

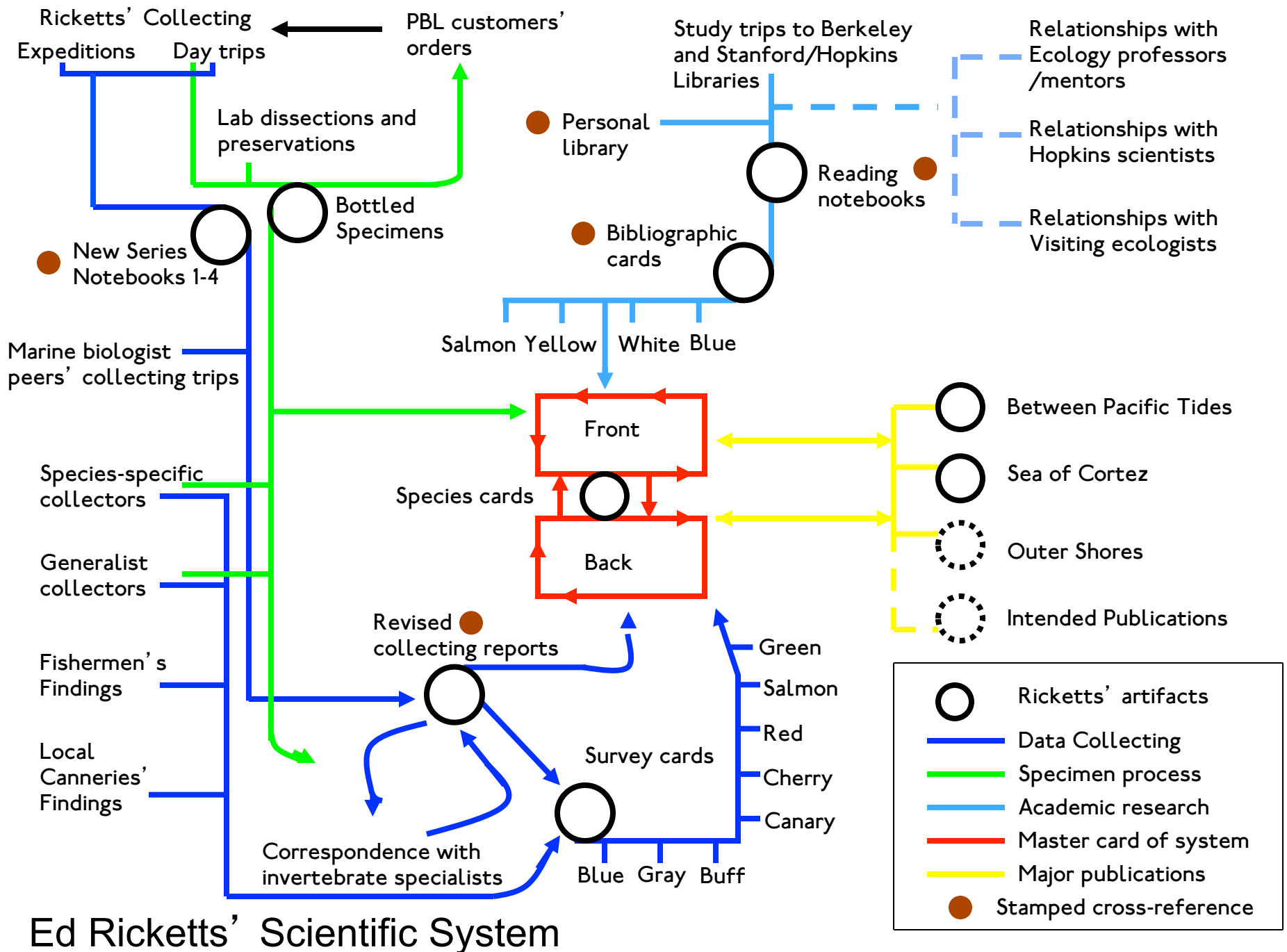
The Great Tidepool: the story of Ed Ricketts' scientific system

