

OCN 350-001

Dr. Phil Bresnahan



Intro to the class

- ▶ Course goals
- ▶ Paper syllabus
- ▶ Canvas (👉 our map from now on)
- ▶ Introduce myself/my background

Course Goals



Goals

1. Stay healthy and help others stay healthy! Physically, mentally...
Please look out for each other, including wearing masks when around others
2. Learn about the oceans!
3. Come away with an ability to see a phenomenon in nature, say, “I wonder what caused that,” and have the tools to try to answer it
4. Learn more about what interests you and talk about that as much as possible

General Schedule

- ▶ Deadlines will all be on Canvas
- ▶ Homeworks, interactive assignments, and exams all have strict due dates!
- ▶ Exam/project dates are on paper syllabus and are being added to Canvas

Paper Syllabus



Canvas



Two main sections of this course

What the professional oceanographic community thinks are the most important issues of our day

- ▶ Sea Change is just one of the possible summary documents available
- ▶ We will also frequently reference the journal named *Oceanography*:
<https://tos.org/oceanography/>
- ▶ Here's a nice article from a recent edition to start with:
<https://tos.org/oceanography/article/career-profiles-options-and-insights38>

What you think are the most important issues of our day

- ▶ Why did you sign up for this class?
- ▶ What did you want to learn about in depth?
- ▶ There are many (interdisciplinary) subdisciplines: geo, chem, phys, bio
- ▶ Many approaches: basic science, applied science, solutions-oriented

A bit about me and my background

(And why should you care)

Robust pH Sensors



LIMNOLOGY and OCEANOGRAPHY: METHODS

Limnol. Oceanogr.: Methods 8, 2010, 172–184
© 2010, by the American Society of Limnology and Oceanography, Inc.

Testing the Honeywell Durafet® for seawater pH applications

Todd R. Martz^{1*}, James G. Connery², and Kenneth S. Johnson³

¹Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA, 92093

²215 E. Welsh Road, Maple Glen, PA, 19002

³Monterey Bay Aquarium Research Institute, Moss Landing, CA, 95039

OPEN ACCESS Freely available online

PLOS ONE

High-Frequency Dynamics of Ocean pH: A Multi-Ecosystem Comparison

Gretchen E. Hofmann¹, Jennifer E. Smith², Kenneth S. Johnson³, Uwe Send², Lisa A. Levin², Fiorenza Micheli⁴, Adina Paytan⁵, Nichole N. Price², Brittany Peterson², Yuichiro Takeshita², Paul G. Matson¹, Elizabeth Derse Crook⁵, Kristy J. Kroeker⁴, Maria Cristina Gambi⁶, Emily B. Rivest¹, Christina A. Frieder², Pauline C. Yu¹, Todd R. Martz^{2*}

Mobile pH/O₂ monitoring: partnering with the community



Photo Credit: Yui Takeshita

Take 4

engineering by
Taylor Wirth,
2014 REU

Mission Bay
High School

Earth Day 2015



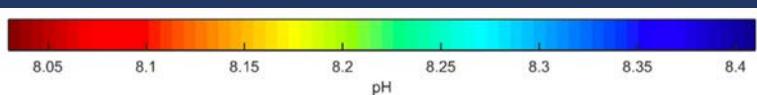
Photo Credit: Brittany Hook



NSF-OCE # 1026607, Ohman et al.

24-Hour Field Survey

observing respiration/photosynthesis cycles
Mission Bay, CA



Contents lists available at ScienceDirect

Methods in Oceanography

journal homepage: www.elsevier.com/locate/mio

Full length article

A sensor package for mapping pH and oxygen from mobile platforms

Philip J. Bresnahan ^{a,*}, Taylor Wirth ^a, Todd R. Martz ^a,
Andreas J. Andersson ^a, Tyler Cyronak ^a, Sydney D'Angelo ^a,
James Pennise ^b, W. Kendall Melville ^a, Luc Lenain ^a,
Nicholas Statom ^a

^a Scripps Institution of Oceanography, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA
^b Ocean Discovery Institute, 2211 Pacific Beach Drive, Suite A, San Diego, CA 92109, USA

