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# The Economic Contribution of Marine Science and Education Institutions in the Monterey Bay Crescent

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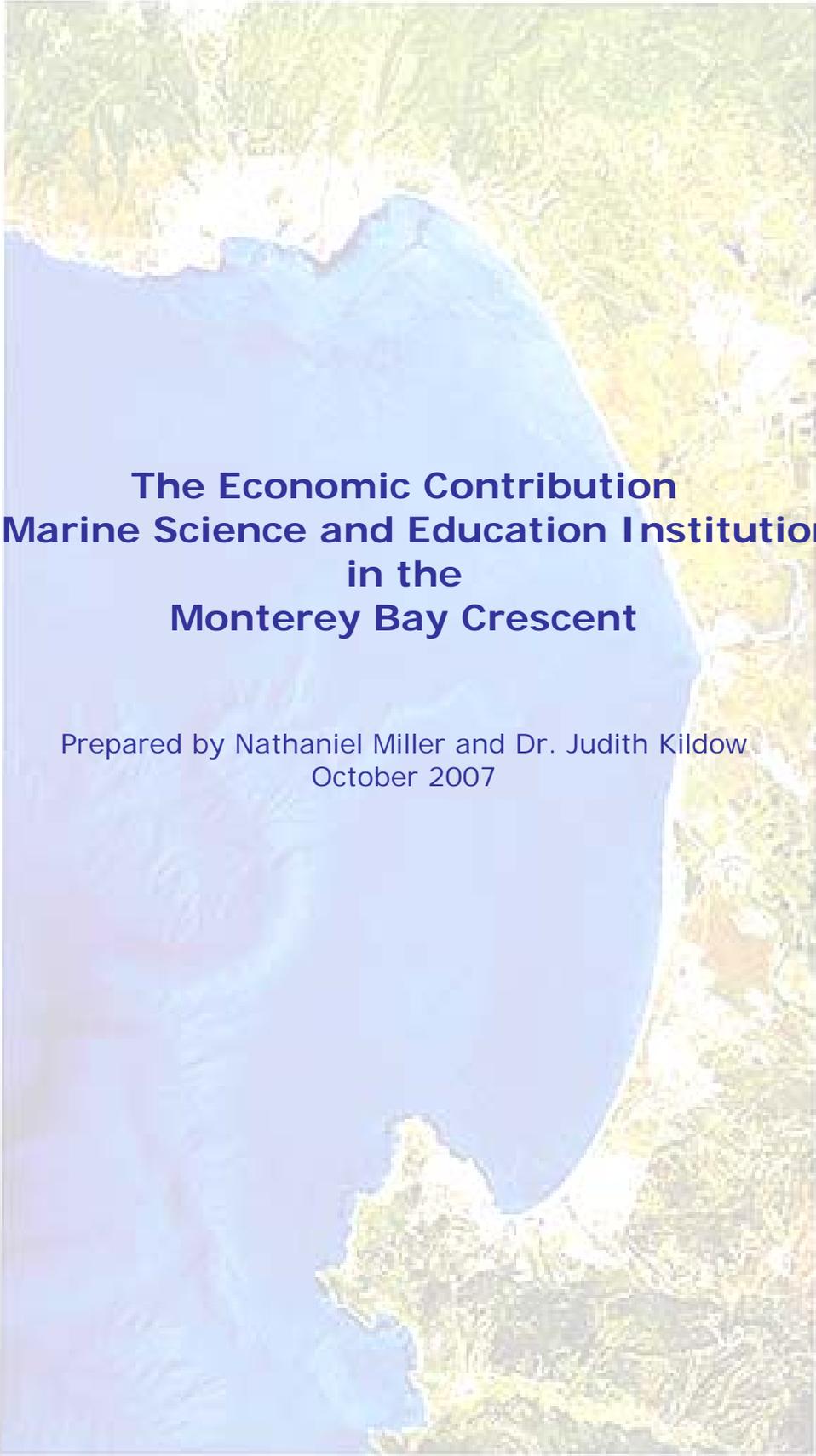
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# The Economic Contribution of Marine Science and Education Institutions in the Monterey Bay Crescent

