

Tentative Order No. R9-2009-0038  
Amending  
Order No. R9-2006-0065 (NPDES No. CA0109223)  
Waste Discharge Requirements for  
The Poseidon Resources Corporation  
Carlsbad Desalination Project  
Discharge to the Pacific Ocean Via  
The Encina Power Station Discharge Channel

April 1, 2009 Statement of Dr. Peter Raimondi  
(with curriculum vitae attached)

Prepared for the San Diego Regional Water Quality Control Board, with funding provided by Poseidon Resources Corporation.

## Review of Impingement study and mitigation assessment – Carlsbad Seawater Desalinization Project

**Pete Raimondi**

**04-01-09**

I have restricted the following review to those issues that affect the estimation of impact resulting from impingement. Specifically, Poseidon has used an approach based on work by Nordby (appendix 7) as the basis for their conclusion that any impingement impacts will be compensated by the mitigation already required for entrainment impacts. Poseidon discusses the merits of their impingement reduction technologies but nowhere quantifies the effect. This lack of quantification was also noted in Nordby appendix 7. This is important because the argument that impingement attributable to CDP is negligible or already compensated hence rests on the assessment of benefit conferred by the wetland mitigation for entrainment impacts. Therefore my review is directed at that approach presented by Nordby and the parameters that are used in the calculations in that approach. Generally I think this approach is a very interesting and potentially an appropriate method for comparison of impingement losses (or any sort of loss) to gains in production provided by the creation or restoration of wetland habitats. However, I have questions with respect to the appropriateness of the approach for this particular assessment

In the Nordby appendix 7 replacement document, the argument is made that that CDP impingement will be compensated for by the mitigation required for entrainment impacts (55.4 wetland acres restored or created). This argument rests on a series of explicit and implicit assumptions or calculations:

- a. That there is compensatory mortality.
- b. That estimates of fish production from a paper by Larry Allen (1982), may be extrapolated to an estimate of 151.36 kg (wet weight – WW- per acre).
- c. That wetland restoration or creation will occur as required and that those restored or created acres have NO current level of production
- d. That all restored or created acres will lead to the production levels estimated in the Allen paper.
- e. That if a-d are true then per acre productivity from the entrainment mitigation acreage is a simple product (e.g. 151.36 kg per acre x 55.4 acres = 8385 kg per year).
- f. That the estimation of the impingement losses resulting from water use of 304 MGD of seawater is without error and that this estimate is best approximated using the average daily impingement loss of 4.7 kg per day (based on all data including non flow related events) yielding an annual loss of ~1715 kg per year.

These calculations and assumptions led Poseidon to conclude that impingement losses are fully offset by the mitigation already required to compensate for entrainment impacts. I disagree with this conclusion for the following reasons.

- 1) **This conclusion rests on the assumption of compensation.** Compensation is another name for density dependent mortality. As applied here it means that reduction in larval numbers due to entrainment has no effect on adult numbers. An example will be useful. Assume that a 100

acre wetland can naturally support 10000 kg of (non-larval) fish. Now assume that a power plant is built and that the modeling of entrainment yields an estimate of the loss of 20% of the larval pool in the wetland. If fully compensatory mortality is assumed then there will be no change to the 10000 kg of non-larval fish. Now let's assume that no such compensation occurs (note that the use of compensatory mortality has not been allowed in any recent entrainment assessments (316B or equivalent)) - here the 10000 kg will decrease to 8000kg (assuming only a change in numbers of fish and no change in size structure). If there is impingement of say 1000 kg of fish per year, the overall biomass will decrease to 7000 kg. Assume an assessment is made of entrainment and mitigation is required that will produce the same number of larvae as that lost to entrainment. Further assume this is in the form of ~20 new wetland acres. Again we make the mandated assumption of no compensatory mortality and we conclude that the non-larval biomass for the wetland will go up 2000kg yielding 9000kg (7000+2000). What about the missing 1000kg? That amount is still missing due to impingement. Based on the logic and math above another 10 acres of new wetland would be needed to produce the biomass lost to impingement.

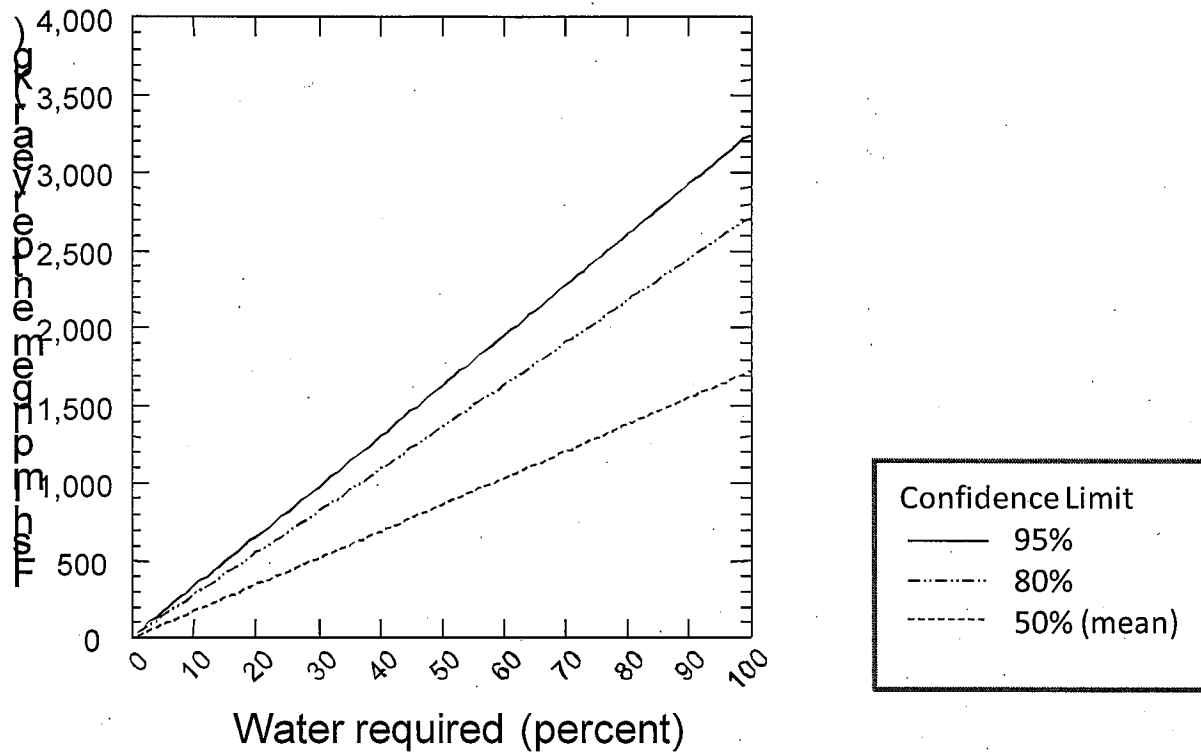
The bottom line is that wetland acreage created or restored based on entrainment impacts cannot be also used to mitigate for impingement impacts unless one invokes compensatory mortality, which is specifically not done in I&E determinations.

