death in 1995. A 65-foot research boat is named after him.

Cliff's major contribution to the Department of Oceanography was his ability to secure grants, mostly from the Office of Naval Research (ONR). These grants supported many individuals, including me on research. ONR also provided funds to acquire and operate the various ships on Oceanography's fleet which included the BROWN BEAR, ONAR, HOH, and the TOMOAS G THOMPSON I.

Cliff enjoyed teaching the undergraduate courses in physical oceanography. I took his course during the summer term at Friday Harbor. He enjoyed field work and was the senior scientist on many cruises. He lead or had a major input to many cruises in the Arctic Ocean on the **USS Burton Island (AGB-1)**. See page 3-16 in this chapter.

Office assignments (From UW directories)

In all I had ten office in various parts of oceanography during the time I was with Oceanography. Below is a list of the offices. I will describe them in more detail following this list.

1948 to 1950 I had a desk in Dr. Barnes office, 201

1950 to 1956 I was in room 324

For a few months in 1959, I was in the routine chem lab.

1959 to 1960, I was in room 318 (assigned phone number 543-5078)

1961 room 214 (my original chem lab)

1962 back to 324

1963 to 1964 room 321

1965 to 1968 Barge room 121, a small but adequate office

1968 to 1973 Barge room 238, a large two-room office

1973 to 1981 Barge room 108, the former student advisors office,
two rooms.

I had several offices from 1959 to 1981. Immediately upon my return, I had a desk in the routine chemistry laboratory, room 224. **Ralph Riley** was the lead chemist. He was very competent and required little supervision. I moved to room 318 on 13 May 1959 and on 13 September 1959 I back to my old laboratory, room 214 for about six months. Then I moved to 324 for one year and then to 321. I shared it with **Don Doyle**, a senior cartographer. In 1963, I was assigned a phone number of 543-5078 which I had until May 1981

The **Oceanography Barge (APL-49)** arrived in mid-1964. It was an old Navy auxiliary personnel living barge. There were over 200 bunks, a galley and scullery, a complete machine shop, and a large engine room that had been deactivated. It was used for temporary quarters for personnel while a ship was tied to it to undergo repairs. Under the City of Seattle Fire Code, the barge had to be treated as a building. Thus, there was a lot of preparation to be done before it could be occupied. This took about six month to accomplish. The first and second decks were converted to offices with the forward bunk room on the first deck converted to a classroom. The lower area was used for storage. The roof had all the ventilating system on it. Often the blowers for ventilation would be noisy so we sometimes turned them off.

From early 1965 to May 1981, I had three offices on the barge. My first office was room 121 on the starboard, Union Bay, side about midship and forward of the scullery. It was about 12 feet wide and 15 feet deep with one porthole, about seven feet off the deck. During the summer, the room would become very hot. When the temperature reached 90°F, I and my helper would leave. Dr. Fleming moved into the large office across the hall. To help keep the south side of the barge cooler when the sun was out, a plywood false wall was installed with about 1.5 inch airspace. This was a big help in keeping the rooms cooler.

In 1967, I moved to room 238 in the after end of the second deck . It was a large office with two rooms and had space for my staff of eight. It had a double wooden door in the west end. When the weather was nice, we would open the doors and enjoy the breeze.

In 1973, the CUEA (Coastal Upwelling Experimental and Analysis) group wanted more space. They made several improvements on the main deck so they could occupy most of the second deck. I moved back to the first deck port side room 108. I now had a two by three foot window as well as two portholes for light. There where three doors leading into the two rooms and a roll up metal curtain in the east room. At one time this was the student advising office. My helpers were in the forward (east) room. These rooms constituted my office until I left in May 1981.

Departure of the Barge

Originally the **Oceanography Barge** cost the department one dollar plus towing charges from Bremerton. It was sold in 1989 to Avondale, Inc. for \$350,000. Several months were required to remove all material from it. I had many records stored in the brig, class room and cartography area. In late 1989, I got a panic call to help in sorting the records that should be retained and those that should be discarded. I was surprised to find my original sketches for diagrams that were used in my publications. **Don Doyle**, lead cartographer, has saved all my originals, the intermediate and final drawings. **Curtis Ebysmeyer** and I went

through about 30 drawers of drawings. Our final *keep* pile was only about 6 inches thick and the *discard* pile was several feet thick. In most cases only the final drawings were saved. The records to be kept were taken to the new **Fisheries Building** on Boat Street for temporary storage until they could be transferred to the **University Archives**. On Thursday, 25 January 1990, at 1045 the Barge was towed away. That afternoon a party to remember the barge was held in the **Marine Science Building** lobby. Thus the life of a valuable “building” was ended after being used by Oceanography for seventeen years. See **Appendix 30** for more details.

IBM 650 Computer and other UW computers

When I returned to the UW in January 1959, the hot topic was the IBM 650 computer. Many of us would have to learn how to program and operate this latest addition to the University. **Dr. David Decker (1923?-2004)** was the director of the Computer Laboratory and taught a class in programming. The **Computer Lab** was located on the fourth floor of **Bagley Hall** over the main entrance.

Because oceanographic data processing requires many repetitious mathematical operations, it was deemed necessary that many of us in oceanography learn how to use this device. When I was informed that I would be taking a class in computer programming, I jumped at the chance. The classes started one week before I was officially on the payroll.

The first time I addressed this monster was on, Thursday 8 January 1959. I was petrified as I stood in front of the control panel with its many dials and flashing lights. In about two weeks, we became very well acquainted and the fear level dropped. But the frustration level remained high and still does today with our “very advanced” computers.

The IBM 650 magnetic drum data processing machine consisted of two bays each being three feet wide, six feet tall and eight feet long. Attached to the computer was an IBM card reader/punch. The internal memory consisted of a drum, about the size of an oatmeal box, coated with ferric oxide and was turning at 1,800 RPM. It held a total of 2,000, ten character words in a bi-quinary format. In today’s concept of storage this would be the equivalent of 20 thousand bytes. The computer I am using to write this biography has 4 billion bytes of internal memory and this is considered to be small. Computers have come a long ways in 50+ years.

There were 3,750 vacuum tubes, mostly 12SN7’s, that did all the work. Operation speeds were measured in milliseconds. It could take as much time as 50 milliseconds to multiply two ten-digit numbers. A patch panel inserted into the end of the card reader/punch determined where the data would be placed into or retrieved from memory.