GRAPHICAL ABSTRACT

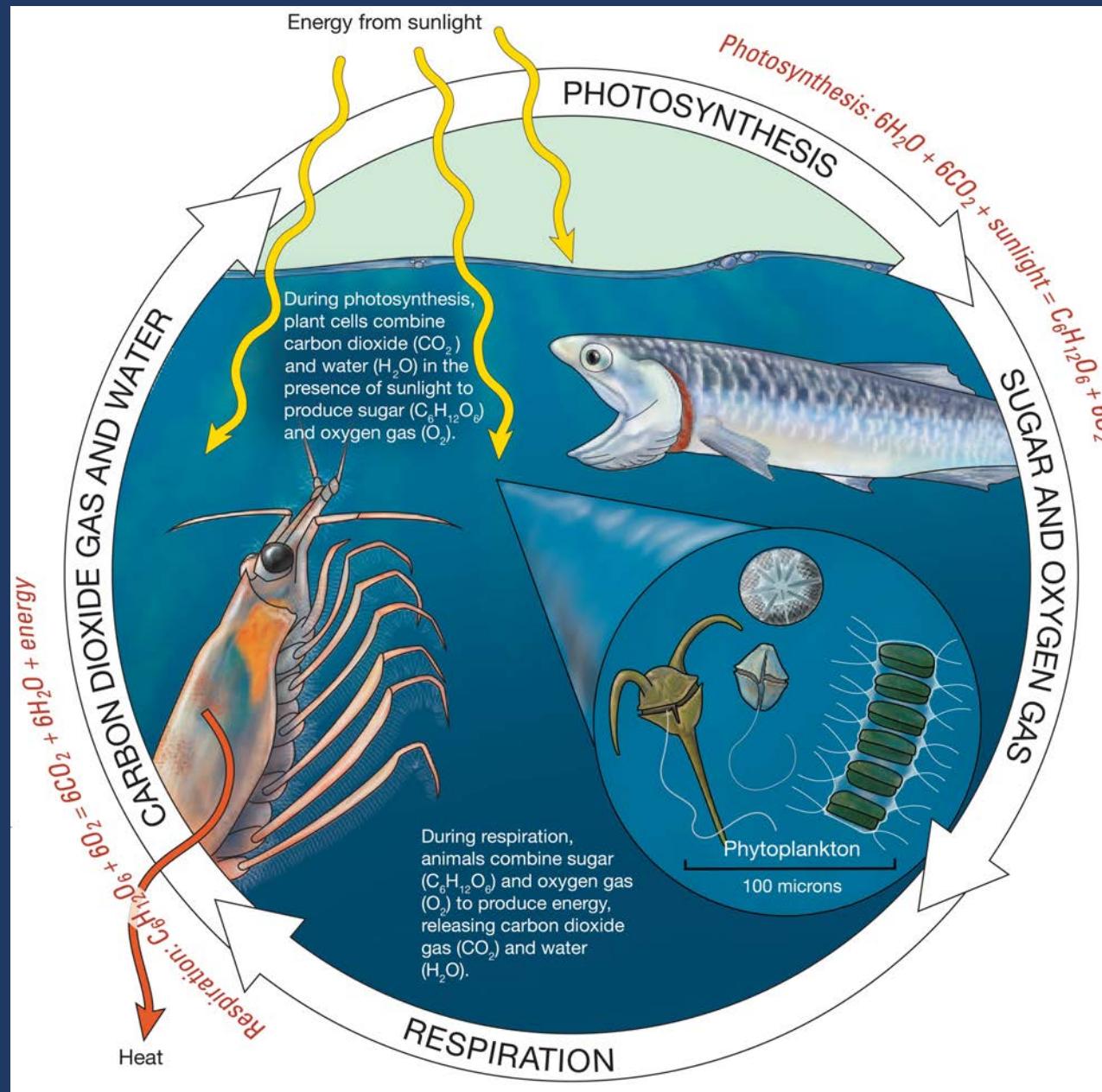
(a) A diagram showing two cylindrical black components. The top one is labeled "23° 55.88 cm". The bottom one has a cross-section showing internal components and is labeled "Seawater in" and "Seawater out".

(b) A diagram of the sensor package with a vertical color scale on its left side. The scale ranges from 0 (blue) to 1.100 (red), with intermediate values: 0.253, 0.421, 0.589, 0.747, 0.905, and 1.063.

(c) A photograph of the sensor package submerged in clear water. It is positioned next to some green aquatic plants.