- 2) **The arguments made by Poseidon do not address the "double counting" problem.** After receiving an the initial review, Poseidon responded that because Goby and Blennies make up 95% of entrainment there is little overlap between entrained and impinged species. They further argued that this lack of overlap meant that the acreage created or restored to compensate for entrainment effects would also compensate for impingement effects because there would be no double counting (see point 1 above). I think this argument is flawed because:
- a. While gobies and blennies are the most commonly entrained species, virtually all species that can be entrained (those that produce larvae) including anchovies and Atherinops are both entrained and impinged
  - b. The argument made by Poseidon assumes, incorrectly, that the number of larvae entrained, represents the impact of entrainment. It does not. The impact from entrainment on adult populations (assuming no compensation) will depend on a number of (mainly) life history factors such as lifetime reproduction, age at entrainment (i.e. older individuals are more valuable than younger ones, and adult stock).
  - c. Poseidon suggests that "this 1715.5 kg per year of predicted fish biomass productivity shall be calculated in a manner which excludes the predicted biomass for entrained lagoon fish species". Presumably this means those species that have no larval phase (sharks, rays, surfperch). *The problem here is that the estimate of productivity that is the basis of the Poseidon productivity calculation is based on species that are entrained by the Encina Power Station (EPS) and completely excludes species that have no larval phase ( see Allen 1982). Hence there is no basis to estimate increased productivity (if any) of the created or restored wetland areas for species not entrained.*

- 3) **The estimates used by Nordby to calculate impingement losses rely entirely on averages.**  
There is nothing wrong with the use of averages as one estimate of effect, however the use of averages as the only estimate of effect relies on the idea that estimates are made without error, which should not be done and is counter to ordinary statistical methodology. I think that a better approach is one based on degree of confidence (or certainty). Here estimates are expressed as the confidence that one has the real average is no higher than some value X. As an example if the average impingement is 4.7 kg per day, then the equivalent statement using confidence limits is that we are 50% confident that the true average is no greater than 4.7 kg per day. In typical inferential statistics, confidence limits of 95% are generally used (see graphs below). In mitigation evaluations, higher confidence levels are used to provide greater certainty that there is full compensation for impacts.
- 4) **The estimates of fish production used by Nordby are based on the assumption that the mitigation wetland will be made up entirely of intertidal mudflats.** The estimate of fish production (151.36 kg per acre per year) is based on Larry Allen's work, which specifically is restricted to mudflats and not to vegetated marsh or even subtidal areas. The most recent wetland design (presented to the CCC by Poseidon) includes 60% vegetated marsh. Note also that Poseidon specifically did not include vegetated marsh in its estimate of area impacted by intake operations (Flow, entrainment and impingement minimization plan – March 9, 2009 page 6.3).
- 5) **The estimates of fish production used by Nordby are based on the assumption that there is no current level of fish production in acres to be restored or created.** This would be true for created acres and not true for acres to be restored. Without a detailed description of the restoration or wetland creation plan, there is no way to assess current level of productivity, or to calculate the net gain in productivity – if any.

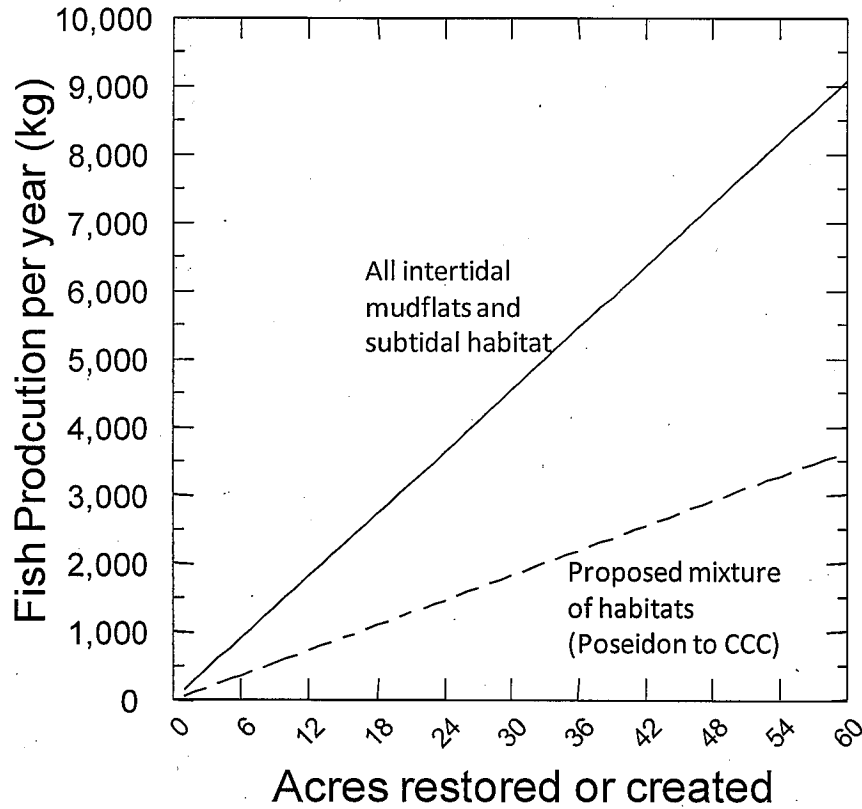
To understand impingement impacts using the logic of the Poseidon approach, I made corrections related to the points I made above. I then recalculated the estimates for fish production and impingement and the acres required to offset the losses under differing scenarios of the amount of water required (the percent of water required by CDP that is not provided by operations of Power Plant). The results are shown below.

First, impingement losses are shown as a function of the percent of water required (not supplied by the power plant operations).

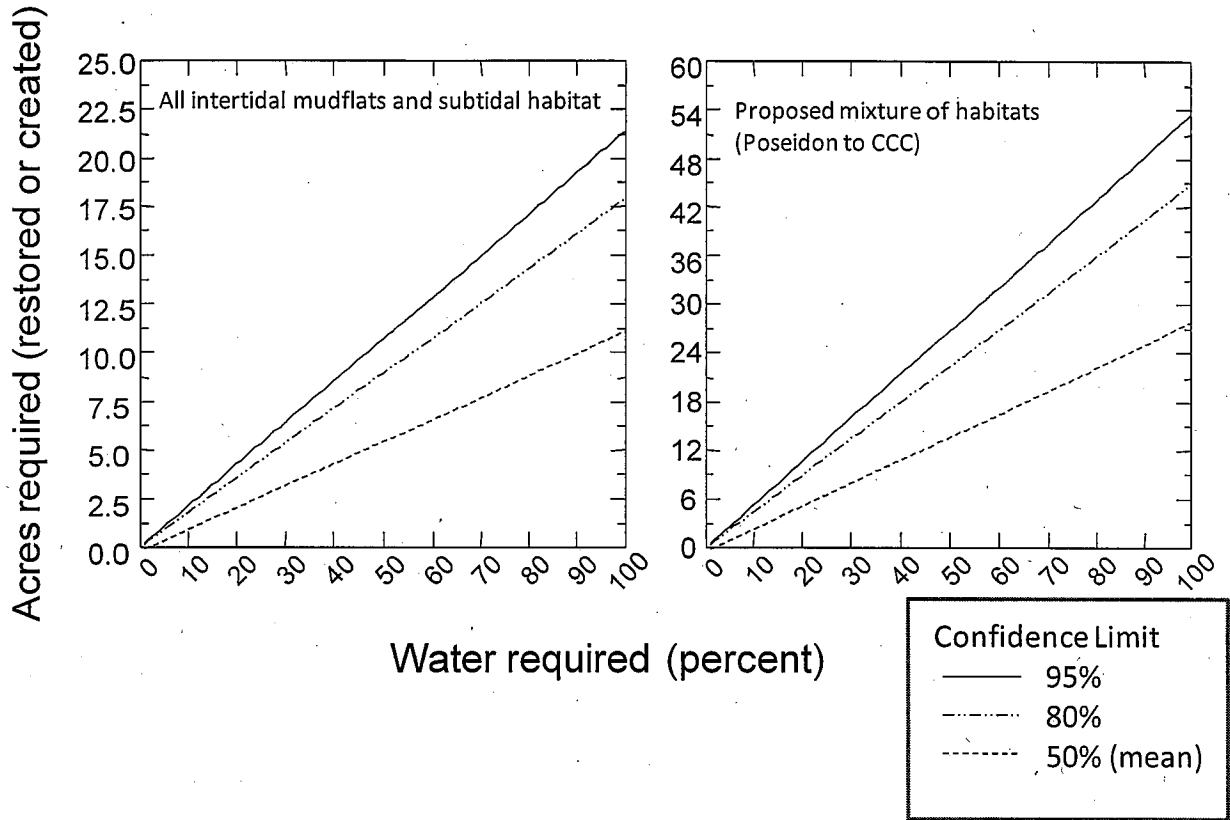


Like the estimate produced by Poseidon and used by Nordby, if CDP requires 100% new water the estimate of impingement based on the arithmetic mean is ~1715 kg. *Note though that if the 80 or 95% confidence limit is used the value increases to 2700 kg (80% CL) or 3250 kg (95% CL).*

Next I estimated the production of fish as a result of the restoration or creation of new wetland habitat (*not the acreage to be restored or created as a result of entrainment mitigation*), under two scenarios: (1) assuming the new wetland would be all intertidal mudflat or subtidal habitats, (2) using a mixture of habitats of which 40% is intertidal mudflats or subtidal.