When the 650 would act up, *Chet Castle* would be called in for the repair. He was the IBM engineer assigned to this 650. One time it took him over three weeks to determine what was wrong with the computer. When he opened a door to a bay, the computer would act correctly. He eventually located a chip out of a capacitor. Dust would accumulate on the exposed wire causing a temporary short. When the bay door was opened the dust would be cleared and normalcy would return. He gave me the module. I kept it on my desk for many years.

A keypunch (IBM model 24 or 26) was used to prepare the data and program on Hollerith (IBM) cards. Each Hollerith (IBM) card had 80 columns and 12 rows where information could be punched in a total of 960 locations. The information on the cards could be in either alphanumeric (A-Z upper case only or 0-9) or binary format. Data sets used alphanumeric characters while programs were usually in binary format. During my tenure at the UW, I used over one million IBM cards.

In addition, to the IBM 650, the computer lab housed the necessary peripheral devices necessary to feed data and programs into the computer. These devices included: key punches, a tabulating machine, card sorters, interpreters, and a collator. The IBM 650 computer, with its necessary peripheral equipment, required over 30,000 watts of electrical power. We had 4.5 tons of air conditioning to keep the room cool.

The IBM 650 laboratory was a do-it-yourself type with some assistance from the "experts" when needed. When you wanted to use the IBM 650, you signed up for a time slot usually in 30 minute increments. A large blackboard was used to write your name in the appropriate time slot. Frequently there were no Anglo-Saxon names on the board.

If you were going to use the machine after regular hours, there was a last-man-out routine for shutting down the entire system; computer, air conditioning, and any other peripheral equipment. Thus, it was always desirable to be the next-to-last person when using the computer on any given day because shutting down the system and securing the laboratory took about 30 minutes.

Prior to creating a print-out of the results, it was often necessary to merge header cards before the data. A card sorter was used to do this. You had to be very careful in the order you sorted the cards. One error required you to start all over. Even though this seemed very laborious, it was actually a very efficient process for preparing good looking reports.

To obtain a print-out your results, we would use a Tabulating Machine. At first only an IBM-402 was available. It used long vertical type bars that moved up and down to the proper character. Only one half of the bars were capable of typing letters. You did not get too close to the 402 when it was running because you could get hit by the vertical movement of the bars.

The most versatile Tabulating Machine was the IBM 407. It used 132 print wheels set at ten per inch. Each wheel contained a complete character set so printing alphanumeric characters was easy. Only upper case letters were available. The paper was usually 14 $\frac{3}{4}$ inches wide but narrower paper could be used. A large patch panel on the right end of the machine controlled the location of the data. Often there would be over 200 patch cords in the panel. I used the 407 to prepare my data reports for publication.

The first programming language we learned for the 650 was the native machine language, the lowest level of programming. Every operation was contained in a ten digit word. A typical instruction may look like **70 1950 0200**. The first two digits were the operation code (**70** for read a card into memory). The next four digits (**1950**) was the location of the data to be stored and the last four digits (**0200**) were the location of the next instruction. Every operation in a program required a separate IBM card so even a simple program such as computing density would take a hundred or more cards. Both program and data were entered into and out of 650 by means of Hollerith Cards.

A short time later, *David Decker* introduced us to an assembler language that used an alphameric code instead of numbers only to describe the process. An assembler program decoded the symbols and created the machine language code. The finished program was punched on to IBM cards in a binary format. The assembler's name was SOAP for Symbolic Optimal Assembler Program. I used this assembler for about three years until the 650 was replaced with a larger IBM 704. This computer used a 32-bit word, was much faster, had 16,000 words of memory and a large hard drive. The many individual disks in this hard drive were about 30" in diameter were kept in a refrigerated cabinet.

The computer lab was moved from Bagley Hall to the basement of Roberts Hall which was a much larger room that housed both the 704 and the 650. The 650 was soon eased out forcing us to learn a new program language. The recommended language for scientific computing was FORTRAN. (FORmula TRANslation). At this point in time, I learned FORTRAN and used it for the rest of my career at the UW.

Several more computers followed. A building on Brooklyn Avenue south of Pacific was constructed to house the academic computer. When the building was first opened, there was a room on the south side of the first floor that had over 50 keypunches. Two high speed card readers were available to feed your data into the computer. The last main frame computer to occupy this space was a CDC 6700. This machine used 64 bit words and had a memory of about 64,000 words. There were several magnetic tape drives attached to computer and several large hard drives. This computer supported many peripheral stations that permitted a person to communicate with the main frame from a distance.



IBM 650 computer



650 tube array with a 12SN7 Vacuum tube



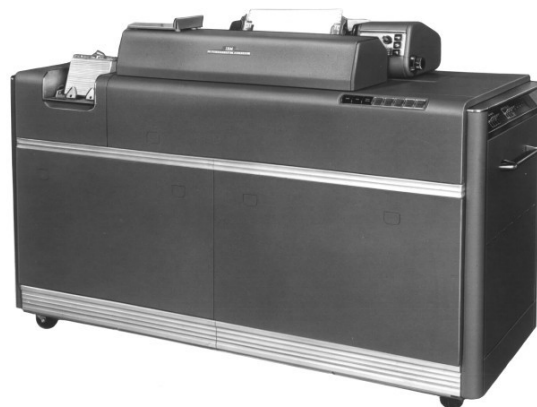
Control Panel of the 650



Patch Panel



IBM 129 Keypunch



IBM 407 Accounting Machine

Oceanography had such a station in the first floor of the Showboat Apartment. This building was torn down in about 1998 to make room for the new Oceanography Building. Because of the large quantity of data I generated, I had an IBM Model 129 Interpreting Key Punch on the Oceanography Barge.

Today in 2012, these early computers are considered to be very primitive. But at that time, it was “state of the art”. We were thankful we could have such a tool to assist in analyzing the huge quantity of data we produced.

Freidan Flexowriter

The **Freidan Programmatic Flexowriter (Model SPD)** was a fancy heavy-duty typewriter that could both punch and read a paper tape. This was one of the first word processors. We used Flexowriter on the **RV Brown Bear** to prepare data for input into a larger computer on shore. Thus by the time the ship had returned from a cruise, the data was ready for final processing. The results were available within one day after returning to port. This was a great assistance in being able to analyses the data shortly after a cruise was finished. The Flexowriter was purchased in February 1964 and was used for about two years when it was abandoned for shipboard use.