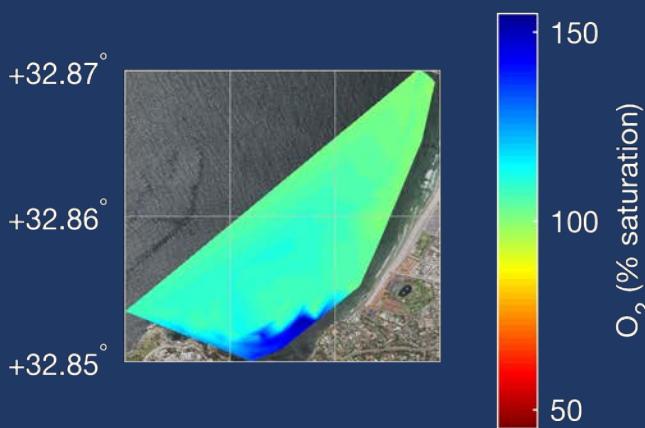
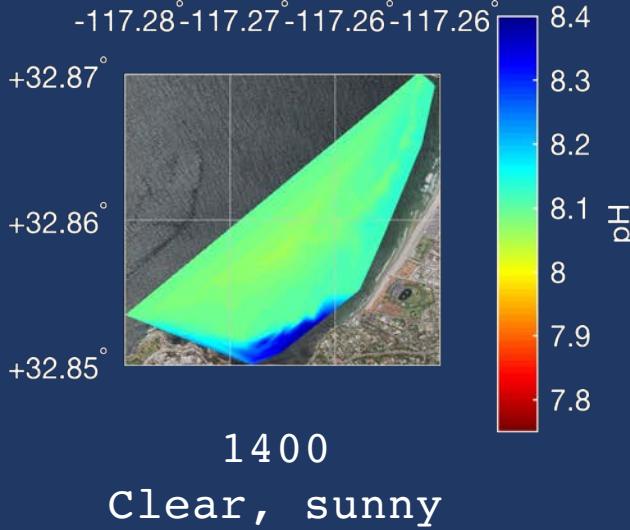


NSF-OCE #1255042, Andersson



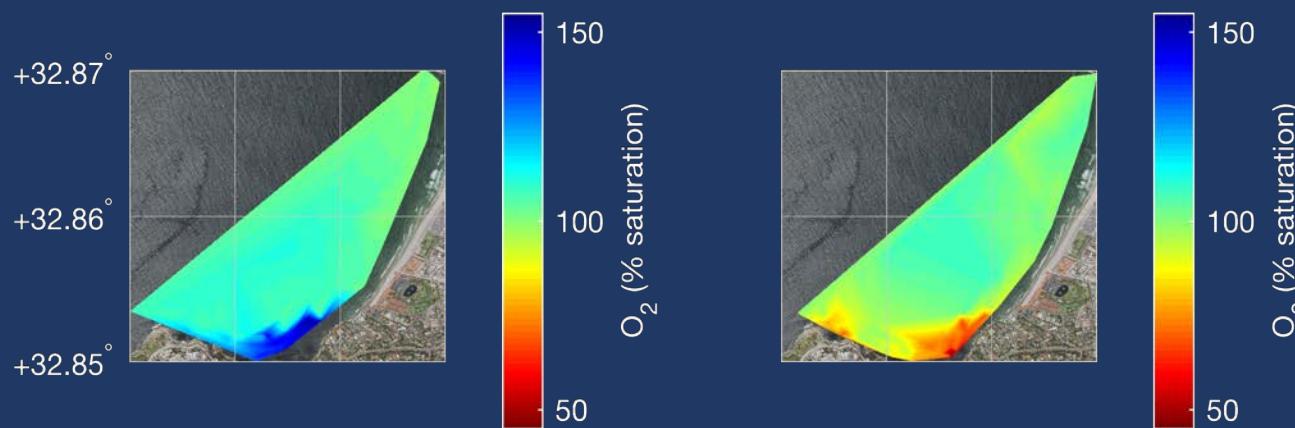
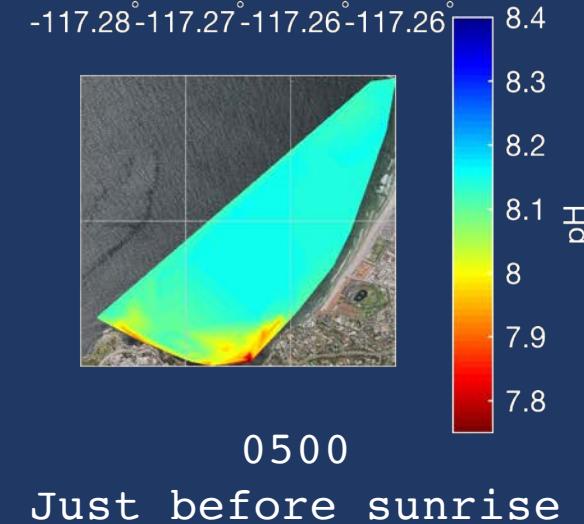
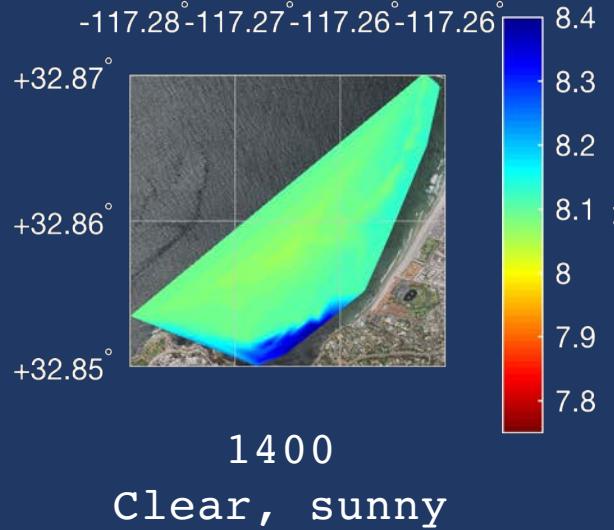
Day/Night Field Survey