Finally I combined production and loss to investigate the acreage needed to mitigate impingement losses over a range in values for water required above that provided by operations of the power plant.



In both graphs there are three estimates of acreage required. These are based on the three confidence limits (see figure 1). The left and right graphs differ based on the design of habitats in the mitigation wetland. If 100 percent of water is needed (304 mgd) then the acreage need to mitigate impingement ranges from ~11-21 (if all the acres are intertidal mudflats or subtidal) to 28-54 (if the wetland is a mixture of habitats – 40% of which are intertidal wetlands or subtidal). Following the 80% CL precedent (from the entrainment assessment) the range in values would be 18 -45 acres depending on the wetland mix of habitats.

It is important to note the following:

- 1) In all calculations shown here I used the value for estimated annual production of fish that was used by Nordby and Poseidon (based on a paper by Larry Allen (1982), extrapolated to an estimate of 151.36 kg (wet weight – WW- per acre)).
- 2) In all calculations used to produce the graphs, I assumed the wetland acreage was new and not restored.
- 3) In all calculations shown here I used the value for average annual impingement of 1715 kg, which was also used by Poseidon and Nordby for their comparison of impingement losses to productivity gains. This value is based on what Poseidon calls the Proportional (3-B) model,

specifically using the 4.7 kg value. Poseidon argues that a more conservative value (2.24 kg/day) is warranted based on the idea that two observations were outliers that should be weighed by some probability of occurrence (Poseidon proposes 5%). I think this argument is flawed. First, Poseidon is confusing outliers with respect to storm events with outliers with respect to impingement. This is a logical error (false converse). Let's assume that there was higher impingement than typical in the storm events and the *storm events* were outliers. This does not allow the conclusion that higher than typical impingement only occurs associated with storm events, which is the basis of the argument by Poseidon. There may be all sorts of other causes of higher than typical impingement. Indeed a few such high impingement events may be typical each year. The problem is that unlike the historical record for storm or flow events we have no such record for impingement that would allow assessment as to how common or rare such high impingement events are. Simply put – in adequate sampling is no reason to discount data. Hence the only reasonable approach is to use the flow proportioned average without adjustment, that is, model 3-B with no discounting.

- 4) Based on the information provided by Poseidon and my review, it is my conclusion that if wetland acres are going to be used to mitigate impingement impacts they need to be new acres not those already required by the entrainment mitigation.
- 5) The approach taken here is based entirely on the approach proposed by Poseidon. There may be other ways to estimate impingement and impacts due to impingement that do not rely on conversion to wetland acreage. As one example, there is almost certainly a non-linear relationship between flow per second (intake velocity) and impingement probability. If intake velocity is reduced, as stated, after the power plant stops operating there may be a substantial reduction in impingement. I think this could be quantified or at least modeled. If such an approach was used there would have to be language in the CDP operating permit limiting intake velocity.
- 6) **As calculated**, the impacts of impingement are substantial and not offset by mitigation proposed for entrainment impacts.



## PETER T. RAIMONDI

Professor of Ecology & Evolutionary Biology, UC Santa Cruz

### EMPLOYMENT

2003-current **Chair**, Department of Ecology and Evolutionary Biology, University of California, Santa Cruz  
2002 **Professor**, Department of Ecology and Evolutionary Biology, University of California, Santa Cruz  
1999 **Associate Professor**, Department of Biology, University of California, Santa Cruz  
1996 **Assistant Professor**, Department of Biology, University of California, Santa Cruz  
1992-95 **Assistant Research Biologist**, Marine Science Institute, University of California, Santa Barbara  
1989-91 **Research Fellow**, Australian Research Council Fellowship, University of Melbourne  
1988-89 **Research Fellow**, University of Melbourne Research Fellowship  
1987-88 **Post-Doctoral Researcher**, University of California, Santa Barbara

### EDUCATION

1982-88 University of California, Santa Barbara, Ph.D. (Biology)  
1980-82 University of Arizona  
1972-76 Northern Arizona University, B.A., (Philosophy)

### MEMBERSHIP IN HONORARY SOCIETIES

Ecological Society of America  
(Editorial Board 2001-Current)  
American Society of Naturalists  
Western Society of Naturalists

### HONORS, AWARDS AND GRANTS (since 1994)

2008 **OPC**, \$200,000 "Baseline data collection for central coast rocky intertidal MPA's, year 2", **David and Lucille Packard Foundation**, \$1,400,000. "Adaptive management of fishery resources in the northern Gulf of California (PANGAS) – Phase II". Co PI at UCSC: Giacomo Bernardi. **US Department of Interior**, \$26,000, "Monitoring of Redwoods National Park", **University of California**, \$45,000, Match for PISCO. **California Fish and Game**, \$35,000 "Cosco Busan Oil spill assessment", **OPC**, \$20,000 "Biological issues related to Wave Energy", **County of Marin**, \$15,000 "ASBS evaluation of Alder Creek"

2007 **Sea Grant**, \$170,000, "Baseline data collection for central coast rocky intertidal MPA's" **University of California**, \$45,000, Match for PISCO. **California Environmental Quality Initiative**, \$400,000 "Community genetics and marine protected areas of the California and Baja California mainland and island array". **Minerals Management Service**, \$933,000. Shoreline Inventory of Coastal Resources **NOAA Fisheries**, \$15,000. "Black abalone population estimates" **US Department of Interior**, \$26,000, "Monitoring of Redwoods National Park"

2006 **University of California**, \$45,000, Match for PISCO. **California Environmental Quality Initiative**, "Assessing the assessment: new models for informing the design of monitoring and evaluation programs for kelp forest ecosystems in California's MPAs" \$500,000. **US Department of Interior**, \$46,000, "Monitoring of Point Reyes National Park" **US Department of Interior**, \$26,000, "Monitoring of Redwoods National Park"

