

1 **Homage to My Mentors [Excerpted from *Ectotherms in Chang-***
2 ***ing Environments. Working in Pasteur's Quadrant*, unpublished**
3 **manuscript]**

4 Marc Mangel, July 2020

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6 *Context:* The preface to the book included a description of the NSF
7 OPUS program (which supported the writing under grant DEB-1451931),
8 acknowledgments to my mentors, a shout-out to some of my younger
9 collaborators, acknowledgment of research support over a long ca-
10 reer working on ectotherms in changing environments, and an overview
11 of how one might use the book. Most of that can disappear, but not
12 the part about my mentors: William W. Hay, Donald Ludwig, Colin
13 Clark, and Phil E. DePoy.

14 **Bill Hay, 1969-today**

15 In the fall semester 1969, I took an upper division course in Oceanog-
16 raphy, taught by W.W. Hay, who is a pre-eminent paleo-oceanographer.
17 His book *Experimenting on a Small Planet* (Hay 2016) is a gem; a
18 third edition is to come out in 2020 or 2021. I did not realize it then,

19 but Bill was quite a radical - he taught us plate tectonics as if it were
20 already well accepted, even though Takeuchi's book had appeared
21 only two years before (Takeuchi et al 1967, Oreskes 1999).

22 In course, we had to do a term paper and I focused on complex
23 ions in seawater (complex ions had been one of my favorite topics
24 in high school chemistry). With Bill's support and tutelage, this be-
25 came my first paper (Mangel 1971). Like many first papers (Holmes
26 1991) this one had minor significance for science but essential for
27 my development as a scientist: I saw how one could use simple
28 mathematical methods and existing data to determine new insights
29 about nature. In helping me publish this paper, Bill provided a role
30 model for how a senior scientist can help a beginning student (for
31 example, sitting in his office and him showing me how to change the
32 font ball on an IBM Selectric typewriter).

33 I kept in touch with Bill over the years and when I was working
34 on the book, he, Don Marszalek and I discussed the functional role
35 of the test in foraminifera, something that they worked on together
36 many years ago (Marszalek et al 1969, Marszalek 1982). This is one

37 of the case studies in the excerpted chapter on potential case studies.

38 **Don Ludwig, 1974-2018**

39 Don Ludwig, who sadly passed away in 2018, was my PhD advisor
40 at the University of British Columbia. In addition to supervising my
41 PhD, Don taught me how to be a researcher, teacher, and mensch;
42 working with him was simply amazing. When I was a student, he
43 would tell me stories about Richard Courant and Joe Keller – his two
44 advisers – and other NYU luminaries (Don had moved from NYU
45 to UBC in fall 1974, the same year that I started my PhD). When I
46 started supervising students and post-docs, I told them stories about
47 Don and Colin Clark. The three about Don that I have told most
48 frequently, which I prepared for his celebration of life in June 2018,
49 are these

50 Buying Coffee There was a cafeteria in the Old Auditorium, which
51 was right next to the Math building, and we would often go there for
52 coffee. Don always bought and when I tried to pay, he'd say (keep in
53 mind, I was then about 25 and he about 45) "I have to pay, because
54 otherwise how would they know who's the professor and who's the

55 student”. Today – at age 69 – I say the same thing to students or
56 post-docs who want pay when we have coffee (they’re still about 25
57 yrs old).

58 A Failed Qualifying Examination Because I already had a MSc
59 degree, there was only one examination in my PhD program be-
60 fore the thesis defense. I completely mis-prepared for the qualifying
61 exam in spring 1976, became flustered, and failed it.

62 I was given a second chance, in November 1976, knowing that if
63 I failed it a second time I would be booted out of the program. I was
64 understandably nervous. One or two days before the exam Don said
65 to me “Just remember that nobody is out to get you. In 10 years,
66 you will not even remember this”. After having participated in more
67 than 100 qualifying exams, I can report that i) Don was completely
68 right – faculty on such committees are not out to get the students and
69 ii) Don was completely wrong – not only do I clearly remember that
70 second exam, but it does not take much to bring up that anxiety after
71 more than 40 years.

72 Editors and Referees Don and I published three papers together

73 over about a 25 year span. It may have been about our first paper in
74 1977, or just a general conversation, in which he told me “You’ll get
75 a paper back from a journal – maybe accepted subject to revision,
76 maybe rejected – and your first thought will be that the editor is an
77 idiot and the referees are fools. Put the paper in a drawer for a few
78 weeks and after that pull it out. Re-read the letter from the editor
79 and the referee comments. You’ll suddenly think ‘Oh, I could have
80 explained that better’ or ‘Hmmm, that’s a good point’ I need to do a
81 bit more work on that piece of the paper’. They’ll turn out not to be
82 the fools you first thought they were”.