Observing Respiration/Photosynthesis cycles
La Jolla, CA



Day/Night Field Survey

Observing Respiration/Photosynthesis cycles
La Jolla, CA



SMARTFIN

FOR CITIZEN/COMMUNITY/PARTICIPATORY SCIENCE



SMARTFIN

FOR COMMUNITY SCIENCE

- Temperature
- GPS
- Motion
- Wet/dry sensor/actuator
- Solar charging
- Fits in standard fin boxes
- Meets performance specs



Sensor
package
smartfin
⌚

SMARTFIN

FOR COMMUNITY SCIENCE

- Temperature
- GPS
- Motion
- Wet/dry sensor/actuator
- Solar charging
- Fits in standard fin boxes
- Meets performance specs
- Cellular data transfer



Sensor
package
smartfin
⌚

Encoded
cellular
transmissions
(3G/LTE)

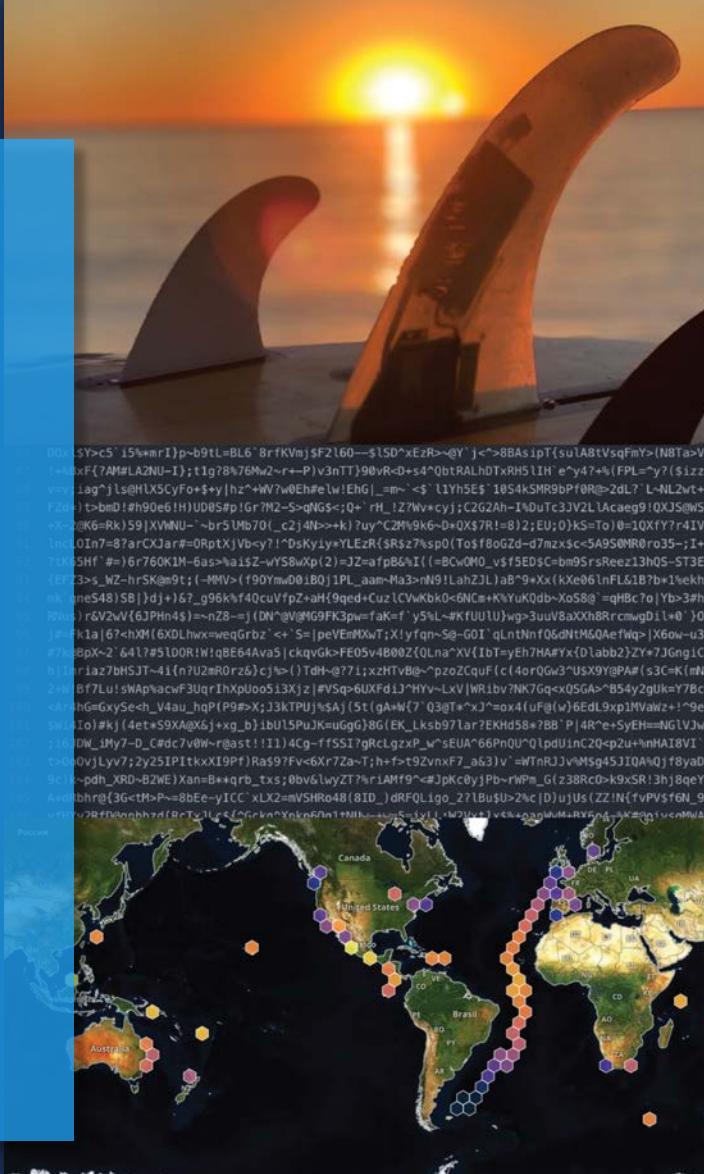


```
00x...$Y>c5"15%mr1)p~b9tL=BL6"8rfKVmjsF2l6o---$LSD^xEr>~eY`j<>8BAsipT(suLA8tVsQfM>(NNTa>VR7  
1+40x{?AM#|LA2NU-U};t1g;?8%76Mz2~r+P)v3nTT)90vR>0+s4^ObtRALhdTxRH51H`e~y4?+%(FPL="y?(SizzvW  
Vv...Lag")ls@#lX5CYf+o-$y|h>+W?w0ch!w!h6_|_m->51Yh5E$ 1054KSMR9p0P@2dL L-NL2vt-mu  
Fz0d+)t+b0d1#h906e(lH)UD0S5#pIGr?M2-S>qNGs+o+ rH_LZ7W*x+cy);C2G2Ah-I%utc3Jv2L1Acceg9!0JX50WSct  
+X-2k6-Rk)59|XvNU|-~br5tUm70_<2>4N>>k) y"u?C2M#9K6-D+0x57R!=82;Eu;)k+S=t0)=0:10XY7?r4IVT0  
In0In7=8?arCxJiar=DRptXjVb<y!^DsKiy=YLEzR($RsZz7sp0(Tof8oGzD-d7mz$c<5A950MRo35-;I+1G  