- 2005 **University of California**, \$45,000. Match for PISCO.  
**Minerals Management Service**, \$415,000. Shoreline Inventory of Coastal Resources  
**David and Lucille Packard Foundation**, \$1,250,000. Adaptive management of fishery resources in the northern Gulf of California (PANGAS). Co PI at UCSC: Giacomo Bernardi  
**David and Lucille Packard Foundation and Gordon and Betty Moore Foundation**. "Partnership for Interdisciplinary Study of Coastal Oceans – PISCO", renewal – 5 years \$25,400,000. Co-PI at UCSC, Mark Carr  
**US Department of Interior**, \$26,000, "Monitoring of Redwoods National Park"
- 2004 **Monterey Bay National Marine Sanctuary** "Researcher of the Year Award"  
**David and Lucille Packard Foundation**. "Consortium for Excellence in Marine Conservation Science" \$1,300,000 renewal for 2004, Co-PI: Mark Carr.  
**Monterey Bay National Marine Sanctuary**. "Effects of sedimentation on nearshore communities: recommendations for disposal of landslide material" Co-PI Mark Carr. \$88,000  
**Monterey Bay National Marine Sanctuary**. "Monitoring of Black abalone populations along the central coast." \$25,000  
**Long Marine Lab**. "Genetics of Black abalone populations" co-PI: Giacomo Bernardi, \$25,000  
**David and Lucille Packard Foundation**. "Ecosystem based management of small scale fisheries in the gulf of California: a planning grant". \$25,000.
- 2003 **California Environmental Quality Initiative**. "Collaboration on Ecosystem Functioning in Giant Kelp Forests: Linking Hydrodynamics to an Essential Forage Species and its Benthos" \$104,979.  
**US Department of Interior**: "The shoreline assessment of changes in rocky intertidal communities" renewal \$999,000.  
**NSF**: The effects of dispersal, gene flow and local adaptation on *Silvetia compressa's* distribution in the intertidal zone. Co-PI Ingrid Parker. This is a dissertation improvement grant for Cynthia Hays
- 2002 **US Department of Interior**: "The shoreline assessment of changes in rocky intertidal communities" \$997,000.  
**California Environmental Quality Initiative**. "Larval pathway and population connectivity in nearshore marine organisms" \$135,000. Co-PI: Mark Carr  
**UCMEXUS**. "Intertidal surveys in the Northern Gulf of CA." \$15,000
- 2001 **David and Lucille Packard Foundation**. "Consortium for Excellence in Marine Conservation Science" \$2,300,000 in additional funding. Co-PI: Mark Carr.  
 Spatial and temporal variation in recruitment to rocky shores: relationship to intertidal communities.  
**UCSB/MMS Coastal Marine Institute**. \$140,877  
**California Department of Fish and Game**. "Squid population genetics." \$36,000  
**UCMEXUS**. "Eradiction of Rats at Isla San Jorge." \$15,000
- 2000 **PISCO University Match for Molecular Genetics**. \$200,000  
**UC Toxics Program - Coastal Toxicology Program**. "Effects of effluents on complex invertebrate behavioral traits of invertebrate larvae and algal zoospores." Renewal, \$30,000  
 Inventory of coastal ecological resources at San Luis Obispo, Santa Barbara counties.  
**UCSB/MMS Coastal Marine Institute**. \$61,447  
 Determining the importance of estuarine and open coast nursery habitats to adult flatfish populations. NOAA National Estuarine Program. \$44,000  
**UCMEXUS**. "Field Guide to the Common Marine Plants of the Gulf of California." \$15,000  
**MMS-Coastal Marine Institute**. "Inventory of coastal ecological resources at San Luis Obispo, Santa Barbara counties." renewal. \$65,236  
**UC Toxics Program - Coastal Toxicology Program**. "Effects of effluents on complex invertebrate behavioral traits of invertebrate larvae and algal zoospores." Renewal, \$25,000  
 Elected to the California Academy of Sciences  
**National Science Foundation**. "Upgrading the Long Marine Lab Diving and Small Boating Programs." \$200,000. Co-PI's Mark Carr and James Estes  
**UCMEXUS-CONACYT**. "Archives of global climate change: a novel use of coralline red algae for reconstructing annual to centennial scale environmental variability." \$25,000

- 1999 **David and Lucille Packard Foundation.** "Consortium for Excellence in Marine Conservation Science." \$3,200,000 (UCSC part of a 17.5 million dollar award OSU UCSB, and Stanford University). Co PI Mark Carr  
**California Department of Fish and Game.** "Squid population genetics." \$27,000.  
**UC Toxics Program - Coastal Toxicology Program.** "Effects of effluents on complex invertebrate behavioral traits of invertebrate larvae and algal zoospores." Renewal, \$25,000
- 1998 **Southern California Educational Initiative.** "Inventory of coastal ecological resources at San Luis Obispo, Santa Barbara counties." \$164,000
- 1997 **UC-MMS-Southern California Educational Initiative.** "Effects of an oil spill on multispecies interaction that structure intertidal communities." \$110,453.  
**National Science Foundation.** "Variability in spore dispersal and its role in kelp population dynamics." \$60,000.  
**National Science Foundation.** "Variability in spore dispersal and its role in kelp population dynamics." Co-PI's Dan Reed and Libe Washburn. \$380,000.  
**UC-MMS-Coastal Marine Institute.** "Effects of temporal and spatial separation of samples on estimation of impacts." \$68,586  
**National Science Foundation.** "Biochemical control of larval settlement and recruitment of the major reef building coral, *Acropora palmata*." Daniel and Aileen Morse, Co-PI's. \$375,000.  
**UC Presidential Mentorship** (support for a UC Presidential Postdoctoral Associate).  
 Approximately \$70,000  
**UC Toxics Program - Coastal Toxicology Program.** "Effects of effluents on complex invertebrate behavioral traits of invertebrate larvae and algal zoospores." Renewal, \$25,000  
**UCSC Instructional Improvement Grant.** "Planning and logistical development of the new field course in Biology: Biology 162--Marine Biology of the Gulf of California." \$4,700.  
**UC MEXUS.** "Potential effects of global change on the intertidal communities in the northern Gulf of California." \$1000.00  
**UCSC COR Faculty Research Grant.** "Potential Effects of Global Warming on Intertidal Communities in the Gulf of California." \$2500  
**Minerals Management Service.** "Interagency Rocky Intertidal Monitoring Network Workshop." \$36,942.
- 1996 **Coastal Marine Institute and Southern California Educational Initiative.** "Effects of produced water on complex invertebrate behavioral traits of invertebrate larvae and algal zoospores." \$122,729  
**UC MEXUS -** "Ecological and economic importance of rhodolith beds in the Gulf of ." \$9,500.  
**UC Toxics Program - Coastal Toxicology Program.** "Effects of effluents on complex invertebrate behavioral traits of invertebrate larvae and algal zoospores." \$35,000
- 1995 **Southern California Educational Initiative.** "Inventory of coastal ecological resources at San Luis Obispo, Santa Barbara and Orange counties." Rich Ambrose and Jack Engle, Co-PI's. \$190,000  
**California Coastal Commission.** "San Onofre nuclear power generating station mitigation project." Dan Reed, Co-PI. \$190,000
- 1994 **California Coastal Commission.** "Inventory of coastal ecological resources at Ventura and Los Angeles counties." Rich Ambrose and Jack Engle, Co-PI's. \$18,616  
**California Coastal Commission.** "Inventory of coastal ecological resources at the Northern Channel Islands." Rich Ambrose and Jack Engle, Co-PI's. \$273,500  
**California Department of Fish and Game.** "Enhancement of Red Abalone Populations Using a Population Based Approach." \$110,608  
**California Coastal Commission.** "San Onofre nuclear power generating station mitigation project." Dan Reed, Co-PI. \$119,087

**Refereed PUBLICATIONS (only submitted, in press or in print shown)**

Beldade, Ricardo; Cudney-Bueno, Richard; Raimondi, Peter; Bernardi, Giacomo. Isolation and characterization of 13 polymorphic microsatellite markers from the Gulf coney, *Epinephelus acanthistius*. Submitted: Molecular Ecology Resources