By Steven and Mary Albert

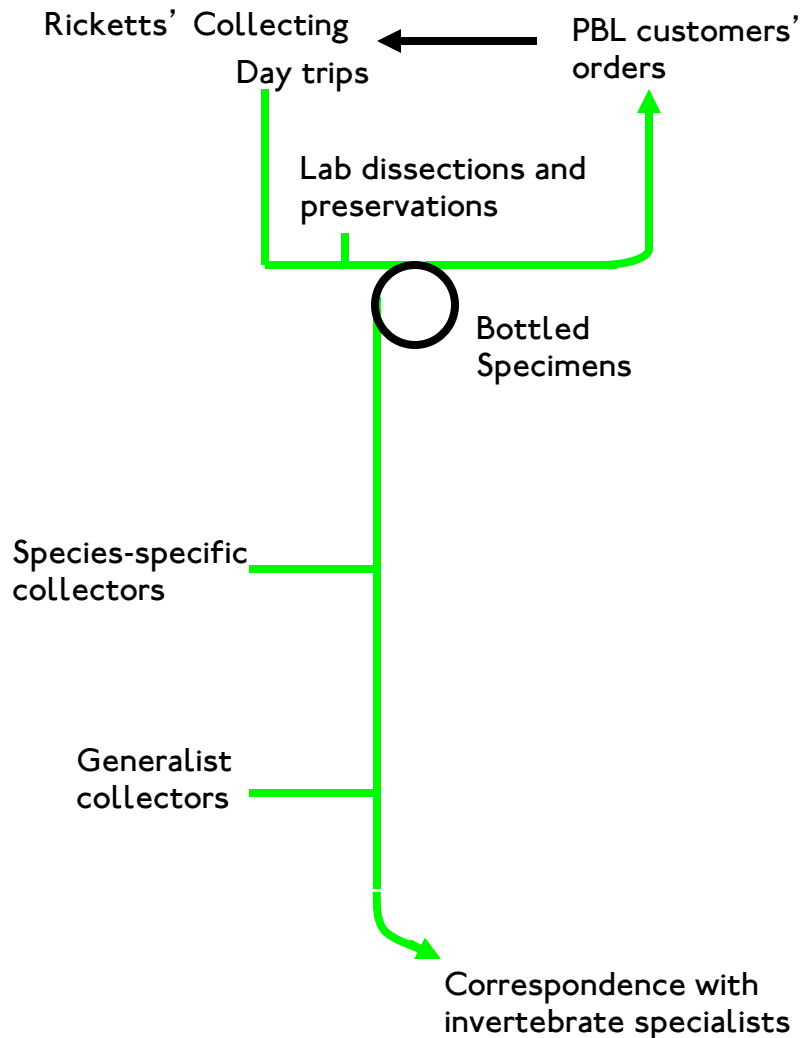
May 2014

Additional Information*

* The diagrams and explanations of Ricketts' system in this pamphlet were derived by the authors from a number of sources, including (1) Ricketts' *Permanent (expedition) notebook*, which outlines the rules by which his scientific system was to be conducted, (2) the instructions for filling out his species and survey cards, as detailed by him on 4x6 cards at the front of his index card files in the Hopkins Marine Station Library, and (3) documents in the Edward Flanders Ricketts Papers, Dept. of Special Collections, Stanford University Library.



Ricketts' scientific efforts in his lab (*Ricketts preserves his specimens*)



Pacific Biological Laboratory customers ordered creatures that Ricketts collected, processed, bottled and shipped to them. Some of the creatures were collected by species-specific collectors and by generalist collectors who seemed to deliver specimens to Ricketts whether he had ordered them or not.

The preserved and bottled specimens were sometimes kept on-hand at the lab and used for reference. In these cases, the species card corner would be clipped to designate that Ricketts had a preserved specimen of this species in the lab.

Ricketts often sent for accurate identification preserved creatures to invertebrate specialists, like the scientists at the National Museum of Natural History and the Smithsonian. Ricketts assigned each specialist a number and that number was entered on the survey cards and RCRs. A special stamp was used throughout the system, that traced by ident number a specialist to the species he had identified.

Exemplary artifacts:

- Photo - Ricketts with waders and holding squid
- Ricketts' hand drawn plan for his ideal lab (Stanford Special Collections).
- The bottled specimens themselves (Aquarium and other places?)
- The Pacific Biological Laboratory (At present location)
- Concrete holding tanks at back of lab
- Card catalog file cabinet
- Specimen bottles
- Others too numerous to list here.

