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Edward Flanders Ricketts and the Marine Ecology of the Inner Coast of British Columbia

by

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Abstract

Marine ecologist Edward Flanders Ricketts made three trips in the early 1930s to British Columbia, Canada, before he published *Between Pacific Tides*, the classic marine ecology text for the west coast of North America, in 1939. *Between Pacific Tides* is a highly influential book, widely read by marine ecology students and researchers working in the intertidal zone. These trips were to the inner coast and sheltered waters of the region. In this article I explore the details of Ricketts' British Columbia inner coast work including comments on collection records, collection site locations and influence of survey results, topics that have not been explored in the literature before.

Key words *Between Pacific Tides*-Jack Calvin- Pacific Biological Laboratories-Estuary

INTRODUCTION

Edward Flanders Ricketts (1897-1948) (Figure 1) was a pioneering American marine ecologist who is very well known for his unique approach to intertidal ecology. Born in Chicago, Illinois, he studied zoology for three years at the University of Chicago and was influenced there by prominent ecologist Warder Clyde Allee (1855-1955). After moving to California in 1923, he began studying shoreline flora and fauna and as well operated Monterey-based Pacific Biological Laboratories, a business that supplied specimens to universities and colleges. ¹ Ricketts wrote an important book on intertidal life with his friend Jack Calvin (1901-1985), a sailor, writer and artist who assisted with writing and took the photos presented. *Between Pacific Tides* (Ricketts and Calvin, 1939) was very influential as it was one of the first studies to look at intertidal invertebrates and their habitats as communities, whereas previous works had taken a single species approach. *Between Pacific Tides* is still in print in its Fifth Edition and is one of the bestselling books published by Stanford University Press (Lannoo, 2010). Ricketts was a friend of Nobel-prize winning author John Steinbeck (1902-1968) and their careers were intertwined. Steinbeck wrote a foreword to the 1948 revised edition of *Between Pacific Tides* and Ricketts is recognized as “Doc”, a main character in Steinbeck’s novel *Cannery Row* (Steinbeck, 1945) set in Monterey. Ricketts and Steinbeck sailed to the Sea of Cortez (Gulf of California) in Mexico on a month-long collecting expedition in 1940 and a decade later Steinbeck re-issued an abridged account of the voyage in his widely-read book, *The Log from the Sea of Cortez* (Steinbeck, 1951)

Ricketts travelled extensively to Oregon, Washington, Mexico and British Columbia to collect invertebrates and make observations on coastal ecosystems and habitats. He made three trips (1930, 1932, and 1935) to British Columbia before he published *Between Pacific Tides* in 1939. In this article I review Ricketts’ collecting trips on the inner coast of British Columbia, in the Strait of Georgia (now known as the Canadian part of the Salish Sea) and along the Inside Passage to Prince Rupert. I review and comment on his collection records, published reports and other material. A map of his collection sites is presented. I also consider how much British Columbia material may have been incorporated into Ricketts’ narrative in the book *Between Pacific Tides* and how his 1930s findings may have influenced his perspective on marine ecosystems. I point out how further research on his collections and surveys may yield additional important baseline information on species and habitats in the region.

As far as I am aware there has not been any discussion in the scientific literature about Ricketts’ British Columbia surveys in the 1930s, which focussed on the inner coast and protected waters of this region. Most of the records for this work were probably lost in a fire in Ricketts’ laboratory in 1936 and in this paper I draw the available information together to give a perspective on his inner coast observations. After *Between Pacific Tides* was published, Ricketts made extensive trips in 1945 and 1946 to the outer coast of British Columbia. His findings on these surveys were published after his death in 1948 (Ricketts, 1946) and they were also discussed extensively by Tamm (2004).