- Alberto F, A. Whitmer, N. C. Coelho, M. Zippay, E. Varela-Alvarez, P.T., Raimondi, D. C. Reed and E. Serrão. Microsatellite markers for the giant kelp *Macrocystis pyrifera*. In Press Conservation Genetics
- Lane JQ, PT. Raimondi<sup>2</sup>, RM. Kudela. Development of a logistic regression model for the prediction of toxigenic *Pseudo-nitzschia* blooms in Monterey Bay, California. In press, Marine Ecology Progress Series
- Cudney-Bueno R, MF Lavin<sup>4</sup>, SG. Marinone, PT Raimondi and WW. Shaw. 2009. Rapid Effects of Marine Reserves via Larval Dispersal. PLoS One: 4(1): e4140(1-7).
- Raimondi, PT. Variation in impact estimation based on different measures of acceptable uncertainty. In Press: California Energy Commission Reports
- Beldade R; R Cudney-Bueno; PT. Raimondi; and G Bernardi Isolation and characterization of nine polymorphic microsatellite markers from the Gulf coney, *Epinephelus acanthistius*. In Press Molecular Ecology Research
- Crawford G., R Gaddam, PT Raimondi, P Nelson and W Sydeman. 2008. Tools and Approaches for Detecting Ecological Changes Resulting from WEC Development. In: DEVELOPING WAVE ENERGY IN COASTAL CALIFORNIA: POTENTIAL SOCIO-ECONOMIC AND ENVIRONMENTAL EFFECTS. PIER Project Report CEC-500-2008-083: Pages 165-183.
- Lohse DP, RN Gaddam, PT Raimondi. 2008. Predicted effects of WEC on communities in the nearshore environment. In: DEVELOPING WAVE ENERGY IN COASTAL CALIFORNIA: POTENTIAL SOCIO-ECONOMIC AND ENVIRONMENTAL EFFECTS. PIER Project Report CEC-500-2008-083: Pages 83-109
- Blanchette CA, CM Miner, PT Raimondi, D Lohse, KEK. Heady and BR. Broitman. 2008. Biogeographical patterns of rocky intertidal communities along the Pacific coast of North America. Journal of Biogeography, 35:1593-1607
- Blanchette C.A., P.T.Raimondi and B.R Broitman. SPATIAL PATTERNS OF INTERTIDAL COMMUNITY STRUCTURE ACROSS THE CALIFORNIA CHANNEL ISLANDS AND LINKS TO OCEAN TEMPERATURE. Submitted Channel Islands Symposium proceedings
- Broitman<sup>1</sup>, B.R., C.A. Blanchette<sup>2</sup>, B.A. Menge<sup>3</sup>, J. Lubchenco<sup>3</sup>, M. Foley<sup>4</sup>, P.A. Raimondi<sup>4</sup>, C. Krenz<sup>3</sup>, D. Lohse<sup>4</sup> and S.D. Gaines<sup>2</sup>. 2008. Spatial and temporal variability in the recruitment of intertidal invertebrates along the West coast of the U.S.. Ecological Monographs, Vol. 78, No. 3, pp. 403-421
- Steinbeck J, J Hedgepeth, P Raimondi, G Cailliet, and D Mayer. Assessing power plant cooling water intake system entrainment impacts. In Press: California Energy Commission reports
- Pfeiffer-Hoyt, AS, MA. McManus, PT Raimondi, and Y Chao. 2007. Dispersal of barnacle larvae along the central California coast: A modeling study. Limnology and Oceanography 52:1559–1569
- Gaylord B, JH. Rosman, DC. Reed, JR. Koseff, J Fram, S MacIntyre, K Arkema, C McDonald, JL. Largier, MA. Brzezinski, PT. Raimondi, SG. Monismith, and B Mardian, 2007. Spatial patterns of flow and their modification within and around a giant kelp forest, Limnology and Oceanography 52(5), 2007, 1838–1852
- Lohse D. P. and P. T. Raimondi. The life of an intertidal barnacle. Encyclopedia of Tidepools, UC Press. Mark W. Denny and Steven D. Gaines, Editors-in-Chief. In Press
- Raimondi, PT, R Sagarin, R Ambrose, C Bell, M George, S Lee, D Lohse, CMiner, S Murray. 2007. Conspicuous color patterns in the sea star *Pisaster ochraceus*. PACIFIC SCIENCE 61 (2): 201-210.

Sagarin, R.D., R.F. Ambrose, B.J. Becker, J.M. Engle, J. Kido, S.F. Lee, S.M. Miner, S.N. Murray, P.T. Raimondi, D. Richards, and C. Roe., 2007. Population size structures of the exploited limpet *Lottia gigantea* across a wide latitudinal range. *MARINE BIOLOGY* 150 (3): 399-413

Luengen AC, PT Raimondi and AR Flegal, 2007 Contrasting biogeochemistry of six trace metals during the rise and decay of a spring phytoplankton bloom in San Francisco Bay. *LIMNOLOGY AND OCEANOGRAPHY* 52 (3): 1112-1130

Miner Miner CM, JM Altstatt, PT Raimondi, and TE Minchinton. 2007. Recruitment failure and shifts in community structure following mass mortality of black abalone limit its prospects for recovery. *MARINE ECOLOGY-PROGRESS SERIES* 327: 107-117

Gaylord, B., D.C. Reed, L. Washburn and P.T. Raimondi. 2006. Macroalgal spore dispersal in coastal environments: Mechanistic insights revealed by theory and experiment. *Ecological Monographs*, 76: 481-502

Reed DC, Raimondi PT, Washburn L, Gaylord B, Kinlan BP and PT Drake. 2005. A metapopulation perspective on patch dynamics and connectivity in giant kelp. In: P. Sale and J Kritzer eds. *Marine metapopulations*. Academic Press.

Raimondi, P.T., Reed, D.C., Wasburn L. and Gaylord, B. 2004. Effect of self-fertilization in the giant kelp *Macrocystis pyrifera*. *Ecology*, 85: 3267-3276

Menge B.A., Blanchette C, Raimondi P.T., Gaines S., Lubchenco J, Lohse D., Hudson G., Foley M., and J. Pamplin. 2004. Geographic variation in keystone predation: a whole-coast experiment. *Ecological Monographs*, 74:663-684

Reed, D.C., S.C. Schroeter, and P.T. Raimondi. 2004. Spore supply and habitat availability as sources of recruitment limitation in giant kelp, *Macrocystis Pyrifera*. *Journal of Phycology* 40:275-284

Forde, S.E. and P.T. Raimondi. 2004. An experimental test of the effects of variation in recruitment intensity on intertidal community structure. *Journal of Experimental Marine Biology and Ecology* 301:1-14

Luengen, A.C., Friedman, C.S., Raimondi, P.T., and Flegal, A.R. 2004. Evaluation of immune responses as indicators of contamination in San Francisco Bay, CA; Development of a novel phagocytosis and phagocytic index method for mussels. *Marine Environmental Research*. 57(3):197-212

Gaylord, B., D.C. Reed, L. Washburn and P.T. Raimondi. 2004 Physical-biological coupling in spore dispersal of kelp forest macroalgae. *Journal of Marine Systems*, 49:19-39

Raimondi, P.T.;Lohse, D; Blanchette, C. 2003. Unexpected dynamism in zonation and abundance revealed by long-term monitoring on rocky shores. *Ecological Society of America Annual Meeting*. 88:275.

Raimondi, P.T., Wilson, C.M., Ambrose, R.F., Engel, J.M., and Minchinton, T.E. 2002. El Niño and the continued declines of black abalone along the coast of California. *Marine Ecology Progress Series* 242:143-152

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#### Book Chapters

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- Raimondi, P.T. and Schmitt, R.J. 1993. Effects of produced water on settlement of larvae: field tests using red abalone. In: *Produced Water-- Technological / Environmental Issues and Solutions*. J.P. Ray and F.R. Engelhardt, eds. Plenum Press, New York. pp 415-430.

#### Technical Reports

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- Raimondi PT. 2006. Data assessment for ASBS/ Ocean Plan for Cal Trans. California State Water Board. 284 pages.
- Raimondi PT. 2006. Written summary of MARINE / PISCO intertidal biological data for Hopkins Marine Station, Fall 1999 through Spring 2006: Data assessment for ASBS/ Ocean Plan. California State Water Board. 179 pages.