83 I left Vancouver in late 1977 but continued to visit Don regularly.
84 Although Don is no longer here to speak with me, his wisdom and
85 kindness endure.

86 **Colin Clark, 1976-today**

87 Don had research money from Canada’s Natural Science and Engi-
88 neering Research Council (NSERC), but regulations then prohibited
89 such funds from being used to support American students (presum-
90 ably because of the large influx of Americans during the Viet Nam

91 war). The early 1970s were a period of high inflation and what had
92 seemed like a generous salary as a teaching assistant (\$400 a month)
93 when I applied to UBC simply did not go very far, especially since
94 our first daughter was born shortly after I started graduate school
95 and the second one was on the way in 1977. I discussed this prob-
96 lem with Don a few times and one day he told me that Colin Clark,
97 who had written a very insightful paper (Clark, 1974) on schooling,
98 had been approached by NOAA Fisheries to work on tuna- porpoise
99 fisheries.

100 I had taken a course in optimal control theory from Colin in my
101 first term at UBC and was sufficiently desperate that I convinced
102 him to hire me as a research assistant on the 1-year grant. I also
103 petitioned the Graduate Dean at UBC to allow me to work both as
104 a Graduate Research Assistant and as a Teaching Assistant, to thus
105 keep my family housed, clothed, and fed.

106 Working with Colin was an equally fantastic experience, and as
107 with Don, I have tried to pay forward the debt that I owe to him. We
108 ended up with a very nice paper on the relationship between over-

109 all abundance of tuna and catch rate of tuna at dolphin-associated
110 schools (Clark and Mangel, 1979); I wrote another paper on a stochas-
111 tic version of those models (Mangel, 1982c). There were difficulties:
112 in the first 6 months of our work, we could not find the right kind
113 of model. In the course of this work, we learned that Jerzy Neyman
114 – motivated by the collapse of the California sardine fishery – had
115 worked on estimating the number of fish schools (Neyman, 1949)
116 and that tuna purse seine vessels spent the majority of their time
117 searching for schools of dolphin and much less time actually setting
118 tuna. It was my introduction to search theory. Colin and I both en-
119 joyed working together on this project and it laid the groundwork
120 for our future collaborations once I moved to UC Davis.

121 **Phil DePoy, 1977-today**

122 Phil DePoy was the Director of the Operations Evaluation Group
123 (OEG) ¹, Center for Naval Analyses, which I joined in November,
124 1977 after defending my PhD. OEG started in 1942 when the US
125 Navy approached Phillip Morse at MIT about providing scientific

¹Most readers of this book know indirectly about OEG and CNA, because my col-
league Christine Fox was the role model for Kelly McGillis's character in *Top Gun*
(<http://www.imdb.com/title/tt0092099/>); also see Farrell (1987).

126 help to deal with the German submarines and other forces operating
127 off the US east coast (see Little, 2002; Tidman, 1984, and Morse,
128 1977 for a history of OEG). Morse recruited Bernard Koopman (an
129 applied mathematician) and George Kimball (a theoretical chemist);
130 together they created the field of operations research in the US while
131 PMS Blackett was doing the same with operations analysis in the
132 UK (Nye, 2004). Phil recently gave an interview that described both
133 the history of OEG and his role at the time I was there (Sheldon,
134 2016). During WWII, Koopman developed the theory of search (e.g.
135 Koopman, 1956a, b, 1957) and in the late 1970s, as turning his pa-
136 pers into a magnificent book (Koopman, 1980). While I was waiting
137 for my security clearance to come through (which took a while be-
138 cause I had lived abroad), Phil suggested that I work through a draft
139 of the book. The final chapter left open the question of how to deal
140 with moving targets and I realized that the methods I had used in my
141 PhD thesis could apply to search problems (Mangel 1981).

142 I continued to work on search problems while in the field with
143 OEG. When I went to the field at Whidbey Island Naval Air Station,

144 Oak Harbor, WA, I developed a method for locating a radio trans-
145 mitter when there are biases in the angle measured by the receiver
146 and the true angle (Mangel, 1981a). That paper received the Koop-
147 man Paper Prize from the Operations Research Society of America
148 in 1982. I describe some of my other work while in OEG in Mangel
149 (1982b).

150 My time in OEG reinforced the power that comes from using
151 simple mathematics in mature and sophisticated ways – which is
152 exactly what we will do in this book. When I left OEG for UC
153 Davis in 1980, my goal was to do OEG-style work with applications
154 in fisheries and agriculture. By OEG-like work, I mean bringing
155 the scientific approach to problems for which the fundamental laws
156 governing the processes are either unknown or too complex to derive
157 from first principles, or for which we know the fundamental laws but
158 do not know the value of the parameters associated with them – thus
159 merging applied mathematics and statistics, motivated by an important
160 applied problem.

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