## **Abstract**

Ocean and coastal areas of the United States contribute significantly to our nation's overall economy. The extent to which our economy benefits from the wide range of marine and coastal activities is not completely understood. The National Ocean Economics Program (NOEP) has attempted to track and value the ocean and coastal-related economic activities in the United States. To date six sectors are included in its information system ([www.oceaneconomics.org](http://www.oceaneconomics.org)). The economic contribution of marine research and education institutions is a sector of activity that lies outside of the normal federal government datasets, but one which seemed to have growing importance and yet was not considered part of the economy. Thus, the NOEP decided to add marine science and education institutions to its sector studies. The goal of this project was to create a prototype strategy at a local level, which could then be adapted for collecting national level data on a state by state basis. This economic sector of institutions and their activities would be comparable to other economic sectors for which the federal government already collects data. The purposes of this project were (1) to select the key indicators that could demonstrate the value of these institutions, and (2) to determine the economic contribution of these institutions to the local, state, and national economies. In order to achieve these purposes, we constructed a survey, tested it at the Monterey Bay Aquarium Research Institute, and then distributed it to the marine research and education institutions of Monterey Bay Crescent. The results of the survey are presented as aggregate information that detail important economic contributions to the region such as: annual budgets, employment figures, annual earned wages, number of students, sources of funding, and distribution of research spending. A summary of the results shows that the combined annual budgets of the marine research and education institutions in Monterey Bay Crescent for 2006 were over \$209 million. There were over 1,700 employees within those institutions with wages totaling nearly \$78 million. The four institutions of higher education included in the survey served 861 students studying ocean sciences and ocean policy. Distribution of funding sources among all institutions surveyed, according to the survey was Federal Government funds at 46% and foundation funds at 35% of the overall research budgets that support these institutions. Research activities focused on coastal processes and on biodiversity had the largest amount of funding, while climate change and marine policy research had the least funding. These results are a window into a growing sector of activities with increasing importance, and begin to fill the void of economic data on the contribution of marine research and education institutions.



# **The Economic Contribution of Marine Science and Education Institutions in the Monterey Bay Crescent**

Prepared by Nathaniel Miller and Dr. Judith Kildow  
October 2007

## EXECUTIVE SUMMARY

Ocean and coastal areas of the United States contribute significantly to our nation's overall economy. The extent to which our economy benefits from the wide range of marine and coastal activities is not completely understood. The National Ocean Economics Program (NOEP) has attempted to track and value the ocean and coastal-related economic activities in the United States. To date six sectors are included in its information system ([www.oceaneconomics.org](http://www.oceaneconomics.org)). The economic contribution of marine research and education institutions is a sector of activity that lies outside of the normal federal government datasets, but one which seemed to have growing importance and yet was not considered part of the economy. Thus, the NOEP decided to add marine science and education institutions to its sector studies. The goal of this project was to create a prototype strategy at a local level, which could then be adapted for collecting national level data on a state by state basis. This economic sector of institutions and their activities would be comparable to other economic sectors for which the federal government already collects data. The purposes of this project were (1) to select the key indicators that could demonstrate the value of these institutions, and (2) to determine the economic contribution of these institutions to the local, state, and national economies. In order to achieve these purposes, we constructed a survey, tested it at the Monterey Bay Aquarium Research Institute, and then distributed it to the marine research and education institutions of Monterey Bay Crescent. The results of the survey are presented as aggregate information that detail important economic contributions to the region such as: annual budgets, employment figures, annual earned wages, number of students, sources of funding, and distribution of research spending. A summary of the results shows that the combined annual budgets of the marine research and education institutions in Monterey Bay Crescent for 2006 were over **\$209 million**. There were over **1,700** employees within those institutions with wages totaling nearly **\$78 million**. The four institutions of higher education included in the survey served **861** students studying ocean sciences and ocean policy. Distribution of funding sources among all institutions surveyed, according to the survey was Federal Government funds at **46%** and foundation funds at **35%** of the overall research budgets that support these institutions. Research activities focused on coastal processes and on biodiversity had the largest amount of funding, while climate change and marine policy research had the least funding. These results are a window into a growing sector of activities with increasing importance, and begin to fill the void of economic data on the contribution of marine research and education institutions.