Ricketts transforms his data (*Ricketts begins his path to discovery*)

Ricketts' Collecting
Expeditions Day trips

New Series
Notebooks 1-4

In the field, while on collecting trips and expeditions, Ricketts first noted the precise conditions of tide, time, weather, position, etc, in the New Series Notebooks 1-4. The notebooks and their specific page numbers and species lists form the basis of all his subsequent data transformation and re-organizing. Many of the notes in the field notebooks are precisely identified habitat focused ecological observations.

The first step in data transformation came when he formalized these notes into Revised Collecting Reports (RCRs). These reports clarify and systematize the notes; the reports were given a number and logged into a post-binder. Any input from specialists is included with their identification number, so that each species is confirmed. Each page represents one particular collecting trip, and there are two filled binders.

The RCRs were logged onto survey cards. The species-specific survey cards have information from multiple RCRs, therefore multiple collecting trips, over many years. The survey cards take the field notes and RCR information and transforms it into a habitat-oriented data set.

The survey cards include data about geographic range, bathymetric zone, exposure to surf, tidal currents, tidal horizon, depth if dredged, type of bottom, position on rock weed or substratum, vegetation (rockweed, kelp eel grass), associates, commensals, breeding season, color, numbers taken or observed, identifier and other summary of observational data.

Ricketts made different colored survey cards for each geographic region on the Pacific Coast (see box below)

Exemplary Artifacts:

- Photos – Ricketts collecting in tidepool, Ricketts at the typewriter
- New Series Notebooks 1-4. Handwritten notes in ledger sized notebooks (Stanford)
- Post-bindings of hundreds of pages of typed Revised Collecting Reports (Stanford Collection)
- Ricketts' typewriter (Unknown)
- Survey cards (Hopkins and Stanford)

Much of Ricketts' ground-breaking work was performed along the central coast and around Monterey Bay and Pacific Grove, but his efforts and ambitions included the entire Pacific Coast. Ricketts' local collecting spots included the Great Tidepool, Aumentos Point, Pt Pinos, Pt Joe, Lighthouse Pt., Monterey Harbour, Asilomar Beach, Bixby Bridge, Big Sur, Elkhorn Slough, and hundreds more. His data collecting efforts were aimed at rediscovering, reorganizing and reclassifying the inter-tidal zone by habitat

Revised
Collecting Reports

Survey cards

Correspondence with
invertebrate specialists

Survey Cards

Green southeastern Alaska, outside
Salmon Inside Passage
Red Queen Charlotte Islands, West Coast Vanc. Id.
Cherry Str. of Georgia and Juan de Fuca
Canary Puget Sound, Hood Canal, etc
Buff Cape Flattery to Pt Conception
Grey Pt Conception to Cedros Id
Blue Cedros through Gulf Calif.

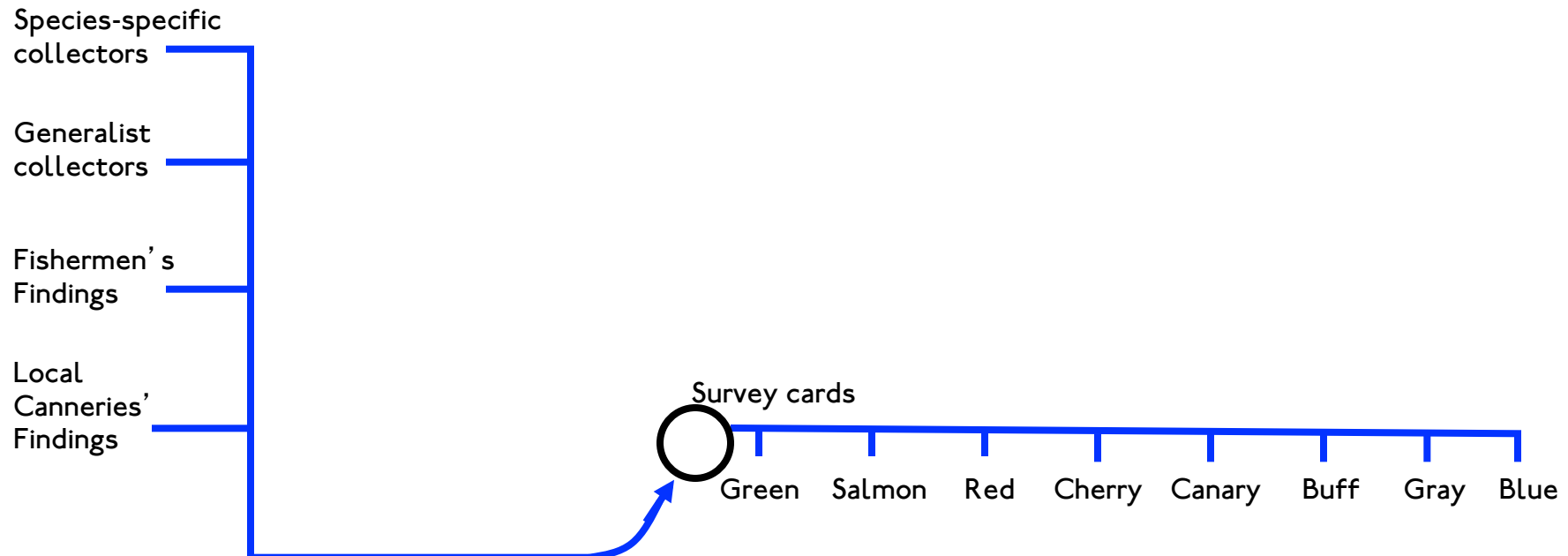
Green Salmon Red Cherry Canary Buff Gray Blue