After the Flexowriter was abandoned for ship use, I had it in my office for many years and used it to prepare reports and documents that needed extensive revision. Using paper tape made it possible to prepared a report in sections and then combine them into final document. It was cumbersome but it worked and worked well for many years.

The procedure for using the Flexowriter for data oceanographic processing was described in Technical Report No. 181 (1968) titled *Processing of oceanographic station data; a coordinated computer-compatible system* by Eugene E. Collias.

Computers within the Department of Oceanography

It was decided that Oceanography should have its own sea going computer. A PDP-5 was purchased and installed on the **RV Brown Bear** in the August 1964. **Monique Rona** and **William Walker** were the principal operators. The input-output device was a teletype. No more IBM cards. What was proven by this experiment was that a computer worked very well at sea and was a valuable tool. But the operator frequently rode the rail.

When the first **RV T. G. Thompson** arrived in December 1965, the Department purchased two IBM-1130's, one for land and one for the ship. This proved to be a very satisfactory addition. The 1130 used a 16-bit word and had 8K of memory. Within a year, 8K more memory was added. This consisted of a rack mounted panel 19” wide, 8” high, 20” deep and cost \$10,000. We know had 16K words of memory and could write larger programs. Because of the limited memory, which we thought of as huge, we used many overlays. Again the

language used was FORTRAN. IBM had written many FORTRAN subroutines to handle alphabetic characters, thus increasing the usefulness of this computer.

In addition to the internal memory, the external memory was a removable disk that was 14" in diameter, 1.5" deep and held 500,000 16 bit words. Access to this removable drive was through a door on the right side of the 1130. One time a head crash occurred while I was operating the computer. A most un-computer like noise originated from the removable disk. I opened the door, turned off the drive and manually stopped the rotation of the disk. When I examined this large disk, there was groove in the platter about ¼ inch wide and 1/8 inch deep all around the platter. This disk was put into the garbage. It took two days to get the computer repaired.

There were three peripheral pieces of hardware attached to each computer – a CalComp plotter, a paper tape reader and a magnetic tape reader. Because the two computers were identical, it was easy to move a program and data from ship to shore and vice versa by means of these disks.

Later another shore side computer was added, a Prime-300. This computer had several remote terminals attached. I had a terminal in my office on the Barge for about three years. It was handy to be able to use the main frame from my office. Again the large removable disks were used for storage. So when you wanted to use the computer, you telephoned the oceanography computer office asked then to put in a specified disk into one of the two disk drives. Then you were in business. These disks were the same as use on the 1130.

Today, the second **RV Thomas G Thompson** has over 20 computers to control the ship from bridge to engine room. Scientists bring their own computers. Times have changed.

Oceanographic Cruises

In my career as an oceanographer, I have participated in over 230 cruises. The ships I have served on, from the University of Washington were: *Oncorhynchus*, *Brown Bear*, *Thomas G Thompson I*, *ONAR*, *HOH* and *Kestrel*. Other ships I have served on were the USN *Burton Island (AGB-1)*, the Canadian ship *Ecola*, and the Scripps ship *Horizon*. On about 80% of the cruises, I was either the Cruise Leader or Senior Scientist. A listing of the Oceanographic cruises I have participated in are listed in **Appendix 31**.

Cruises on Brown Bear

When I returned to the University, I attempted restart the Sound Surveys. I was only partially successful because the **RV Brown Bear** was used much more for offshore work. From January 1959 to 30 December 1965, I made 24 cruises on the **Brown Bear**. I was the Cruise Leader on cruise BB-381 the last scientific cruise of the **Brown Bear** (28–30 December 1965). I felt that the Department of

Oceanography made a poor decision by not keeping the **Brown Bear**. She was a very good ship for near shore and inshore oceanography. She had a small crew dedicated to science and accommodations for 15 scientists

I made several offshore cruises on the **Brown Bear** that had some interesting incidents. On **Cruise BB344, 18 May to 5 June 1964**, we cruised out as far as weather station **PAPA**. This was located nominally at 50° N and 145° W and was occupied by the Canadian navy ship **HMS St. Catherines**. **Richard Tripp** was the senior scientist. Dick eventually came to Seattle and worked for the Department of Oceanography. The purpose of this location was to provide meteorological data in an area of active weather. There were several other weather stations in the North Pacific. We arrived at PAPA on Wednesday, 27 May 1964, at 0500. We made simultaneous water sampling casts to check our techniques and to compare results. Several of us took our small boat and transferred to the St. Catherines to look around. Dick Tripp showed us the scientific facilities and introduced us to the captain. The St. Catherines was a large ship about 300 feet long with over 50 feet of beam. It was riding very steady in the water. When I looked at the Brown Bear, I thought it was turning hand springs. We on the Bear thought it was quite calm and did not notice how much the Bear was rolling. My party transferred back to the Bear and prepared to depart. We made the customary dipping of flags when suddenly we heard a **bag pipe and drums!** A piper and drummer were sending us off. So we made two complete circles around the St. Catherines before departing. This was a send off to be remembered.

The last *offshore* cruise I made on the **Brown Bear** was **BB352, 11 – 28 January 1965**. We made two lines of stations, one just south of the Cape Flattery out to 140°W and then south and into the Columbia River. We made a station every 12 hours beginning at 0600 and again at 1800. We sampled to a depth of 3,500 meters when possible.

Cruises on first Thompson

The first **Thomas G. Thompson** arrived in Seattle and was tied off onto the **Oceanography Barge** on Wednesday, 15 December 1965 at 1200. The skipper was **Franklin Wallace Princehouse**, Marine Superintendent and former skipper of the **RV Brown Bear**. The Brown Bear tied up on the outboard side of the **Thompson**.