RICKETTS’ 1930 TRIP

Ricketts made a trip to the east coast of Vancouver Island (west coast of the Strait of Georgia) in July and August 1930.² He collected specimens of the sea anemone *Anthopleura* subtidally at Comox (Figure 2) on 1 July 1930 and deposited them to the California Academy of Sciences museum in San Francisco.³ He probably collected other specimens for his company so the trip was likely a combination business/research endeavour. We know that he visited the researchers at Pacific Biological Station at Nanaimo, British Columbia because he is mentioned as a visitor in the Station's annual report for 1930 (Clemens, 1930). Ricketts was likely visiting polychaete specialists Cyril and Edith Berkeley (1878-1973; 1875-1963), crustacean specialist Josephine Hart (1909-1993) and zoologist Charles McLean Fraser (1872-1944) at the Station. Ricketts corresponded widely with specialists around the world and was in frequent contact with the Berkeleys and Josephine Hart about polychaetes and crustaceans.

I discovered that Ricketts also visited the east (mainland) side of the Strait of Georgia on his 1930 trip. In the Smithsonian National Museum of Natural History (USNM) in Washington D.C. collections there are specimens of barnacles *Balanus glandula* and *B. crenata* from Pender Harbour, collected on 11-13 August 1930.⁴ The records were elusive because barnacle expert Henry Augustus Pilsbry (1862-1957), who actually did the identifications, listed the collection as a gift from Pacific Biological Laboratories. Subsequently I also found a reference to a USNM collection of amphipods (*Corophium ascherusicum*) from Pender Harbour in a paper by Shoemaker (1949). Although this record is not in their digital files, USNM biologists confirmed this collection was made by Ricketts on August 11 1930. Clarence R. Shoemaker (1874-1958) was a noted amphipod expert who confirmed many of Ricketts' identifications.

As mentioned in *Between Pacific Tides* (p. 30) Ricketts conducted a feeding experiment at Pender Harbour and this may have been in 1930 or on his 1932 trip to the area (see below). Ricketts fed a chiton (unidentified) to a sea anemone (*Metridium dianthus*) and observed the digestion rate. This was one of the rather rare observational experiments that Ricketts conducted. Collections made at Pender Harbour in 1930 or 1932 included an encrusting sponge (*Mycale macginitei*) from the rocky intertidal and the bristle worms (*Pectinaria brevicoma*) dredged from the mud bottom (*Between Pacific Tides*, p.176, 199).

THE GRAMPUS TRIP – 1932

Jack Calvin owned *Grampus*, a 10 m power launch. Together with his wife Sasha Andrevna Calvin (1901-1971), he, Ricketts, and well-known writer Joseph Campbell (1904-1987) travelled from Tacoma, Washington to Sitka, Alaska via the Inside Passage. They left Tacoma on 29 June 1932. *Grampus* made about 14 stops in British Columbia where Ricketts collected or made ecological observations that are recorded in his Wave Shock essay (Ricketts, 1932) which was only recently made available in the compilation of essays about Ricketts edited by Janice M. Straley (2015); I draw much of the following material from the essay. A few details of the expedition not given in the Wave Shock essay are mentioned in Tamm (2004) and I also draw from that source.

Their first stop in British Columbia was at Clam Bay, between Thetis and Penelakut Island (formerly Kuper Island) where they anchored on 2 July 1932. Ricketts noted "tens of thousands" (p.49) of the bubble shell or nudibranch *Haminoea vesicular* in eelgrass beds, presumably by wading or perhaps

looking over the side of the canoe that the *Grampus* carried. Ricketts was looking especially for the clinging jellyfish *Gonionemus vertens*, which was one his favoured organisms for his business but found only a few at Clam Bay.

Grampus then travelled northwest to Nanaimo, where the vessel anchored on 3 July 1932 because of weather, and then crossed over to the east side of the Strait of Georgia the next day. A stop was made at Pender Harbour. Ricketts sampled and collected with a dredge on a northeast reach of Agamemnon Channel, close to Pender Harbour, on 4 July 1932. He described an invertebrate fauna characteristic of the tidal-swept area – starfish *Pisaster*, polychaete *Serpula*, “the vividly red tunicate *Steyla stimpsoni*” (p.49), the mussel *Mytilus*, and medium to giant barnacles *Balanus cariosus* were some of the dominant organisms. He collected specimens of the red sea cucumber *Cucumaria miniata* in the area and deposited them in the Museum of Comparative Zoology at Harvard University in Cambridge, MA.^{5,6}