# INTRODUCTION

In 2004 the U.S. Commission on Ocean Policy published a report entitled “An Ocean Blueprint for the 21<sup>st</sup> Century.” The report began by emphasizing that a major challenge addressing our oceans is simply not recognizing their value. While in many ways the oceans’ value cannot be precisely estimated, there are many direct and indirect ways to measure how the oceans contribute to our economy. The National Ocean Economics Program (NOEP) using Quarterly Economic Census data compiled by the Bureau of Labor Statistics (BLS) provides a wide range of economic and socio-economic information related to U.S. coasts and oceans and their contribution to the U.S. economy – the portion of the national economy that relies directly on ocean assets or services for inputs or outputs. To date, the NOEP has measured six private service and industrial sectors. In this study, we depart from the usual sectors to include a service sector that is both public and private, and therefore cannot be compiled from the normal BLS datasets. We have compiled some similar categories for this study as for the others of wages, number of establishments, and number of employees for this new sector of Marine Science and Education, so that the NOEP can maintain consistency among sectors and geographies as before. The only difference is between annual budgets compiled for this study and gross domestic product for normal BLS sector data. For this new sector, we have added several new indicator categories: total annual budgets, number of students, and sources and topical categories of funding. This report uses these indicators to estimate the economic contributions of marine research and education institutions to the economy.

## THE INSTITUTIONS

We began with the marine institutions of the Monterey Bay Crescent because they were already organized under a framework, Monterey Bay Crescent Ocean Research Consortium (MBCORC) (see Figure 1). The survey of these institutions served as a beta test for applying the survey to the entire state of California, and eventually to all 30 coastal states of the United States. Significant institutions or subdivisions of institutions that had a majority marine, coastal, or watershed focus were included in the survey. This includes entire institutions devoted to marine research and/or education, such as Monterey Bay Aquarium Research Institute, as well as divisions such as the Department of Science and Environmental Policy at California State University, Monterey Bay. The final list was comprised of 22 institutions (see Appendix A for the complete list), ranging from Santa Cruz to Pacific Grove. The survey was completed and returned during the summer 2007, by 20 of the 22 institutions giving us 91% feedback. The Naval Research Laboratory and Fleet Numerical both declined to participate in the survey.



**Figure 1 Monterey Bay Crescent**

Source: Monterey Bay Crescent Ocean Research Consortium

## RESULTS

### ANNUAL BUDGETS

Using the results of the NOEP survey<sup>1</sup> the annual budgets of the 22 marine institutions of Monterey Bay Crescent totaled **\$209,496,619** for 2006. The annual budget for an institution includes yearly expenditures (operational costs), wages, and overhead costs.

### TOTAL EMPLOYEES

Using the results of the survey<sup>2</sup> there were 1726 employees at the 22 marine institutions in the Monterey Bay Crescent. Total employees are calculated by a head count of all wage and salaried employees at the institution or within the division. By using data from the Bureau of Labor Statistics one can compare the total employees in marine research and education (**1,534**) at the 19 institutions in Monterey County with other important sectors of the economy as well as the employment figures for the county as a whole. This is displayed in Table 1 below. Considering the fact that Marine Research and Education is but one of many sectors of the “ocean economy,” compared with the Agriculture or Leisure and Hospitality sector economies, 1% of total jobs in the county is quite impressive.

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<sup>1</sup> Includes estimates compiled by Gary Griggs for the two institutions that did not respond to this study, the Naval Research Laboratory and Fleet Numerical.

<sup>2</sup> Includes estimates compiled by Gary Griggs for the Naval Research Laboratory and Fleet Numerical.

**Table 1 Employment in Monterey County**

Totals for Monterey County, 2006		
Sector	Jobs	% of Total Jobs
Agriculture	40,411	24%
Leisure and Hospitality	21,010	12%
Marine Research and Education	1,534	1%
All Sectors	168,173	

Source: Bureau of Labor Statistics

**TOTAL WAGES**

Using the results from the 20 completed surveys, wages for the institutions totaled **\$77,703,883**. This includes the total wages and salaries within the institution, but not fringe benefits. Using data from the BLS, one can compare the total wages from Marine Research and Education of Monterey County (**\$56,218,883**) with other important sectors of the county. Furthermore, one can examine the average wage of employees within these sectors. This is an area where the Marine Research and Education sector stands out. As shown in Table 2 below, the average wage within the Marine Research and Education sector is more than twice that for the Leisure and Hospitality sector, and nearly **\$20,000** higher than that for Agriculture. The average wages for those employed by marine research and education institutions are well above average for Monterey County, and contribute disproportionately to the economy. This demonstrates the large monetary contributions of the sector that have a ripple effect throughout the entire economy.