One interesting event occurred when I was teaching Ocean X380. I was scheduled to take the X380 class for a short cruise to demonstrate our new Neil Brown STD and data acquisition system aboard the **Thompson**. On Tuesday, 18 January 1966, I had a briefing with some of the ships crew to explain what I wanted to accomplish. We left on the afternoon of Wednesday, 19 January 1966, and were entering the locks when the thrust bearing on the electric propulsion

motor came loss. The armature shifted aft about six inches thereby destroying this motor. The **Hoh** and **Onar** were dispatched to tow the **Thompson** back to the University Barge. This was quite a demonstration for the X380 class. While the main motor was being repaired several other defects were discovered and corrected. Finally on Wednesday, 2 August 1966, six and one-half months later, the **Thompson** set sail for a 9 day cruise designated at **TT002**.

I made four cruises on the **Thompson** including one from San Diego to Seattle. I flew to San Diego and spent one day with **Ray Lawton** before joining the ship. I took us ten days to get back to Seattle.

RV Kestrel

The **RV Kestrel** was a Norwegian style fishing boat about 65 feet long. It was acquired by the University in the early 70's and sold on Friday, 19 September 1980 to Mark J. Gilkey, 1874 NW Blue Ridge Drive, Seattle, 98177 for \$81,334.78. It was used mostly as a day boat. I used it for the Metro studies from 5 November 1974 to 19 November 1975.

According to records in the University of Washington Archives (Box 60), I used the Kestrel on three contracts from 7/75 to 6/76 as follows

<u>Contract</u>	<u>Hours used</u>	<u>Contract name</u>
63-5836	216.0	Port Orchard Studies
63-1546	170.5	Metro Nutrient Studies
63-5830	49.0	Liberty Bay Waters

Projects I worked on

From the time I returned to the University in 1959 until I retired in 1980, I worked on eight major projects, prepared three major publications and one unpublished book. The projects were:

- Puget Sound Surveys
- Bellingham Bay study
- Kiket Island proposed nuclear power plant
- Sewage discharge from Metro's sewers
- Columbia River studies
- Dabob Bay
- Metro Nutrient Study
- Grays Harbor evaluation for the US Army Corps of Engineers

The major publications are:

- The Atlas of Physical and Chemical properties of Puget Sound
- Index to chemical and physical data in Puget Sound
- An annotated bibliography of Puget Sound

A book, sponsored by Sea Grant on the physical and chemical properties of Puget Sound (unpublished)

Many of these and other projects will be described separately. Publications will be found in my curriculum vita (**Appendix 32**).

I also visited several high school to talk about oceanography. I was invited to lecture before several marine related groups.

Bellingham Bay Survey

The first major project I worked on upon my return to Oceanography was *An Oceanographic Survey of the Bellingham-Samish Bay System*. This survey was conducted under a contract with the Puget Sound Pulp and Timber Company of Bellingham, WA. The purposes were (1) to determine the distribution of Fresh and sea water in the system and (2) to examine the influence of the adjacent seawater masses upon the system. The survey was conducted from April 1960 through November 1961 for a total of 14 cruises. We made current measurements using drogues, dye studies, anchored recording current meters, as well as water samples. The results were published in two volumes: *{Oceanography Special Report No. 32, Volumes I and II}*.

Trip to John Hopkins

As part of the Bellingham Bay Survey, we wanted to use dye tracer studies to follow some of the water masses. Since we had no first hand experience in this technique, **Dr. Barnes**, decided I should go to **John Hopkins University, Chesapeake Bay Institute** in Baltimore, Maryland to become better acquainted with dye tracer techniques. I spent six days (17 – 22 October 1960) there and had first hand experience of making a dye study. This was being done in the lower Chesapeake Bay aboard the **RV Lydia Louise II**. **Dr James Carpenter (1928-2003)** developed the dye techniques for use in Chesapeake Bay. **Mr. H. H. "Bud" Whaley**, was my official guide. On the way back to Baltimore, we stopped at the Yorktown Revolutionary War Park and saw a reenactment of the surrender of the British **General Cornwallace** to end the revolutionary war.

After my visit to **John Hopkins University**, I went to Washington DC for two days and became a sightseer. **Tom Glancy** showed me around the town. Then I went to Louisville, KY for three days to attend the Annual Convention of the Christian Church (Disciples of Christ).

Trips to Washington DC for NODC

For many years, I had been using a modified form of the NODC (National Oceanographic Data Center) format of data (Hollerith) cards. Because of my experience, I was invited to become part of the NODC working group to finalize

a NODC data format to be used for both offshore and inshore oceanographic data presentation.

In 1967, I made two trips to Washington DC as part of a working group to decide upon the format of IBM cards to be used for storing oceanographic data. The working group sat around a large table. In back were an equal number of lookers who listened but did nothing more than occupy a chair.

Columbia River effects

The **Atomic Energy Commission (AEC)** became aware that many of the radioactive byproducts from the Hanford Atomic Works were being discharged into the Columbia River. Oceanography received a major contract to study the distribution of radioactive nuclides from the mouth of the Columbia River seaward. Part of the study was to include the distribution of the Columbia River effluent along the coasts of Washington and Oregon. I made a total of 11 cruises either on the **Brown Bear** (265, 288, 293, 308, 312A, 326, 335, 344, and 352), or the **T G Thompson I** (30 and 60) in connection with this contract.

On one cruise, (Brown Bear 293, 14 September to 20 October 1961), we determined that the Columbia River effluent covered an area equal to the combined area of the states of Washington and Oregon. We used a continuous water sapling device that made it very easy to determine the edge of the plume. The sensor was located in the sea water intake that cooled the auxiliary generator. The edge of the plume showed a marked increase (or decrease) in salinity, 32.5‰ being the defining value.

Kiket Island

Kiket Island is a small island about two miles east of Deception Pass. (See map on page ____.) It was the site of a proposed nuclear power plant to be constructed jointly by **Seattle City Light** and **Snohomish County Public Utility District No. 1**. The research included oceanographic studies and biological studies. The biological studies were conducted by the Fisheries Research Institute (FRI). The Applied Physical Laboratories (APL) performed some dye diffusion studies. A small laboratory and boat shelter was constructed on the northwest side of the Island. An existing house was used for overnight use and an office.

Clifford Barnes was the principal investigator for the entire project. I was the senior scientist for our group, **Quinton Jerome Stober** was the senior scientist for FRI, and **Terry Ewert** was senior scientist for the APL group.