The *Grampus* made two stops in the Desolation Sound area, likely on 6 July 1932. An emergency stop for engine repairs at Refuge Cove on West Redonda Island enabled Ricketts to sample a “coral colored sponge (similar to *Esperiopsis rigida*)” (p.49). Ricketts then visited the salt water lagoon at Squirrel Cove and observed “a most remarkable fauna of sea cucumber *Stichopus*, starfish *Dermasterias*, and enormous *Terebratalia*...” (p.50) (brachiopods). A few specimens of *Gonionemus* were taken at both Refuge Cove and Squirrel Cove. Travelling through the Yuculta Rapids likely on 6 July 1932, Ricketts noted that these rapids were unlikely barriers for pelagic larvae. The next stop for the *Grampus* was at Port Harvey possibly on July 8; unfortunately the collection date for the sea cucumber (*Cucumaria miniata*) obtained there (“from Mrs. Dawson’s float”) and donated to the Harvard museum was not recorded.^{5,6}

After travelling across Milbanke Sound the *Grampus* re-entered the Inside Passage and Ricketts’s next collecting place was at Bella Bella. Ricketts collected specimens of the nudibranch *Melibe leonine* here in an eelgrass bed. At the next stop, on 17-18 July 1932, Ricketts collected sea anemones at Fisherman Cove, near Butedale, and also made extensive observations of the invertebrate fauna ...”Shelled snails were especially abundant; *Thais lamellose* and *Searlesia dira* both by tens of thousands” (p.51). Ricketts deposited specimens of the anemone *Anthopleura* from this site to the California Academy of Science museum.^{3,6} The collection records might need correcting however because they state Fisherman Cove is in Howe Sound, near Vancouver, British Columbia – and although there is such a place it is likely the specimen is in fact from the Fisherman Cove near the Butedale site. The collection dates of 17-18 July 1932 on the record are correct.

Continuing north through narrow and scenic Grenville Channel, the expedition stopped in at Lowe Inlet on 19 June 1932. Ricketts gives some interesting comments on the highly estuarine nature of the inlet “...it would be easy to believe that fresh water is the chief limiting marine factor in these inlets”(p.52). Ricketts noted that fresh water above the salt water layer caused the anemone *Urticina* to hang limp and half open. Revealing his experimental side once again, Ricketts put the anemone in sea water obtained outside the inlet, and observed “we got them to expand nicely” (p.52) – in effect an observation of the salt tolerance of the species. Ricketts collected the sea anemone *A. artemisia* here and specimens were donated the California Academy of Sciences museum.^{3,6}

Canoe Pass, “some 30 miles north of Prince Rupert” (p.54), was the last site in Canada that Ricketts mentioned before *Grampus* crossed into Alaska. It is not exactly clear where this site is as “Canoe Pass” is a frequently used local name up and down the coast. However Isaccson and Hourston (1972) list this locale on the Tsimpsean Peninsula near Prince Rupert, which is likely where it is. Ricketts (1932) noted the extraordinary abundance of the jellyfish *Aequorea* here and also mentions in a footnote in *Between Pacific Tides* (p.173) the “great beds” of sea cucumber *Cucumaria miniata* in Canoe Pass, British Columbia.

Ricketts probably did collect sea anemones here but the collection record for *A.artemisia* from Canoe Pass in the California Academy museum might need correcting.^{3,6} It lists Canoe Pass on Westham Island in the Fraser River estuary as the collection locale, with the date 21 July 1932, which matches the time *Grampus* would have been around Prince Rupert. However Canoe Pass near Westham Island is in a freshwater and highly turbid reach of the Fraser River estuary where sea anemones could not survive. Ricketts also deposited a collection of the sipunculid *Golfingia margaritacea* from this site to the USNM, once again with the location Canoe Pass, 21 July 1932.^{4,6} On the collection card Canoe Pass is listed as on Kate Island, but I could not find this island listed in a gazetteer for the north coast of British Columbia.