Ricketts' non-academic network (*Ricketts a man of the people*)

Data also came from the experiences of non-academic and industry personnel. Ricketts used their experiences and findings to give breadth to his survey cards. On the survey cards there was space for detailed reference to exactly who, when and where a species sighting or finding occurred. Considering how frequently these non-academic people engaged with marine invertebrates, they must have been an invaluable resource for Ricketts.

Exemplary artifacts:

- Photo – Ricketts with friends
- Correspondence with free-lance knowledgeable species specific collectors.
- Letter from Ricketts carried by generalist collectors to explain their activities.
- Notes on survey cards about his contacts with local fishermen and canneries
- Photos of Canneries in work at the time
- Cannery documents describing the amounts and types of fish collected.



Ricketts' bibliographic and library work (*Ricketts on the cutting edge of academics*)

Bibliography Cards

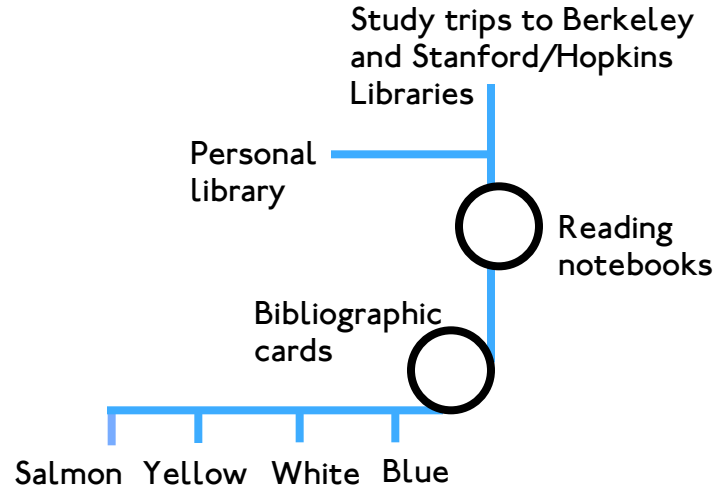
If a book or article was:

to be cited in a particular publication, it was noted on a **salmon** 3 x 5 card.

already cited in a particular publication, it was noted on a **white** 3 x 5 card.

need not be cited in a particular publication, it was noted on a **blue** 3 x 5 card.

used for more than one species, it was noted on a **yellow** 3 x 5 cross-reference card.



Ricketts regularly visited the UC Berkeley and Stanford/Hopkins libraries to consult current academic literature in marine biology with reference to the identification, description and distribution of intertidal species, as well as wider knowledge of oceanographic science. He read periodicals and books, and also accumulated a large scientific library of his own.

Ricketts kept meticulous records of citations and bibliographic information for every species he collected. There were four different colored cards (see box), designed to include UC library call numbers, Ricketts' New Series Notebook page number references, location in Ricketts' library (on shelf, under window, etc.) if it was "on hand but not bound." The corners were designed to be clipped on one corner if the book was on hand, or on another if the journal was bound with a PBL custom cover. The side was to be notched depending on which of Ricketts' publications it was to be cited in. There was also a rubber stamp which indicated a cross reference to another class of species.