**Table 2 Wages in Monterey County**

Totals for Monterey County, 2006			
Sector	Total Wages	% of Total Wages	Average Wage
Agriculture	\$1,056,169,000	17%	\$26,136
Leisure and Hospitality	\$461,312,000	7%	\$21,957
Marine Research and Education	\$56,218,883	1%	<b>\$45,558</b>
All Sectors	\$6,384,847,000		\$37,966

Source: Bureau of Labor Statistics

## ECONOMIC CONTRIBUTION TOTALS FROM SURVEY

Table 3 below displays the economic indicator results of the survey completed by 20 of 22 marine research and education institutions in Monterey Bay Crescent.

**Table 3 Monterey Bay Crescent Economic Indicators**

<b>20 Marine Research and Education Institutions, 2006</b>	
Total Annual Budgets	\$169,496,619
Total Annual Wages	\$77,703,883
Total Employment	1,426
Total Students	861

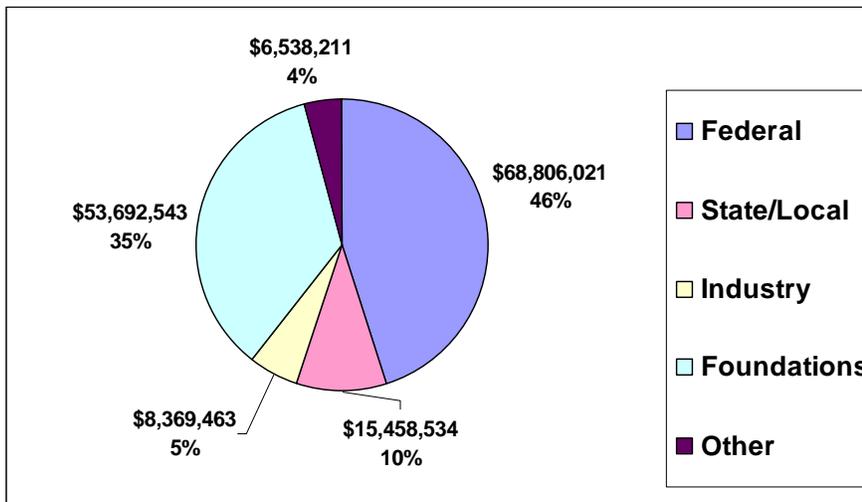
By combining the data collected by the survey with the research by Gary Griggs, which includes the two institutions that are absent from this survey, we can display a more inclusive account of the total annual budgets and employment of the 22 marine research and education institutions in Monterey Bay Crescent. This is displayed in Table 4 below.

**Table 4 Monterey Bay Crescent Budgets and Employment**

<b>22 Marine Research and Education Institutions, 2006</b>	
Total Annual Budgets	\$209,496,619
Total Employment	1,726

## SOURCES OF FUNDING

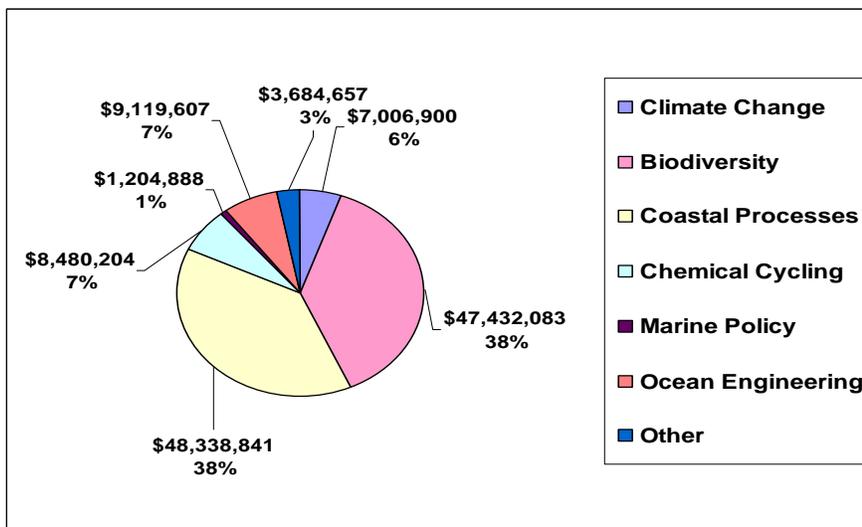
Another category of the data demonstrates sources of funds for these institutions. This information is important to realize the stability of the flow of funds over time. Again, the information has been collected from the 20 marine research and education institutions that participated in the survey. The pie chart below shows the amount and distribution of funding sources (see Figure 2). Federal money is the largest source of funds for marine science and education in Monterey Bay Crescent, followed by private foundations, state/local, industry, and “other” funding. The significant percentage of private funding at the Monterey Bay Aquarium Research Institute explains a large piece of the foundation slice.