DEEP COVE- 1935

Ricketts visited to southern Vancouver Island in August 1935. He collected nemertean worms (*Carinella rubra*) at Deep Cove on Saanich Inlet and noted they were very abundant, under rocks (*Between Pacific Tides* p. 176). He had plans of sampling at outer coast locations on southwest Vancouver Island (Victoria, Sooke and Jordan River) but there are no records of collecting at those places. So far as we know he did not make it to the outer coast on this trip.²

His 1935 trip to Vancouver Island was an interesting venture because he also attempted to take three live invertebrate specimens back to California. The animals were likely crabs, as correspondence about the specimens was with Los Angeles carcinologist Steve A. Glassell (1884-1948).⁷ However the animals did not survive the trip, which involved a ferry to the mainland and a two or three day drive south.²

INFLUENCE OF RICKETTS' INNER COAST DATA

The British Columbia coast has a relatively low profile in the detailed fauna descriptions in *Between Pacific Tides*, with most of the mentions stating that British Columbia locales are the northern extent (or rarely southern extent) of the range of a species or that other scientists collected at them. The book was first submitted for publication in 1930 (Egerton, 2016) but was not published until 9 years later so there were opportunities to include some material from his three trips to British Columbia. The book does mention Ricketts's personal collections or observations at Canoe Pass, Refuge Cove, Squirrel Cove, Fisherman Cove (all from 1932), Deep Cove (1935), and Pender Harbour (1930 or 1932). There are also

mentions of observations or biological information from general areas described as British Columbia, the Strait of Georgia or northern British Columbia. Given that Ricketts was based in California, many of the examples in the book are from the outer coast of that region or Mexico, as might be expected. However the communities of the inside waters of British Columbia offered a “quiet water” (a term he often used) assemblage that was a contrast, or foil, to the wave-shock affected communities of the outer coast. In this context, perhaps his work on the inner coast of British Columbia was an important component when Ricketts was developing his ecological theory (see Ricketts 1932 for details) that wave action was a major controlling factor on coastal ecosystems.

Ricketts’ 1932 observations during his *Grampus* trip on the influence of freshwater flows on inlet invertebrates were likely the first example, albeit limited, of an estuarine ecological study in British Columbia. His field experiments with sea anemones at Lowe Inlet identified the influence of a halocline (the border between the freshwater lens on the surface of an estuary and the salt water layer below) on organism distribution and he clearly noted fresh water as a limiting factor. He also recognized the importance of what we now call cumulative effects “...The chief limiting factors of quiet water communities are probably...temperature fluctuations...salinity fluctuations due to rain, influx of fresh water and evaporation...fluctuations in oxygen...occasional presence and deposition of silt...and probably other minor factors, important in their sum” (Ricketts, 1932, p. 70). He specifically identifies these four factors later on in the paper. It was not until 23 years later, in 1955, that Bousfield (1958) conducted the next faunal assessment of British Columbia estuarine habitats, along the Strait of Georgia. Several ecologists later studied this estuarine coast (see Levings et al 1983; Burd et al 2008).

CONCLUSIONS AND FURTHER INFORMATION

In some ways Ricketts’ 1930s trips to the inner coast of British Columbia were formative and likely provided preliminary observations for his comprehensive view of marine ecology. No doubt a lot of valuable information gathered in these trips was lost in the 1936 fire in his laboratory – material that factored into his thinking and ultimately might have been incorporated into *Between Pacific Tides*. Perhaps because he was not able to sample the outer coast in his 1935 trip, a decade later he made several important and more detailed trips in 1945 and 1946 to the British Columbia outer coast, especially to the west coast of Vancouver Island, the Queen Charlotte Islands (now known as Haida Gwaii), and the north coast around Prince Rupert. For completeness I plotted the sampling locales for those trips and further note there other places such as Bamfield and Kildonan on Alberni Inlet where he made observations but did not collect (Figure 2). These expeditions have been well documented in Tamm (2004) and in Rickett’s notebooks from his trips (Ricketts, 1946). Ricketts intended to publish a magnum opus ecological synthesis volume that covered the west coast of North America, from Mexico to Alaska. The book likely would have incorporated more British Columbia data, including those from his trips in the 1930s and 1940s, but that was not to be as he died when his car was hit by a train in Monterey in 1948 (Lannoo,2010).