Exemplary artifacts

- Ricketts' personal library now housed at Hopkins
- PBL bibliography cards with cross referenced notations (Hopkins)
- Reading notebooks with handwritten notes from reading trips (Stanford Special Collection)

Ricketts' academic network (*Ricketts was accepted in the academic world*)

- Relationships with Ecology professors/mentors
- Relationships with Hopkins scientists
- Relationships with Visiting ecologists

Though Ricketts' scientific efforts were unique, no scientist can do groundbreaking work without input from other scientists. He was part of an academic scientific effort to explore how the new ideas of ecology could contribute to our understanding of the natural world.

Ricketts had attended the University of Chicago and studied under ecologist pioneers Victor Shelford and W.C. Allee.

He frequently corresponded with scientists around the country including at the Smithsonian and the National Museum of Natural History.

He had a network of local scientists at Hopkins Marine Station with whom he may have discussed marine invertebrate science, including many visiting scholars (Don Kohrs of the Hopkins Library is currently researching this).

Ricketts' reading trips took him to the Hopkins Marine Station at the same time that scholars were visiting from around the world. The exact degree of cross-fertilization of concepts and ideas is currently unknown (again, see Don Kohrs)

Exemplary artifacts:

- Photo – Early influential ecologists – for example - Profs Allee, Shelford, Elton
- University records (location unknown)
- Correspondence with specialists (Stanford Special Collections)
- Communications with Hopkins Scientists and Hopkins visitors (Hopkins logs – see Don Kohrs)
- Old Hopkins Marine station photos (Hopkins)

Tracking the data (*Ricketts' stamps - an obsession with interconnections*)



Ricketts designed a meticulous system. One method he used to insure accuracy and eliminate duplication was to create stamps that were used throughout the system. These stamps marked when and where a piece of data had been registered in another form. Yet another means to track information through the system, they were confirmation of a completed cross-referencing, and allowed for peace of mind.

Ricketts' New Series Notebooks, his personal library, his reading notebooks, the revised collecting reports, and bibliographic cards all have evidence of the stamping system; though it is not used frequently it is used widely.

Exemplary artifacts:

- Stamp system described - Permanent (expedition) notebook (Stanford)
- Stamps themselves (whereabouts unknown)

Revised
collecting reports

Pacific Biological Laboratories Rubber Stamps

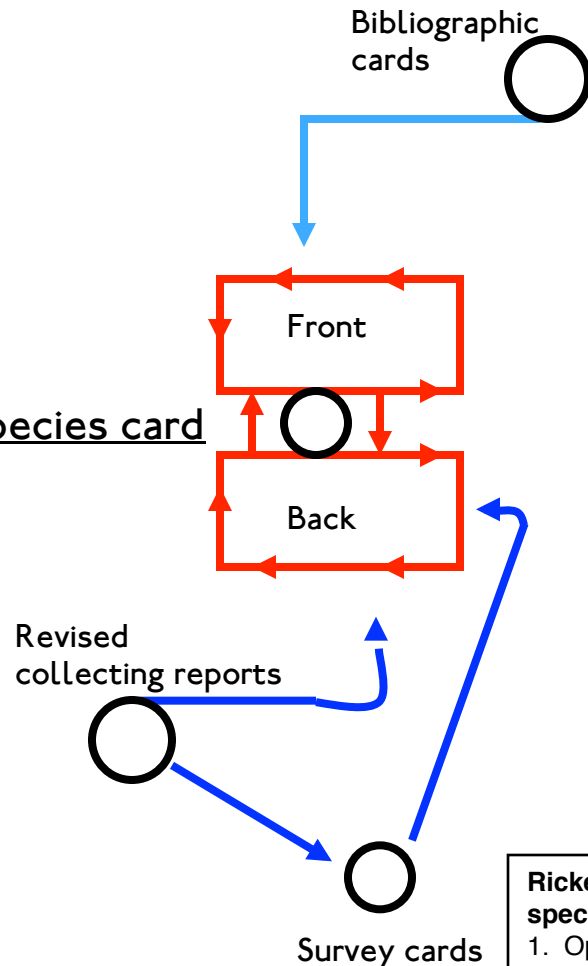
- bibliographic cross reference to
- posted to Survey card
- posted to RCR
- posted to Spec. card Pac. Biol. Lab. date:
- specialists Ident, date received, posted to RCR
- AC. BIOL. LAB. Accessioned and entered in Bibliography of _____ Date:
- punched Cross. ref. to Species Card
- entered in Bibliography of:

The Master Card of the System (*Ricketts brings all the information together*)

Front of Species Card includes:

- Linnean taxonomy
- Its original description
- Type of locality, niche etc.
- Key account (standard Modern Reference)
- Space for long quotation describing interesting fact.
- Location of exemplary photo or drawing of species
- Location of description according to Johnson & Snook '27; Ricketts & Calvin '39
- General geographic region - as designated by an edge notch for resorting
- Intertidal or Dredged
- Whether there is a specimen on hand or not
- Along the top edge there is space to place color coded tabs (see box).
- Published references to recent Pacific Occurances (noting that if he ran out of space he was to include an additional white card behind this one.)

Species card



As the master card of the system, the Species Card is an outstanding piece of cross-referencing and interconnecting. It brings together and links all of his efforts: the initial collecting trip reports, RCRS, Survey cards, notes from libraries, bibliographic cards, information from all collectors, all specialists, all academics and the preserved species at hand.

"The Species Card is the master card of the system" (Ricketts, Permanent (Expedition) Notebook)

"The eventual idea for the species card file would be to have an entry for every marine shore animal recorded in the area from Bering Sea to Ecuador, intertidally, or to a depth of 25 or 30 fms." (Ricketts, Permanent (Expedition) Notebook).

Back of the Species Card includes:

- The Species' distribution
- Supplemental Information source:
- Morphological notes
- Predominant ecological niche - as designated by edge notch for resorting and quick identification.
- Space for edge notch determining link to associated survey card
- Depth and nature of bottom if dredged

Ricketts' Designations for Positional Tabs across top of species card, left to right:

1. Open (for flexibility)
2. Systematics (nomenclature, taxonomy)
3. Zoogeography
4. Ecol and nt. hist. General philosophical principles for which that particular species is merely the point of departure. Not specific ecol and n.h. data relating to that species
5. Morphology, physiology, etc

Ricketts' publications (*Ricketts communicates his ideas to the public*)

Ricketts' produced two highly regarded works on intertidal life in his lifetime, *Between Pacific Tides* and *Sea of Cortez*. These publications were the final transformation of Ed Ricketts vast data and reflects his ultimate expression - *his* interpretation of intertidal life through habitats. *Between Pacific Tides* is the first book to be arranged by habitat. In this and in many other ways Ricketts' grand system is reflected in these publications.

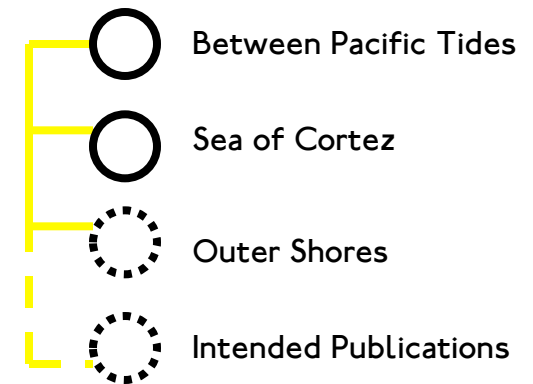
For example, Ricketts provides an appendix to *Between Pacific Tides* that arranges creatures by standard Linnean taxonomy. If Linnean taxonomy is your starting point, then simply look up the phylum Nemertea, the ribbon worms, and in this appendix you will find important bibliographic references for species in this phylum and each species is cross-referenced by its unique species number. Say, for the species "*Cerebratulus* sp. (of Elkhorn Slough) ... §239" a quick flip back through the book to species 239 ("§239") and you will read about *Cerebratulus* in the mud flats, low-tide horizon, buried in substratum habitat*.

Between Pacific Tides is the first book to be arranged by habitat. Its importance to the history of ecology is growing (see Dr. Keith Bengston's forthcoming work on Ed Ricketts' place the history of ecology and natural history).