- Miner M., P.T. Raimondi, R Ambrose, J Engle and S. Murray. 2005. Monitoring of Rocky Intertidal Resources Along the Central and Southern California Mainland: Comprehensive Report (1992-2003) for San Luis Obispo, Santa Barbara, Ventura, Los Angeles, and Orange Counties. OCS Study MMS-2005-071
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- Donlan C. Josh , Héctor Avila-Villegas, Daniel Bercovich Ortega, Noah Biavaschi, Natasha Bodorff, Rick Boyer, Tosha Comendant1, Donald A. Croll, Richard Cudney-Bueno, Ricardo Galván de la Rosa, Gregg R. Howald, Luis Felipe Lozano-Román, Carlos Morales, Olegario Morales, Zaid Morales-Gonzalez, Pete Raimondi, Jose Angel Sanchez, Diana Steller, Bernie R. Tershy, Peggy Turk-Boyer. 2003. Black Rat (*Rattus rattus*) Eradication from the San Jorge Islands, Mexico, ICEG Technical Report: 26 pages
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- Raimondi, P.T. 2001. Determination that fish behavioral barriers tested at San Onofre Nuclear Generating Station are ineffective. A report to the California Coastal Commission. 24 pages.
- Holbrook, S.J., Ambrose, R.F., Botsford, L., Carr, M.H., Raimondi, P.T., and Tegner, M.J. 2000. Ecological issues related to decommissioning of California's offshore production platforms. Report to the University of California Marine Council. 41 pages.
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- Engel, J., Ambrose, R.A. and Raimondi, P.T. 1997. Synopsis of the interagency rocky intertidal monitoring network workshop. Minerals Management Service. OCS Study 97-0012.
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#### **Scientific advisory Panels leading to NEPA 316B reports**

Regional Water Quality Control Board: Diablo Canyon 316B Demonstration Report: Entrainment and impingement effects at Diablo Canyon Nuclear Power Station. 624 pages.

Regional Water Quality Control Board: Moss Landing 316B Demonstration Report: Entrainment and impingement effects at Moss Landing Power Plant. 531 pages.

Regional Water Quality Control Board: Morro Bay 316B Demonstration Report: Entrainment and impingement effects at Morro Bay Power Plant. 545 pages.

**Papers resulting from lab members from grant activities (at least in part). These are intended to show the productivity of our lab members or productivity resulting from our grants.**

**2006-2007**

**Hays, CG.** 2007. Adaptive phenotypic differentiation across the intertidal gradient in the alga *Silvetia compressa*. *Ecology*. 88(1):149-157.

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**Brown, J.A.** 2006. Using the chemical composition of otoliths to evaluate the nursery role of estuaries for English sole *Pleuronectes vetulus* populations. *Marine Ecology Progress Series*. 306:269-281.

**Brown, J.A.** 2006. Classification of juvenile flatfishes to estuarine and coastal habitats based on the elemental composition of otoliths. *Estuarine, Coastal and Shelf Science*. 66: 594-611

**Burford, M.** and Larson, R.J. *In press* Genetic heterogeneity in a single year-class from a panmictic population of adult blue rockfish (*Sebastes mystinus*). *Marine Biology*.

**Johnson, D.W.** 2006. Density dependence in marine fish populations revealed at small and large spatial scales. *Ecology*. 87: 319-325.

**Johnson, D.W.** 2006. Predation, habitat complexity, and variation in density dependent mortality of temperate reef fishes. *Ecology*. 87:1179-1188

**Ritter, A.F. and Preisler, R.K.** 2006. Spatial variation in structure of an intertidal fish assemblage reflects daily settlement patterns. *Marine Ecology Progress Series*. 317: 211-223,

**Ritter, A.F.** (*In review*). Habitat variation influences movement rates and population structure of an intertidal fish. *Oecologia*.

**Springer, Y.** *In Press*. *Oecologia*.

**2005**

**Barnett-Johnson, R.C.**, Ramos, F.C., Grimes, C.B. and MacFarlane, R.B.. 2005. Validation of Sr isotopes in otoliths by laser ablation multicollector inductively coupled plasma mass spectrometry (LA-MC-ICPMS): opening avenues in fisheries science applications. *Canadian Journal of Fisheries and Aquatic Sciences*. 62: 2425-2430.

**McManus, M.A.**, Cheriton, O.M., **Drake, P.T.**, Holliday, D. V., Storlazzi, C.D., Donaghay, P.L., and Greenlaw, C.E. 2005. The effects of physical processes on the structure and transport of thin zooplankton layers in the coastal ocean, *Marine Ecology Progress Series*. 301: 199-215.

**Drake, P.T., McManus, M., and Storlazzi, C.** 2005. Local wind forcing of the Monterey Bay area inner shelf. *Continental Shelf Research*, 25(3), 397-417.

#### 2003-2004:

**Ammann, A.J.** 2004. SMURFs: standard monitoring units for the recruitment of temperate reef fishes. *Journal of Experimental Marine Biology and Ecology* 299:135– 154

Hayes, S.A., **Bond, M.H., Hanson, C.V.**, and MacFarlane, R.B. 2004. Interactions between endangered wild and hatchery salmonids; can the pitfalls of artificial propagation be avoided in small coastal streams? *Journal of Fish Biology* 65(Supplement A):101-121.

**Halpern, B.S.**, S.D. Gaines, and R.R. Warner. 2004. Export of production from marine reserves: effects on fisheries and monitoring programs. *Ecological Applications* 14: 1248-1256.

**Halpern, B.S.**, S.D. Gaines, and R.R. Warner. 2004. Moving the discussion about marine reserve science forward: a response to Willis et al. *MPA News* 5(7): 1-2.

**Halpern, B.S.**, S.D. Gaines, and R.R. Warner. *in review*. Habitat size, recruitment, and longevity as factors limiting population size in stage-structured species. *American Naturalist*.

**Halpern, B.S.**, E.T. Borer, E.W. Seabloom, and J.B. Shurin. *in review*. Predator effects on ecosystem stability. *Ecology Letters*.

**Halpern, B.S.**, C. Pyke, C. Haney, P. Zaradic, H. Fox, and M. Schlapfer. *in review*. Gaps and mismatches between global conservation priorities and spending. *Proc. Nat. Acad. Sci.*

**Hays, C.G.** The effects of nutrient level, grazer community and source population on seagrass-epiphyte interactions. In press, *Journal of Experimental Marine Biology and Ecology*.

Heck, K.L., **Hays, C.G.**, and Orth, R.J. 2003. A critical evaluation of the nursery role hypothesis for seagrass meadows. *Marine Ecology Progress Series* 253:123-136.

Sheridan P.F., and **Hays, C.G.** 2003. Are mangroves nursery habitat for transient fish and decapods? *Wetlands* 23(2):449-458.

Micheli, F., **B.S. Halpern**, L.W. Botsford, and R.R. Warner. *in press*. Trajectories and correlates of community change in no-take marine reserves. *Ecological Applications*.

Minello, T.J., Able, K.W., Weinstein, M.P., and **Hays, C.G.** 2003. Salt marshes as nurseries for nekton: testing hypotheses on density, growth, and survivorship through meta-analysis. *Marine Ecology Progress Series*. 246:39-59.

Planes, S., Doherty, P., and **Bernardi, G.** 2001. Unusual case of extreme genetic divergence in a marine fish, *Acanthochromis polyacanthus*, within the Great Barrier Reef and the Coral Sea. *Evolution*. 55:2263-2273.

**Storlazzi, C and McManus, M.A.** 2003. Long-term, high-frequency current and temperature measurements along central California: Insights into upwelling relaxation and internal waves on the inner shelf. *Continental*

Shelf Research. 23: 901-918.

Syms, C., and G. P. Jones. 2004. Habitat structure, disturbance and the composition of sand-dwelling goby assemblages in a coral reef lagoon. *Marine Ecology Progress Series*. 268:221-230.  
Barnett-Johnson. Sources of Salmon. *In PISCO Coastal Connections 2004*: 3:13.

Beck MW, Heck KL, Able KW, Childers DL, Eggleston DB, Gillanders BM, Halpern B, Hays CG, Hoshino K, Minello TJ, Orth RJ, Sheridan PF, and MR Weinstein. 2001. The identification, conservation, and management of estuarine and marine nurseries for fish and invertebrates. *Bioscience* 51(8):633-641.

Brown, J. A. 2003. An Evaluation of the Nursery Role of Estuaries for Flatfish Populations in Central California. Ph.D. Dissertation. University of California, Santa Cruz. 138 pages.