From the final report, I quote:

The objectives of this study of the physical and chemical oceanography of the waters of Skagit Bay were: (1) to acquire and analyze sufficient data to permit the prediction of the distribution of waste heat from the discharge of cooling water

from the propose Kiket Island nuclear power plant, (2) to provide background information needed for the biological survey conducted during the same period by the Fisheries Research Institute of the University of Washington, and (3) to provide information necessary for engineering designs, such as optimizing the location of intake and outfall lines, from the viewpoint of minimizing any environmental impact, economics and feasibility.

This project began on in August 1969. The field program was terminated 7 October 1971 and the final report was submitted in December 1973. In all 42 cruises were made in the study area. By late 1972, the plan for the nuclear plant was dropped due to environmental concerns. Seattle City Light and Snohomish County PUD sold the property in 1980.

This was a fun project involving many different types of observations. The first four cruises were made as part of the research sponsored by the Office of Naval Research (ONR). From 10 February 1970 to 7 October 1971, cruises to measure water characteristics were made at three week intervals, for a total 29 tri-weekly trips.

Recording weather stations were installed at six locations and tide level recorders at seven locations. Because of the remoteness of these instruments, it was more practical to fly than take a boat. By the use of a float-plane, the instruments could service in one-half day as opposed to two days by boat. We chartered planes from **Kenmore Air Harbor**. **Bill Fisk** was pilot on all the trips we made. One of our weather stations was located on the light structure off of Strawberry Point. Bill would carefully head for the light structure and cut the engine so we would drift to the light and tie off. One time returning from Kiket Island we encountered a low ceiling of about 200 feet. We flew just above the masts of the fishing boats.

Tide gages were installed at seven locations. One tide gage was located on Charles Island owned by the **Scripps's** family. We had full use of the house on the island when we had to stay overnight. Dorothy accompanied me on one of the trips. We took the ferry from Anacortes to Lopez Island, drive to the south tip of the island and the caretaker would meet us with his small boat and ferry us to Charles Island. This was a pleasant evening. In exchange for the use of the island's pier, we gave the **Scripps's** family a complete set of our tide records.

Currents near Kiket Island were measured using both drift poles and anchored current meters. In order to determine our position we used sextants and the horizontal angle technique. It was necessary to have known land marks many of which were not on the charts. Using a theodolite borrowed from Joel Colcord of Civil Engineering, **John Lincoln** and **I** "cut in" many of the landmarks both natural and artificial. We would put out drogues set at selected depths, follow

them in shall boats and determine their positions. The trajectories were then plotted to give us an idea of the water movement.

We established several anchored current meters in the water. Their location was marked with buoys. We did loose one set that apparently became captured by a log boom.

One time we had the FRI barge **Kumtuks** towed to the area. It had both living and laboratories on it. We used this as a base for several current surveys and dye studies made by the **Applied Physics Laboratory**.

After the field work was completed, it took nearly two years to prepare the final report and is found in the publication titled ***Skagit Bay Study Dynamical Oceanography, Final Report by Collias, Barnes and Lincoln***. It carries the *Department of Oceanography reference number M73-73, December 1973*.

Metro Nutrient Studies

The sewerage treatment plants of the Municipality of Metropolitan Seattle (METRO) discharge their effluent into Puget Sound at many locations from Pulley Point to about Edmonds. METRO contracted with the Department of Oceanography in July 1973 to study the potential effects of these sewer discharges upon the waters of Puget Sound. We set up a series of 29 stations from Tacoma north to Point No Point and occupied them every three weeks. The first tri-weekly cruise was made on 5-7 November 1974 and was concluded on 17-19 November 1975 for a total 22 cruises. We took water samples and an STD lowering at each station. We used the **RV Kestrel** for these cruises. **Rachel Ozretich** did the nutrient analyses aboard ship using an onboard autoanalyser. The results of this study are presented in the report ***A STUDY OF THE NUTRIENTS IN THE MAIN BASIN OF PUGET SOUND***, by *Collias and Loehr, February 1977*. A copy of the abstract is in **Appendix 33**.

Grays Harbor

I received a contract to prepare **A REVIEW OF WATER CHARACTERISTICS OF GRAYS HARBOR 1938 – 1979 AND AN EVALUATION OF POSSIBLE EFFECTS OF THE PROPOSED CHANNEL WIDENING AND DEEPENING PROJECT UPON PRESENT WATER CHARACTERISTICS**. **Lincoln Loehr** and I combed the literature and visited **Grays Harbor College** to obtain the data they had. We also evaluated a mathematical model of Grays Harbor created by the Civil Engineering Department. This was a masters thesis for Bruce Robert Cleland (1978). We started this project in November 1979. The final report was completed in January 1981 but the reference number assigned was M80-22. The data report contained data from over 36,000 records and is over 1,000 pages long.

I had retained sufficient funds to pay for my salary (½ time) even though I had officially retired on 30 July 1980. This was my last major project while employed by Oceanography.

Working for the Bureau of Commercial Fisheries in Honolulu

In 1965, **Gunnar Seckel** invited me to work for the Bureau of Commercial Fisheries (BCF) in Honolulu on the ESTROPAC data that had been collected by BCF. They had no one on their staff who could do the type of analysis Gunnar wanted. So I went to Honolulu on 15 February 1965 and stayed until 19 March 1965. I stayed with **Mrs. Elsie Smith** and her daughter, **Martha Jane** who was Rebecca's age. They lived about four blocks from the University of Hawaii campus at 1810 Hunneywell. **Elsie** was a Professor of Nursing at the University of Hawaii. She had a cancerous lesion on her face and had surgery while I was there. I helped take care of Martha Jane while Elsie was in the hospital.

The BCF office was at 2500 Dole Street on the edge of the University of Hawaii (UH) campus. I spent many hours in the UH computer laboratory. This was interesting work and was appreciated by the BCF staff. I did not complete all the work I had been assigned so I brought it back to Seattle and finished it about one month after my return to Seattle.

For lunch, we would often go to the cafeteria in the East-West Center. I explored parts of the campus but most of my time was spent either in the BCF office or the computer lab.

The research vessel **RV Townsend Cromwell** was assigned to Honolulu and was operated by BCF-Honolulu. I had the opportunity to go on a short harbor tour on this ship. **Townsend Cromwell** was a well known oceanographer from Scripps who was killed in 1962 when the airplane on which he was a passenger crashed in Mexico. He was going to a port in Mexico to meet his ship.