Exemplary artifacts

- *Between Pacific Tides* (Ricketts and Calvin), 1st Edition, 2nd Revised Edition, other subsequent editions
- Book reviews
- Correspondence with publishers
- Log of the Sea of Cortez (Steinbeck and Ricketts)
- The Outer Shores (Hedgpeth 1978)

* Species run roughly from low numbers in the front of the book starting with Species 1, "The small dingy snails that litter the highest rocks ... *Littorina*" in the protected outer coast rocky shore habitat and high numbers toward the back, ending with Species 338 "the havoc-working shipworm ... *Toredo diegensis*" in the wharf piling, protected piling habitat.



Ricketts' contribution contextualized (*Ricketts - on the cutting edge of science*)

Ricketts was on the cutting edge of science. He did excellent field work using the ecological approach, centered on habitat. He was part of a group of scientists defining concepts and terms like niche and habitat and ecosystem.

Currently, Dr. Keith Bengtson of the University of British Columbia frames Ricketts' efforts within the history of Marine Inter-tidal Science. Elton's *Animal Ecology* (1927) (page 161-163) gives a precise definition of what an ecologist should be. Ed Ricketts is all of that.

Exemplary Artifacts:

- Photo – Ricketts portrait
- Ricketts' library of ecology texts (Located at Hopkins Marine Station Library)
- copy of Elton's text (Bibliography card and his copy on hand at Hopkins?)
- Ricketts' own notebooks and manuscripts on his musings and general thoughts (Located at Stanford Special Collections)
- Keith R. Bengtson; *publication forthcoming*

RICKETTS' MATERIAL CONSULTED

Edward Flanders Ricketts Papers, personal and professional papers 1936-1979, M0291, Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

Tidepool collecting Notebooks and Revised Collecting Reports

Edward Flanders Ricketts Papers, EFR - **Toni New Tidepool Book notebook** n.d., Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

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Edward Flanders Ricketts Papers, **New Series Note Book # 3**, M0291, Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

Edward Flanders Ricketts Papers, **New Series Note Book # 4**, M0291, Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

Edward Flanders Ricketts Papers, **RCR Revised collecting reports, Buff, Cape Flattery to Pt. Conception, (list of species taken)**, Post binders 1 and 2, M0291, Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

Edward Flanders Ricketts Papers, **RCR Revised collecting reports, Red, West Coast Vancouver Island - Queen Charlotte Island, (list of species taken)**, Post binders 1 and 2, M0291, Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

Expedition notes

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Edward Flanders Ricketts Papers, **Trip One. 1940 Trip to Mexico. Notebooks 1 and 2**, M0291, Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

Edward Flanders Ricketts Papers, **Second 1940 Mexico trip. Notebooks 1 and 2**, Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

Edward Flanders Ricketts Papers, **HMS notebook, Gulf of California data**, Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

RICKETTS' MATERIAL CONSULTED (CONT.)

Other notebooks and materials

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Edward Flanders Ricketts Papers, **Oceanographic notebook**, M0291, Dept. of Special Collections, Stanford University Libraries, Stanford, Calif

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Edward Flanders Robb Ricketts materials, **Ricketts scientific library (book collection)**, Reference desk materials section, Hopkins Marine Station Library, Stanford University, Pacific Grove, CA

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Pacific Biological Laboratories (PBL) Cards

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Edward Flanders Robb Ricketts materials, **PBL Survey Cards**: Buff (Cape Flattery to Pt Conception), Reference desk materials section, Hopkins Marine Station Library, Stanford University, Pacific Grove CA edricketts.stanford.edu/index

Edward Flanders Robb Ricketts materials, **PBL Survey Cards**: Gray (Pt Conception to Cedros Id), Reference desk materials section, Hopkins Marine Station Library, Stanford University, Pacific Grove CA edricketts.stanford.edu/index

Edward Flanders Robb Ricketts materials, **PBL Survey Cards**: Blue (Cedros Id through Gulf Calif), Reference desk materials section, Hopkins Marine Station Library, Stanford University, Pacific Grove CA edricketts.stanford.edu/index

Edward Flanders Robb Ricketts materials, **PBL Species Cards**, reference desk materials section, Hopkins Marine Station Library, Stanford University, Pacific Grove CA edricketts.stanford.edu/index

Edward Flanders Robb Ricketts materials, **PBL Bibliography Cards**, reference desk materials section, Hopkins Marine Station Library, Stanford University, Pacific Grove CA edricketts.stanford.edu/index

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(One of Ed Ricketts' card catalogue cabinets, Pacific Biological Laboratories:

Photo by authors)