7iNSH "#=67660K1H-Gas>@L52-wfSwxwp(2)=Iz-arTp&I((BCwOM0_vsf5ED$=bm05rsReez13hQ5-ST3E70  
(EF>s_W2-hrSk@#9t:(-Mv>-(f90ymw00180)jPL_aam-Ma3>@N9!LanZJL)B"9*x(Kx060lFL&IB7b1<ekh4<  
-neS481SB|)d+)+l2_.g96KwF40cuVfpZ+ah{9qed+CuZLCwKb0<GNc+K%YuKdb>x0S8|=qHBc7o|Yb>3#hr<  
-hbu) r6V2wV{6JPhn4$)<-nZ8-|j(DN^@!@G9FK3p=fa=k' y5!<-KfuU)U)wg>3uuV8axXh8RrcmwgD1+w=)067  
-je...k1a|67<chM!6xDLhwx-weqGrbz <+ S=peVEmMwv;Xiyfqn-S0 GOI qLnNnf06&NTMs0Aefwq>|X6w-u3r<  
-Bp>2' &41?51DDRI!W|qB664Av5|ckvgk>FE05vIB00Z{Qln'a'XV{IbT=yEhHA#fx{Labzb}Zy+7JGng1cyq  
-h|Driaz7bHSJT-41(n7U2#R0rz&)k>(|)TdH=>771;xzHTvB@-~pzoZCquF{c(4or0Qw3^USX9Y@PA#s3C=mNEd  
-2wBF7Lu:sWApvacwf3UqrInxploos13Xjz|#VSq=6UXFd1J~HYv-LxV|Wrlbv?Nk7Gg<xQSGA>~B54y2Guik=Y7Bco4  
->rhG6xSech_V4au_hqP(P9#>x;J3kTPU)%$A|St(gA#W("03@T*xJ>=o4(uF(w)6EdLxpx1Mwz+!^9e1X  
-00|Io#k{j(4et+SSXA@{g_xg_b}jb1L5PuJk=u(GgG)8G(EK_Lksb971ar?EKhd58?BB'P|4R^e+SyEH==NGLVJwJ  
-j80DW_IMy7_d_0#dc7veW-r@st!!11)4Cg-rFSI7gRclGzxP_w'sEU@66PnQU|QlpduinC2Q+p2u+mnHaI8V1 n  
-t00OvLy7;zy251PttxKI9Pf)Ra697fVc6x7r7za-t;h+f>f92Vznxf7_a631v =WtnRJjvMs945JJQnQj8yA0J^  
-9c1~pdh_XRD-B2WE)Xan=B+qrb_txs;Bv6!wyZT?rLMf9^~#JpkceyJpb+rwPm_G(z3BRC0-k9xSR|3hj8qeY=e7  
-Abobhrg{3G<tM>P=~8bEe-yICC'xLx2=mVSHRo48(8ID_)oRFQLigo_27lBu>2%[D]ujUs(ZZIN{fvPV$16N_9'3
```