When not working, I had time to explore Honolulu and the surrounding area. Mrs. Smith was a member of the **Honolulu Christian Church (Disciples of Christ)** and I attended regularly with her and Martha Jane.

One Saturday, Elsie took Martha Jane and me to the **Polynesian Cultural Center**. This center is sponsored by the Mormon Church and has many well done displays both live and set-ups of the life on the various South Seas islands.

Another Saturday we went to the leeward side of Oahu to a private home near Chainman's Hat. This was a very enjoyable afternoon walking the beach and getting away from the traffic of Honolulu.

Edith Hazelwood, who was at the University of Washington and now in Honolulu, invited me to her home one time. This is the only time I went swimming and this was in a pool.

On another trip, Gunnar and I went exploring in Diamond Head and the beaches in the area. The Blow Hole was spouting quite high. On some Sunday afternoons, I would walk to downtown Honolulu explore the area. It was fun to sit at the corner of Kalakaua and Lewers and people watch. Across the street was a dance studio on the second floor. You could sit on a sidewalk bench and watch many people trying to learn the Hawaiian dances.

Another time I went to the public library to see if I could find information on my Grandmother's step children. My Grandfather **Harley Leroy Sherwood**'s second wife had two boys by him and after they divorced she married a **Cecil McBride** and moved to Honolulu. McBride adopted her boys and they took the name McBride. One of the boys, **Claude**, worked for the territory of Hawaii for many years. The information I found about him indicated that he spent four years on the mainland going to college. When he returned, he became the Secretary to the Territorial Governor. I also found out that he was arrested for "speeding down Kalakaua Boulevard at the ferocious rate of 25 miles per hour".

I took many 35 mm slides and had them processed in Honolulu. I prepared several slide shows and sent the home so Dorothy would know what I was doing.

Teaching

The first class I assisted in teaching was ocean X-380 a course designed especially for offices of the **US Coast and Geodetic Survey**. This course was designed to give the offices an useful knowledge of the basic knowledge of oceanography without all the details. It was a very abbreviated ocean 101. I coordinated this class four times.

I had talked to Dr. Fleming about teaching some of the courses like field methods or Ocean 101. In the spring of 1960, he asked me if was still interested in teaching and I said yes. He assigned the 1960 **Field Methods course, Ocean 460**, to me for the summer of 1960. I had the title of **Acting Assistant Professor**. Each student had to select a project that was to be done in the open ocean. When all projects were in, we planned a cruise on the **Brown Bear** so they could work on their individual project and have hands-on experience on a true oceanographic cruise. To complete the course, each student had to write a paper evaluating their individual project. The paper was graded for content and use of English. I taught this course in 1961, 1962, 1963 and 1970. Teaching this course for the first time, gave me time to write a paper on the Machine Processing of Oceanographic Data. **Monique Rona** and I collaborated on this paper {*Oceanography Technical Report No. 181*}.

I had ten students in the 1960 Ocean 460 class. They were:

James O'Keefe	Michael Fleming
Wendel Drigers	Ralph Miller
Jerry Schimke	Alan Pease

J. Chow
Dianne Haggerty

Gary Wiegland
Gene North

I was assisted on land and at sea by:

John W. Stevens
Betty Reynolds
Douglas Rustad

Ralph Riley
Peter McCrory

I asked if I could teach Ocean 101 in the evening classes. This was approved and I taught Ocean 101 a total of 18 times from 1965 to 1980. I had the title of **Extension Lecturer** for this course. I enjoyed teaching Ocean 101 even though most of the students were taking it just to fulfill the necessary distribution science requirement. In 1965, I used the classroom in the Oceanography Barge. From 1967 to 1969, I used the large lecturer hall in Fisheries. Then from 1970 on, I used Room 14-18 in the Ocean Teaching Building. I usually had 40 in the class but once I had 80. I had at least one Teaching Assistant. I still have most of my class notes. A listing of the courses I have taught is in **Appendix 34**.

Publications

During my time in Oceanography, I had a total of 52 publications, 13 of them were data reports giving all the observations made in Puget Sound from 1948 to 1970. I had three papers published in journals. Several reports presented the results from the various projects I worked on. My bibliography is in **Appendix 32**

There were three publications of considerable significance. The major publication was ***The Atlas of Physical and Chemical Properties of Puget Sound and Its Approaches***. This was a Washington Sea Grant Publication. Over 1,000 copies were printed. In 2004, I had a contract with the Washington State Department of Ecology to put this publication onto a CD-ROM. This Atlas is a visual presentation of water properties in many parts of Puget Sound. It is a historical record of what Puget Sound was like from 1950 to 1970. Today it serves as the baseline to determine what changes have occurred Puget Sound and whether or not these are man made changes or natural changes.

Several times a bibliography of papers and reports has been prepared. The last one was by myself and ***Svetlana Andreeva*** titled ***Puget Sound Marine Environment, an annotated bibliography***. This was a Washington Sea Grant Publication.

Another Washington Sea Grant Publication was ***Index to Physical and Chemical Oceanographic Data of Puget Sound and its Approaches, 1932-1966***. This report lists all known data obtained by the Oceanographic Laboratories, the Department of Oceanography, Washington State Department of Fisheries, the

Washington State Pollution Control Commission and the Pacific Oceanographic Group in Nanaimo, BC

Data reports for the EPA

In 1978, I was approached by the US Environmental Protection Agency to put all data from Puget Sound onto punched cards using the EPA's STORET format. This required conversion of metric values into English values as specified by the STORET format. I developed a computer program for the IBM 1130 to accept our data decks of cards and convert the information to the STORET format using card output. This resulted in over 280,000 cards. These cards were sorted according to STORET specifications and the whole bunch of cards sent to EPA in Virginia. The cards were read and put into a computer in a read-only file.