**Figure 2 Sources of Funding: 20 Marine Institutions, 2006**

### RESEARCH SPENDING

The final section of the survey sought data on categorical allocations of research money. The institutions provided the budgeted amounts designated both for research projects, and specified research topics. Projects were categorized by their main focus of research.<sup>3</sup> What is interesting to note from the figure below is the large amount of money allocated for Biodiversity and Coastal Processes projects (76% of total money spent), as well as the small amount of money allocated for Climate Change (6%) and Marine Policy projects (1%) (see Figure 3).<sup>4</sup> It will be interesting to see how the relatively low percentages of funding for climate change and ocean policy change over the next few years, as both of these areas appear to be of rising interest.



**Figure 3 Areas of Research Spending**

<sup>3</sup> See Appendix C – “Instructions” for category definitions.

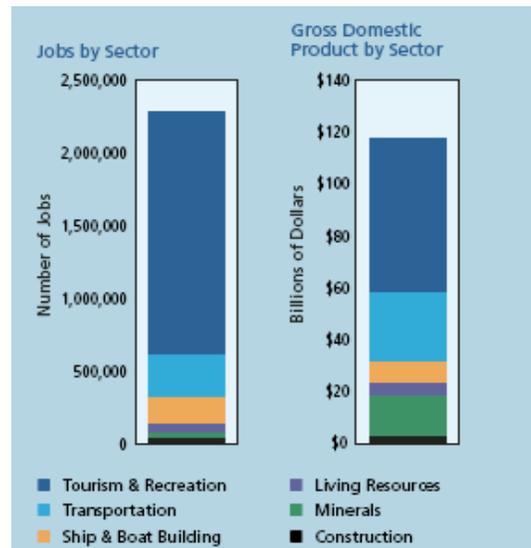
<sup>4</sup> See Appendix C – “Instructions” for category definitions.

## CONCLUSIONS

Our conclusions from the results of this survey follow: 1. marine research and education institutions contribute significantly to the economy in the Monterey Bay Crescent Area through jobs, wages, and annual budgets; 2. the federal government and foundations make up a majority of the funding sources; and 3. coastal processes and biodiversity research receive the highest amount of funds, while Climate Change and Marine Policy receive the least. More broadly, we can conclude that it is important and necessary to understand the contributions of marine research and education institutions to the ocean economy so that the public and policy makers appreciate these efforts. We can now begin to add marine research and education market data to the many other sectors that reflect our dependence on the oceans.

### THE BROADER CONTEXT

The NOEP Ocean Economy, until now has estimated values for six sectors: (1) Marine Construction, (2) Living Resources, (3) Offshore Minerals, (4) Ship & Boat Building, (5) Tourism & Recreation, and (6) Marine Transportation. Each sector includes the following indicators: number of jobs, earned wages, and (GDP) value added after the cost of doing business. Employment figures and Gross Domestic Product (GDP) of the six sectors are shown here for 2000 (See Figure 4).