SMARTFIN

FOR COMMUNITY SCIENCE

- Temperature
- GPS
- Motion
- Wet/dry sensor/actuator
- Solar charging
- Fits in standard fin boxes
- Meets performance specs
- Cellular data transfer
- Free and open data on custom data aggregation portal (IOOS partner)



Sensor
package
smartfin
⌚

Encoded
cellular
transmissions
(3G/LTE)



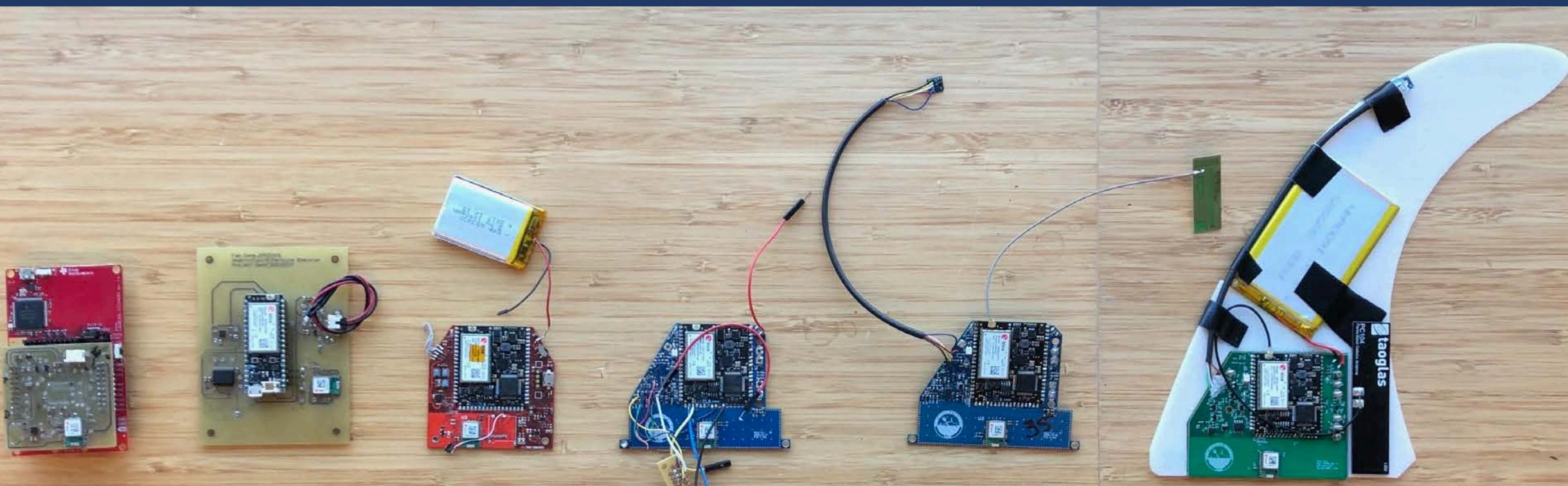
Particle

Web
(smartfin.axds.co)



R&D Successes

- Full engineering stack: hardware, firmware, software
- Water quality sensors in dev
- 5 continents, 300 fins, and 2719 sessions as of Jan. 2020
- IP licensed to nonprofit for manufacturing



What can we learn?