Brown, J.A. 2002. A Plan for Monitoring the Fish Assemblage in Elkhorn Slough. Elkhorn Slough Technical Report Series 2002:1. (Download from [http://www.elkhornslough.org/research/bibliography\\_tr.htm](http://www.elkhornslough.org/research/bibliography_tr.htm))

Brown, J.A. 2001. A Review of Marine Zones in the Monterey Bay National Marine Sanctuary. *Marine Sanctuaries Conservation Series MSD-01-2*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Marine Sanctuaries Division, Silver Spring, MD. 137pp. (Download from <http://www.sanctuaries.nos.noaa.gov/special/zoning/zones.html>)

Gillanders, B. M., K. W. Able, J. A. Brown, D. B. Eggleston, and P. F. Sheridan. 2003. Evidence of connectivity between juvenile and adult habitats for mobile marine fauna: an important component of nurseries. *Marine Ecology Progress Series* 247:281-295.

Heck KL, Hays CG, and RJ Orth. 2003. A critical evaluation of the nursery role hypothesis for seagrass meadows. *Marine Ecology Progress Series* 253:123-136.

McManus MA, OM Cheriton, PJ Drake, DV Holliday, CE Greenlaw, CD Storlazzi and PL Donaghay. submitted. Thin Layers and the Transport and Retention of Marine Plankton in Coastal Systems. *Marine Ecology Progress Series*.

Minello TJ, Able KW, Weinstein MP, and CG Hays. 2003. Salt marshes as nurseries for nekton: testing hypotheses on density, growth, and survivorship through meta-analysis. *Marine Ecology Progress Series* 246:39-59.

Sheridan PF, and CG Hays. 2003. Are mangroves nursery habitat for transient fish and decapods? *Wetlands* 23(2):449-458.

Storlazzi C and MA McManus. 2003. Long-term, high-frequency current and temperature measurements along central California: Insights into upwelling relaxation and internal waves on the inner shelf. *Continental Shelf Research*. 23: 901-918.

## UNIVERSITY SERVICE

### Department of Ecology & Evolutionary Biology

2005- current	Hosted ACE students as summer interns
2004-current	Led Marine lab tours for prospective undergraduates
2003 – current	Chair Ecology and Evolutionary Biology
2001-2003	Executive Committee
	Personnel Committee
	Graduate Advisory Committee
1999-2001	Personnel Committee EEB

2000- Executive Committee  
 Personnel Committee  
 Graduate Advising Committee (GAC)  
 Space Committee (EMS & COH)

#### Department of Biology

1999-2000 Executive Committee  
 Graduate Advising Committee (GAC)  
 1998 - Chair, Evolutionary Biology/Ecology Search (Associate/Full Level)  
 OPB Graduate Advising Committee (GAC)  
 1997-1999 Member UC-MEXUS Advising Panel (Systemwide)  
 1997-1998 OPB Graduate Advising Committee  
 1996-1997 Member, Marine Ecology Search Committee  
 Member, Plant Ecology Search Committee  
 1995-1996 Member, Behavioral Ecology Search Committee  
 1996- Member, Research Committee  
 1996-2001 Member, Graduate Advising Committee (GAC)  
 1995-1996 Behavioral Ecology Search Committee

#### Division of Physical and Biological Sciences (start 2003)

2003- current Chair, Department of Ecology and Evolutionary Biology  
 2000- current Faculty Manager – Big Creek Ecological Reserve  
 1998-current Member, UC Natural Reserves Committee  
 1998-current Member, Conservation Biology Search (Environmental Studies)

#### Campus

Multiple ad hoc committees

#### UC Systemwide

2004- White Mountain Reserve Station Advisor  
 1996-2004 UCTOXICS program (teaching the UCTOXICS field course at Bodega Bay)  
 2004- UCMEXUS review committee  
 2000- University Select Committee on Marine Issues  
 1999-2000 Select Scientific Advisory Committee to the University of California Marine Council  
 (UCMC). Systemwide committee

### **PROFESSIONAL ACTIVITIES**

#### Consultative or Other Service to Civic, State or National Governmental Agencies

2007- current Scientific Advisory Team to the State of CA Marine Protected Area process  
 2005-current California Energy Commission (scientific advisory committee examining effects of Huntington  
 beach and El Segundo Power Plants  
 2004-current Monterey Bay National Marine Sanctuary Desal working Group  
 EPA review of draft 316A & 316B regulations  
 2003-current Statewide Desalinization Task Force  
 Monterey Bay National Marine Sanctuary Action Plan Working Groups (Tidepools and  
 Desalinization)  
 NCEAS working group on Central California Nearshore Plan

- California Energy Commission (Scientific advisor for Power Plant Impacts at El Segundo and Huntington Beach operations)
- 2002-current National Marine Sanctuary Working Group on Monitoring Programs  
National Marine Sanctuary Program (NOAA). Scientific Advisor to National Monitoring programs  
County of San Luis Obispo. Scientific Advisor to Mitigation for cleanup at Guadalupe Dunes  
Scientific advisor to Monterey Bay National Marine Sanctuary "Sanctuary Integrated Monitoring Network (SIMoN)"
- 2001 Workshops on the design of monitoring programs for California State Agencies.
- 2000-current California Energy Commission. Scientific Advisory Panel (for power plant impacts to the marine environment)
- 1996-current State of California Regional Water Quality Control Board. Scientific Advisory Panel (for power plant impacts to the marine environment)  
US Department of the Interior. Minerals Management Service. Management of Data for Inventory Programs  
US Department of the Interior. Minerals Management Service. Production of a model to assess the success of mitigation programs.  
California Coastal Commission, San Francisco, CA: Mitigation of the effects of the San Onofre Nuclear Generating Station - Scientific Advisory Panel.
- 1995-current California Regional Water Quality Control Board. Technical Advisory Committee. Effects of Entrainment of Diablo Canyon Nuclear Facility on larval fish.
- 1994-1996 County of Santa Barbara, Santa Barbara, CA. Reviewer of marine related deliverables and documents.
- 1991-1995 MEC Analytical, Carlsbad, CA: Determine effects of oil drilling on benthic communities
- 1991-1992 Marine Review Committee, Santa Barbara, CA: Analysis of impact of San Onofre Nuclear Power Generating Station
- 1990 Dames and Moore, Melbourne, Australia: Evaluation of potential impact of marina renovation  
Dames and Moore, Melbourne, Australia: Review of EIR for Tin Smelter in Northern Australia
- 1988 Marine Review Committee, Santa Barbara, CA: Analysis of impact of San Onofre Nuclear Power Generating Station
- 1988-1990 Dames and Moore, Melbourne, Australia: Design of water quality monitoring program for the coastal areas of Tasmania
- 1985-1988 Chambers Group, Los Angeles, CA: Effects construction of oil pipelines on intertidal reefs

Service to the Staff or Editorial Board of Scholarly Journals or other Publications (since 1994)

Reviews (Journals of agencies where I regularly review manuscripts)