This worked well until about 1979 when a user here in Seattle somehow wrote over the file destroying most of the data. **John Underwood**, of EPA here in Seattle, asked if I could restore the file. I had stored the cards on the Oceanography Barge in a secure area. When I examined the cards, they were in excellent condition. My next concern was finding a high-speed card reader that could handle the large number of cards. I knew that the UW Oceanography Department did not have a high-speed reader. I checked with the UW Academic Computing Center and they had disposed of all their high-speed readers. I checked with Boeing and they had no such reader. I finally located a high-speed card reader owned by the Seattle Public Schools. I made arrangements so that we could use their reader under supervision of their operator. The reader was so fast that it took three of us to keep the cards going into and coming out of the machine. The resulting conversions were put onto a magnetic tape. I then took this tape to the NOAA lab at Sand Point. We downloaded these tapes into their computer and stored the data on eight 5.25" floppy disks. These discs were copied several times and distributed, some to EPA, some to the University of Washington and some to private sources. Later on, I converted these to seven 3 1/2 inch floppies and eventually to one CD. Hopefully, this data is now in many secure locations.

Trip to Sunnyside high school

The Sunnyside, Washington high school had requested that our Department of Oceanography send a representative to speak at their career days. I was tapped to do this job. Dorothy, Clinton and Pat Rigg along with me went to Sunnyside. I presented to several classes the type of work that oceanographers do. I told them about education requirements at the University level and job opportunities. How many of these students listened I do not know. I do not know if any of them ever went into oceanography. This was a fun event and the weather was quite warm.

Trips to Sacramento high school

My brother-in-law, Charles LaDue, was head of the Science Department at the Rio Americana High School in Sacramento, CA. Twice he invited me to present a program on Oceanography to many of his classes. The school district paid for my expenses. The first visit was from 23 to 27 November 1971. I had given Charles a Nansen Bottle, a messenger, and two non-working reversing thermometers that I used in my demonstrations. These items were from the surplus equipment we had at the Department of Oceanography. I presented my lecture several times to over 140 students. Dorothy's mother, Catharine Rigg went with us. We had a good Thanksgiving Dinner with John and Dorothy Shockley as guests. We also went to Sutter's Fort and to the Folsom State Prison where I purchased a carving of a cat mounted on black velvet.

The second trip to Sacramento was from 21 to 28 November 1976. On this trip I gave six lectures in two days. We had a good Thanksgiving dinner with Kit and Chuck. We then went to San Francisco to visit Rachel and her family. Again the Sacramento school district paid for my way.

Retirement party 30 July 1980

On April Fools' Day 1976, I presented to the department chairman letter of resignation stating that I would retire in four years. Finally the day came and after much paperwork with upper campus I formally retired on Wednesday, 30 July 1980. The department had a retirement party for me in the foyer of the Marine science building. About 75 people showed up. There was finger food and good talking. At the end the department chairman, James Baker, presented me with a chronometer that had an engraved plaque on its lid. They also presented me with a Kelvin sounding machine. I had tried several times to dispose of this item but somehow it was hidden and I was the recipient. I took this machine home and place it in our garden at the East End of how are sidewalk. It remains there today.

Left in May 1981

My official retirement day was 30 July 1980 but I had to finish the Grays Harbor project. I had reserved enough money in this contract to pay for my time as a halftime employee. Lincoln Loehr and I finished the final report in December.

I then obtained enough funds from the academic budget for a halftime billet until May 1981. During this period I catalog all of the data I had taken and had stored on the barge. Then one day in early May I decided if I did not leave soon, I would stay for far longer time. I cleaned out my office took many the books home and donated many to the oceanography Library.

I had a good 30+ years at the University of Washington and I will never regret my time spent there.

Chapter 3-5
**NORTHWEST CONSULTANT
OCEANOGRAPHERS**

Founders (1963 – 1970)

Northwest Consultant Oceanographers (NCO) was originally established by members of the University of Washington Department of oceanography. In this manner, it was possible for these members to do outside consulting without having to have continued permission of the school. The University Faculty Handbook established the amount of time a faculty or staff member could do consulting. But this had to be cleared by the Department and the Dean of the college. NCO was originally incorporated on 12 September 1963 at 10:32 am. The fiscal year ended on 30 June of each year.

Some of the original share holders (and number of shares) in NCO were:

<i>Ocean Science Capital Corporation, Palo Alto CA</i>	6,000
<i>F. Ward Paine</i> , President	1,000
<i>James, A Crutchfield</i> (UW)	250
<i>John Dermody</i> (UW) Secretary-Treasurer	325
<i>Richard H. Fleming</i> (UW)	825
<i>Maurice Rattray Jr</i> (UW)	225
<i>Richard H Van Haagen</i> (Palo Alto, CA)	150
<i>Joe S. Creager</i> (UW)	75
<i>T. Saunders English</i> (UW)	75
<i>M. Grant Gross</i> (UW)	75
<i>Francis A. Richards</i> (UW)	125
<i>Russell H. Sullivan</i> joined the company in 1965	1,000

Other interested parties, who were not stockholders, were:

Capt S. B. Grenell
James M Hilton

It the 18 August 1967 Board of Directors meeting, Russell was elected Vice President and Secretary-Treasurer

Valeri L Giannini, of Ocean Science Capital Corp., became President in June 1968 and continued for about three years. According to his 19 March 1971 report, the company had 23 contracts in 1969 and 1970 for a total fee of \$112,230. Val tried to run the company from his Palo Alto office. This was not satisfactory

NCO revitalized (1971 – 1988)

The original group was in business until about 1970 when most of them either sold or forfeited their stock back to Ocean Science Capital Corporation. ***Russell Sullivan*** and I took over the company and formed a new Chapter S Corporation on 1 July 1971. The original incorporators were: ***Russell*** and ***Carolyn Campbell Sullivan*** and ***Dorothy Mae*** and ***Eugene Evans Collias***. Russ was the President and I was the Secretary-Treasurer. We selected as our bank the **Seattle First National Bank** (Now **Bank of America**). On 1 April 1975 we made the company a for-profit corporation in the State of Washington. In March 1979, ***Lincoln C. Loehr*** was made an Associate. In 1980, he was elected to be a Junior Partner and Vice President. In 1978, Carolyn Sullivan was replaced by ***Gail Sullivan*** as a director.

The three of us (***Russell***, ***Lincoln*** and ***I***) kept the company going until about 1987. ***Russell*** officially resigned his office of Vice President on 1 July 1986. ***Lincoln*** ran for a seat in the State legislature but lost to the incumbent ***Nancy Rust***. Also, contracts were becoming harder to obtain. So by the end of 1988, we dissolved the corporation.