- How variable coastal parameters are (and how that affects organisms that live there)
- Health of coral reefs/seagrass beds/kelp forests/mangroves
- How do surf breaks change with sea level rise and coastal development
- Things we haven't known to ask



Article

Comparison of Two Methods for Measuring Sea Surface Temperature When Surfing

Robert J.W. Brewin ^{1,2,*}, Tyler Cyronak ^{3,4}, Philip J. Bresnahan ⁴, Andreas J. Andersson ⁴, Jon Richard ⁵, Katherine Hammond ⁵, Oliver Billson ^{6,7}, Lee de Mora ², Thomas Jackson ², Dan Smale ⁸ and Giorgio Dall'Olmo ^{2,9}

Engineering a Smartfin for Surf-Zone Oceanography

Philip J. Bresnahan
Tyler Cyronak
Todd Martz
Andreas Andersson

Scripps Institution of Oceanography
University of California, San Diego
San Diego, CA, USA

Shannon Waters
Surfrider Foundation
San Clemente, CA, USA

Andrew Stern
Jon Richard
Katherine Hammond
John Griffin
Lost Bird Project
New York, NY, USA

Benjamin Thompson
Boardformula, Inc.
San Diego, CA, USA

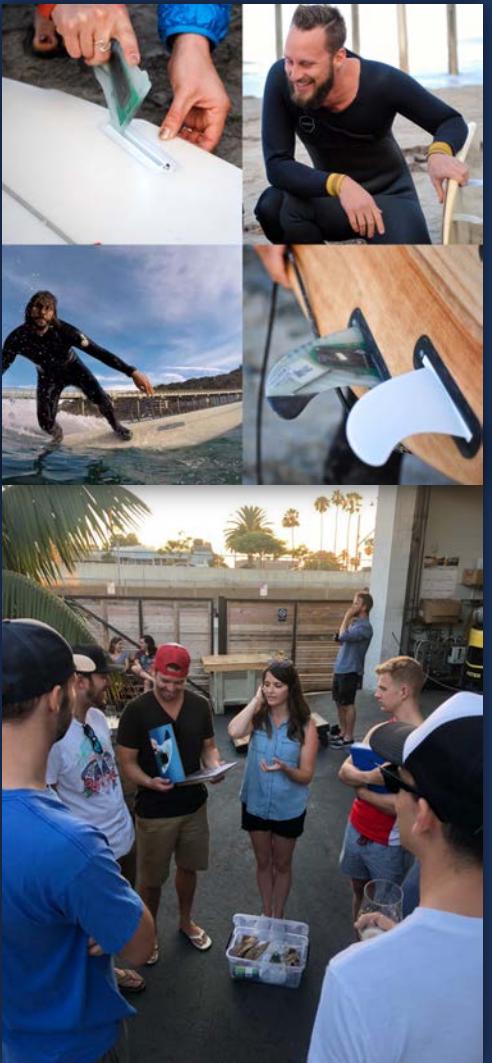
PERSPECTIVE ARTICLE

Front. Mar. Sci., 02 November 2017 | <https://doi.org/10.3389/fmars.2017.00351>

Expanding Aquatic Observations through Recreation

Robert J. W. Brewin^{1,2*}, Kieran Hyder³, Andreas J. Andersson⁴,
Oliver Billson^{5,6}, Philip J. Bresnahan⁴, Thomas G. Brewin⁷,
Tyler Cyronak⁴, Giorgio Dall'Olmo^{1,2}, Lee de Mora¹, George
Graham⁸, Thomas Jackson¹ and Dionysios E. Raitsos^{1,2}

Community Engagement



Forbes

New Post 5 days ago 6,215 views

SURFER FEATURES VIDEOS PHOTOS GEAR SWELLWATCH FORUMS MAGAZINE

Science

Home News Journals Topics Careers

SHARE

f 1K
t 2
in 147

SMART
SAN DIEGO
THE MY
OCTOBER 1



Surfing fin-embedded sensors collect coastal data.
Kat Hammond

Scientists put a 'smartfin' on my surfboard. Is it the next wave in ocean monitoring?

By Jon Cohen | Sep. 8, 2017, 12:50 PM



A bit about me and my background

(And why should you care)

Science is a process, an ongoing set of actions.

Not just some already-published textbook!

It is an opportunity to explore the world around us (sometimes outside, sometimes using computer models)



Always looking for students

DIS (directed independent study), honors thesis, graduate school eventually,
some hourly paid opportunities

Closing Notes:

Next lecture: overview of Sea Change

Everyone have access to a computer? We will use some free software this semester but you'll need a computer, not just mobile device. Let me know ASAP if you need assistance finding a workable machine.

In general, Fridays will be for interactive computer work, so please bring your computer!



Questions?