Nature

Science

Ecology, Ecological Monographs - editorial board

Evolution

American Naturalist

Coral Reefs

Oecologia

JEMBE

Marine Biology

Marine Ecology Progress Series

Invertebrate Biology

Australian Journal of Ecology

Australian Journal of Marine and Freshwater Research

National Science Foundation

Sea Grant

Participation in Public Lectures or Forums

- 2006 International Temperate Reef Symposium 2006-“Latitudinal Variation In Rocky Intertidal Community Structure Along The West Coast Of North America” (Blanchette, Miner, Raimondi, Broitman)  
Society for Conservation Biology - Long-term monitoring of intertidal resources and implications for the management of coastal ecosystems (Readdie, Raimondi, Blanchette, Menge)
- 2004 Ecological Society of America Invited Symposium Talk. “Interhemispheric variation in keystone predation rate and impact in upwelling ecosystems”, presented by Bruce Menge.  
Monterey Bay National Marine Sanctuary. Desalinization symposium. “Entrainment effects resulting from desalinization”  
National Center for Ecological Analysis and Synthesis (NCEAS). “Central Coast Marine Initiative”
- 2003 Ecological Society of America Invited Symposium Talk (I was the organizer) “. “Unexpected dynamism in zonation and abundance revealed by long-term monitoring on rocky shores”
- 2003 Moss Landing Marine Laboratories “Unexpected dynamism in zonation and abundance revealed by long-term monitoring on rocky shores”
- 2003 State of California Desalinization working Group “Ecological effects due to impingement and entrainment”
- 2003 Gordon and Betty Moore Foundation “Overview of PISCO”
- 2003 Marine Interest Group “Unexpected dynamism in zonation and abundance revealed by long-term monitoring on rocky shores”
- 2003 Monterey Bay National Marine Sanctuary “Unexpected dynamism in zonation and abundance revealed by long-term monitoring on rocky shores”
- 2002 PISCO Symposium “Intertidal monitoring: its uses and abuses”
- 2002 Research Activity Panel to Monterey Bay National Marine Sanctuary “Techniques of and lessons from Intertidal Monitoring”
- 2001 Invited Symposium talk Western Society of Naturalists “Intertidal Community Structure: Stasis is not the Norm”
- 2000 Chair and organizer of the 4th International Larval Biology Conference. UC Santa Cruz  
Southern California Academy of Sciences, Los Angeles, Invited syposium speaker  
Phycological Society of America, San Diego, Invited symposium speaker  
Fifth International Temperate Reef Symposium, Capetown, South Africa, contributed talk
- 1999 Mexican Phycological Congress, La Paz, Mexico, Invited Plenary speaker
- 1998 Symposia Organiser and Speaker, Larval Biology Conference. Melbourne, Australia
- 1997 Platform Abandonment Symposium, Ventura California. “Water Quality Issues Associated with Platform Abandonment.”  
Interagency Rocky Intertidal Monitoring Workshop, Conference Organizer. Santa Barbara
- 1996 8th International Coral Reef Symposium, Panama City, Panama. “Flypaper for Coral Larvae.”  
8th International Coral Reef Symposium, Panama City, Panama. “Complex Larval Behavior and the Distribution and the Vertical Distribution and Orientation of *Agaricia humilis*.”
- 1995 Sensory Ecology and Physiology of Zooplankton., Honolulu, Hawaii. “The use of a novel chemo-inductive substrate resolves factors involved in recruitment of coral larvae.” with Morse, A.N.C.  
2nd Bienial Larval Biology Meetings, HBOI, Fort Pierce, Florida. “A chemo-inductive substrate for coral larvae; A new tool for ecological studies.” with Morse, A.N.C.  
Southern California Academy of Sciences, Fullerton, CA. “Counts per Unit Area, Size Frequency Measurements.”  
Society for Environmental Toxicology and Chemistry, Vancouver, British Columbia. “Effects of oil and gas development activities in southern California on larval settlement.”  
Society for Environmental Toxicology and Chemistry, Vancouver, British Columbia. “A field investigation to determine the impact of offshore drilling activities on natural larval settlement.”
- 1994 Platform Abandonment Symposium, Santa Barbara, CA. Symposium Chairman
- 1993 Seventh Annual Research Symposium, University of California Toxic Substances Research and Teaching Program, Santa Cruz, CA. “Some consequences of alteration of swimming behavior in abalone larvae and kelp zoospores.”

- 1992 Temperate Reefs Symposium, Auckland, New Zealand: "Effects of point source pollution of the settlement of larvae."  
Sixth Annual Research Symposium, University of California Toxic Substances Research and Teaching Program, Santa Barbara, CA. "Developmental stage-specific responses to perturbations."  
International Produced Water Symposium, San Diego, California. "Effects of produced water on settlement of larvae: field tests using red abalone."  
Australian Society of Fisheries Biologists, Hobart, Tasmania. "Robustness of estimates of recruitment rates for sessile marine invertebrates."
- 1991 Western Society of Naturalists, Monterey, California, Session Chairman  
Fifth Annual Research Symposium, University of California Toxic Substances Research and Teaching Program, San Francisco, CA. "Stage-specific effects of point source pollution on marine larvae."
- 1990 Western Society of Naturalists, Monterey, California
- 1989 Temperate Reefs Symposium, Melbourne, Australia. "Are Larvae Perfect?" Invited symposium talk
- 1988 Western Society of Naturalists, Long Beach, California
- 1987 American Society of Limnology and Oceanography, Madison, Wisconsin. "Predator-induced settlement of an intertidal barnacle." Invited symposium talk.
- 1985 Western Society of Naturalists, Monterey, California: "The effect of a herbivorous gastropod on an intertidal hermit crab."  
N.Z. Marine Sciences Society, Christchurch, New Zealand. "The effect of a herbivorous gastropod on an intertidal hermit crab: commensal or amensal?"

#### Invited Research Seminars

- 2006 Cal State LA, California World Oceans, National Marine Fisheries (San Diego)
- 2005 University of Arizona, Humboldt State University
- 2003 Hopkins Marine Lab
- 2002 Moss Landing Marine Lab
- 2001 Bodega Marine Lab, UC Davis  
Cal Poly, San Luis Obispo  
California State University, Humboldt  
Duke University, Raleigh, Durham, North Carolina
- 2000 Bodega Marine Lab
- 1998 Moss Landing Marine Lab, Moss Landing, CA
- 1997 Hopkins Marine Station, Pacific Grove, CA
- 1995 Louisiana State University, Baton Rouge, LA  
University of California, Santa Cruz, CA
- 1994 University of California, Santa Cruz, CA
- 1993 California Coastal Commission, Santa Barbara, CA
- 1992 University of Oregon, Eugene, Oregon  
Oregon Institute of Marine Biology, Charleston, Oregon
- 1991 Marine Science Consortium, Queenscliff, Victoria, Australia  
California State University, Northridge, California  
Hopkins Marine Laboratory, Monterey, California
- 1990 Northern Arizona University, Flagstaff, Arizona  
College of the Atlantic, Bar Harbor, Maine
- 1989 University of Melbourne, Melbourne, Australia  
Victorian Institute of Marine Sciences, Melbourne, Australia  
Monash University, Melbourne, Australia
- 1988 California State University, Los Angeles

#### Scientific Expeditions and Field Work

- 2007 Field Research in Mexico



2006 Field Research  
2004 Field Research and Teaching, Moorea, French Polynesia, November – December  
Field Research, Puerto Penasco Mexico, June – August  
2003 Field Research, Puerto Penasco Mexico, June – August  
2002 Field Research and Teaching, Moorea, French Polynesia, November – December  
Field Research, Puerto Penasco Mexico, June – August  
2001 Field Research, Puerto Penasco, Mexico, June  
2000 Field Research and Teaching, Moorea, French Polynesia, November – December  
Field Research, Puerto Penasco Mexico, June – August  
1999 Field Research, Puerto Penasco Mexico, June – August  
1998 Field Research, Puerto Penasco Mexico, June – August  
Field Research, coastal Sonora, Mexico, November – December  
1997 Field Research, Bonaire, Netherlands Antilles, September  
Field Research, Puerto Penasco, Mexico, June - August  
1996 Field Research, Bonaire, Netherlands Antilles, September  
Field Research, Puerto Penasco, Mexico, August  
September Field Research, Moorea, French Polynesia, July  
1995 Field Research, Bonaire, Netherlands Antilles, September  
Field Research, Moorea, French Polynesia, July  
1994 Field Research, Bonaire, Netherlands Antilles, May  
Research Cruise, MV Rambo, January  
1993 Field Research, Bonaire, Netherlands Antilles, July - August  
Field Research, Bonaire, Netherlands Antilles, May  
1992 Research Cruise, RV Independence, October  
Research Cruise, RV Independence, April  
Research Cruise, RV Independence, March