We had two offices during our operation of NCO. The first was in my study at our home for about three years. Then Russell converted the second floor of his home at 8037 37th Ave NE to our offices. I had the back room, Lincoln had the north room and Russell had the east room. This proved to very efficient. Frequently we would go the New Peking Café run by Helen Chew for lunch. Other times we would walk to Godfather's Pizza at NE 75th and 35th NE. The three of us had a very good working relationship that made NCO profitable for all of us.

The years we operated NCO were good to us. From 1975 to 1985 we had a net income of \$326,452 and expenses of \$109,054. We were able to take \$118,277 in draws. This left \$99,119 which we had in the profit share plan.

Some of the Board of Directors meeting were held as follows:

- 28 September 1979 at 5300 34th Ave NW, Seattle
- 5 September 1980 at 5100 15th Ave NE, Seattle
- 10 April 1980 at 6049 Seaview Ave NW
- 1 July 1982 at Hiram's, 5300 NW 34th Street, Seattle
- 21 February 1983 at 1500 NE 148th Street, Seattle
- 21 September 1983 at the Wedgewood Broiler. 8230 35th Ave NE
- 24-26 April 1984 at 3555 Las Vegas Blvd, Las Vegas NV

At this meeting the following officer were appointed:

Lincoln – President
Russell – Vice-President
Eugene – Secretary-Treasurer.

During our ownership of NCO, we had many contracts. A summary of many of the contracts follows:

Clam Bay

Manchester

Salmon Net Pen culture

NCO was asked to examine the draft interim guidelines for the management of salmon net-pen culture in Puget Sound. The proposed net-pen site was near Tekiu Point in Hood Canal. We evaluated the historic water characteristic data and made a drogue study at the proposed site on 8 September 1986. **Lincoln** was responsible for this project.

Commencement Bay Study (Dames & Moore)

The US Army Corps of Engineers was studying the effects of potential outfalls on the waters of Commencement Bay (Tacoma) off Ruston and in the Narrows. We made comprehensive drogue studies and fixed current meter studies at these two locations.

Chambers Creek

Pierce County planned to install a sewer outfall near Chambers Creek about one mile south of Stillacomb. It was our task to make current observations an several tide stages. We released drogues set at various depths and tracked them for several hours. We had several chaser boats and the **Fia Fia**, a 45 foot twin screw yacht, as the mother boat. We performed these measurements between _____ and _____. Our final report was presented to _____ on _____.

Drogues for Kahl Scientific

Russell and **Eugene** constructed several drogues for Kahl Scientific Company of El Cajon, CA. Kahl had a foreign customer who wanted drogues about one meter square. We constructed them with an aluminum frame covered with rip-stop nylon. Each drogue had a specified length of 100 pound test stainless steel fishing line. We provided each drogue with a wooden packing case and then sent them to Kahl. We made and shipped in the summer of 1982 and received \$3,219.12.

Marina County Water District

We received a contract with the Marina (California) County Water District to evaluate all data collected in Monterey Bay as related to Marina's waste water treatment discharge. This was to be a simple one time study but it continued to evolve and eventually the contract lasted for over one year. Our initial contact was **John Isakson** whose father was a member of Marina's advisory council. We

were to report to **Robert Tuttle** the lawyer for Marina. **Margaret Held** was the executive director of the water district. **David Foote** of **Nolte and Associates** in San Jose, CA, was the engineer in charge of Marina's design of the outfall. **Lincoln** and **Eugene** had the responsibility for this contract. We made twelve trips to Monterey and testified at two hearings. This contract began on _____ and ended on _____.

Dissolved Oxygen for Terry Whittedge

City Light weather tapes

Protection Island currents

Arco weather station

The ARCO refinery in Ferndale needed a weather system at the end of their pier to assist in landing the tankers that tied up to their dock. ARCO wanted the air speed and direction and water currents at about 10 feet below mean lower low water. We designed such a system, built the shed in which it was to be stored, assembled the components and install the system. ARCO installed the necessary electrical conduits and we pulled the connecting wires through the conduits. We hired a scuba diver to install the current sensors. Russell and I were responsible for the design, construction and installation. The system was installed in early April 1973. We received \$16,247.12 for this job.

Sequim marina weather

Russell and I installed three MRI weather stations in Sequim Bay at the site of the proposed John Wayne Marina. We made monthly trips to Sequim Bay for six months to change the tapes and put in new batteries. We read each tape using the technique I had developed at the University of Washington and sent the results to the Battelle Research Laboratories in Sequim.

Burlington Northern Railroad

The Burlington Northern Railroad was plagued for many years by landslides occurring near Golden Gardens. NCO was requested to make a survey of the area and determine the effect of the slide material upon the biota in immediate vicinity. We had **Dr. Lee Bennett** make a size analysis on the slide material and had **Dr. Eric Lindgren** examine at the biota in the area. We did this study in the fall of 1974.

Parametrix, Ruston and Tacoma Narrows

Fildago Bay Marina

Boeing – surface currents from Seattle to Victoria

The officers of hydrofoil ship that Boeing had developed need reliable information on the currents in Puget Sound and in the eastern end of the Strait of Juan de Fuca. Any ship traveling at about 40 knots needed to know where to expect floating debris. Even though the leading foil of the ship was very sharp, a sunken log could cause the foil to collapse. It was our task to prepare charts over a typical tide between Seattle and Victoria that would indicate the most likely current velocity at any given point along the ships course. We presented the final product to the Hydrofoil group in June 1981.

Totten Inlet

In early 1969, NCO was approached by Mr. Harold Dunkelberger make a survey of Totten Inlet for the possible location of a sewerage outfall for a proposed 323 lot development. NCO first made a literature survey and presented it initial report on 26 June 1969. This was titled ***Report of a Study and Analysis of Oceanographic Conditions in Totten inlet, Puget Wound, Washington.***

Further consideration by the engineering firm of John D. Swift and Associates located in Lacey, WA indicated that direct measurements of currents at the outfall site were necessary. On Saturday, 13 November 1971, Russell Sullivan and Eugene Collias made a series of drogue studies from 0900 to 1645. The results were sent to the engineer in a report titled ***Report of a Current Study made in Totten, Inlet, Puget Sound, Washington.***

We had to present the information of a Pollution Control Panel in Olympia. It was surprising that for such a small project, it received the same treatment as did the West Point outfall. We never heard if the project was carried out as planned.