Ricketts’ legacy lives on and as more of his unpublished material becomes available it is likely that additional information on his findings will be discovered as important baseline data for both the sheltered and exposed waters of the British Columbia coast, as well as providing further insight into his

thinking. Although I have explored some of Ricketts' written material on British Columbia from the 1930s, and searched for his collection records in three of the American museums where he deposited specimens, there are likely more interesting data to be found. Some of the material needs to be carefully investigated. For example in the Stanford University archive of collecting cards from his 1945 and 1946 trips there is an entire subcategory called "Queen Charlotte Islands, British Columbia" with an extensive list of taxa.⁸ However when opening the taxa lists pdf, there are additional records from numerous locations on Vancouver Island and the inside waters of the north coast mainland (e.g. Nass River estuary, near Arrandale). Some of his observations on his later trips were likely also firsts for British Columbia. For example, found under the Stanford listings for Amphipoda, his observations on the specific biological effects of pollution from the Port Alice and Prince Rupert pulp mills in 1945 and 1946 are probably among the earliest examples of the effects on invertebrates of estuarine pollution in British Columbia. Thus further research into these files will no doubt reveal more valuable and interesting data that Ricketts obtained for marine ecosystems on the west coast of Canada.

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NOTES

¹ Pacific Biological Laboratories was jointly founded by Albert E. Galigher (1899-1960) and Edward F. Ricketts in 1923. The initial Lab was in a one-story board and batten building located on Fountain Ave., Pacific Grove. In 1924 the partnership with Galigher ended and in 1928 Ricketts moved the Lab to 740 Ocean View Ave., Monterey (it was later renumbered 800 and after that a 1 mile stretch of the Ave. was renamed Cannery Row (1958). Michael Hawkes, Botany Department (retired), University of British Columbia, Vancouver, to C.D. Levings, pers.comm., 3 March 2019

² URL (Accessed 6 April 2019 https://web.stanford.edu/group/seaside/ed/COLLECTING_TRIPS). (KOHRS, Don G.2016. Collecting Trips Along the Pacific Coast: Draft Edward F. Ricketts' collecting trips along the Pacific coast)

³ URL (accessed 5 April 2019 http://researcharchive.calacademy.org/research/izg/iz_coll_db/index.asp?) (California Academy of Sciences, Institute for Biodiversity and Sustainability, Invertebrate Zoology Collection)

⁴ URL (accessed 5 April 2019 <http://collections.nmnh.si.edu/search/iz/>) (Smithsonian National Museum of Natural History, Department of Invertebrate Zoology Collections)

⁵ URL (accessed 5 April 2019 <https://mcz.harvard.edu/invertebrate-zoology>) (Harvard University, Museum of Comparative Zoology, Invertebrate Zoology)

⁶ deposition not recorded in Ricketts, 1932

⁷ URL (accessed 6 April 2019 <http://naturespace.org/Steve.A.Glassell.Zoologist.htm>) (VAN DE HOEK, "Roy" Robert Jan, 2009. Steve Glassell, Los Angeles Marine Invertebrate Zoologist: Carcinologist of Pacific Seashores from 1930 to 1940s).

⁸URL (accessed 5 April 2019 <https://seaside.stanford.edu/survey>) (Hopkins Marine Station: Seaside-History of Marine Science in Southern Monterey Bay. Ed Ricketts Survey Cards)

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List of Figures

Figure 1. Edward Flanders Ricketts with a Humboldt squid (*Dosidicus gigas*), July 1936. Photo © by Ralph Buchsbaum (1907-2002). With permission from Vicki Buchsbaum Pearse.

Figure 2. Map of the British Columbia coast showing Ricketts' collection sites in 1930, 1932, 1935 (inner coast), 1945 and 1946 (outer coast). There were four additional collection sites in the Masset area and nine in the vicinity of Clayoquot Sound. Some of the stopover points for the 1932 *Grampus* voyage are also shown. Additional places named in the text: 1 Strait of Georgia (now known as the Canadian part of the Salish Sea) 2 Tacoma, Washington 3 Sitka, Alaska 4 Grenville Channel 5 Fraser River estuary 6 Vancouver Island 7 Milbanke Sound 8 Queen Charlotte Islands (now known as Haida Gwaii) 9 Alberni Inlet

Collecting sites for E. F. Ricketts in British Columbia 1930-1946, including harbour stopovers for 1932 *Grampus* voyage