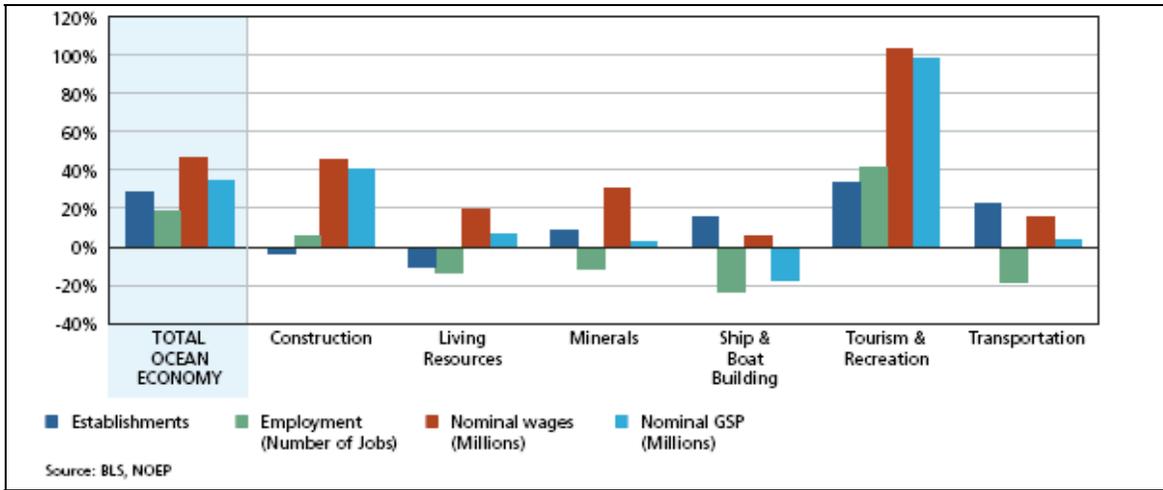


Source: NOEP

**Figure 4 Employment and GDP in the Ocean Economy 2000**

The six market sectors are comprised of multiple industries. These industries, and their over-arching sectors, do not represent the entire market contribution of coastal and ocean activities. Applying the template from this study to all coastal states, the NOEP will add other sectors to its national Ocean Economy dataset. By collecting annual estimates for the current six sectors of the Ocean Economy one can examine current levels of contribution as well as changes over the years. This additional

sector will provide a more complete and accurate understanding of the total Ocean Economy and trends. Figure 5 demonstrates the power of time series to examine changes over time, focusing on the current six sectors of the Ocean Economy.



**Figure 5 Changes in the Ocean Economy 1990-2000**

### PREVIOUS WORK

There has been no previous attempt to single out marine science and educational institutions as a separate economic sector, although, Gary Griggs, Director of the Institute of Marine Sciences at the University of California, Santa Cruz has collected budget and employment figures for the institutions of Monterey Bay Crescent over the last several years. This sector differs from the other six sectors in many ways, because these institutions represent both public and private establishments, and the federal government accounts reflect only private business activities. This new sector will be an amalgam of public and private sector activities.

In addition to estimating economic contributions of this Marine Research and Education sector, a second goal of the survey was to determine the allocation of research expenditures. Research projects were classified into seven categories: Climate Change, Biodiversity, Coastal Processes, Chemical Cycling, Ocean Engineering, Marine Policy, and Other. This information informs us about what areas of research are receiving the most attention and funding.

### ACKNOWLEDGEMENTS

The entire NOEP team contributed significantly to this study. Thanks especially to Bonnie Lockwood who edited the study for publication. Furthermore, Norm Steinberg, Patrice Carroll, Gary Griggs, George Matsumoto, and our contacts at the 20 institutions in Monterey Bay Crescent gave their time and effort to help complete the project.

## References

Monterey Bay Research Ocean Consortium. [www.mbcorc.org](http://www.mbcorc.org) Accessed on 10-10-07.

Unpublished research by Gary Griggs. University of California Santa Cruz.

U.S. Commission on Ocean Policy (2004). “An Ocean Blueprint for the 21<sup>st</sup> Century.”

U.S. Department of Labor, Bureau of Labor Statistics [www.bls.gov](http://www.bls.gov) Accessed on 10-10-07.

## Appendix A

### Major Marine Research and Education Institutions: Monterey and Santa Cruz Counties

August 2007

1. University of California, Sea Grant Extension Program  
8272 Moss Landing Road  
Moss Landing, CA 95039
2. Division of Science and Environmental Policy  
California State University Monterey Bay  
6133 Fifth Avenue  
Seaside, CA 93955-8001
3. Elkhorn Slough National Estuarine Research Reserve  
1700 Elkhorn Road  
Watsonville, CA 95076
4. \*Fleet Numerical Meteorology and Oceanography Center (not included in survey)  
7 Grace Hopper Avenue- Stop 1  
Monterey, CA 93943-5501
5. Hopkins Marine Station  
Stanford University  
Pacific Grove, CA 93950
6. Institute of Marine Sciences  
Earth and Marine Sciences A-315  
University of California  
Santa Cruz, CA 95064
7. Marine Pollution Studies, California Dept. of Fish and Game  
Moss Landing Marine Laboratories  
8272 Moss Landing Road  
Moss Landing, CA 95039-9647
8. Marine Wildlife Veterinary Care and Research Center  
California Department of Fish and Game  
1451 Shaffer Road
9. Conservation Research at Monterey Bay Aquarium  
886 Cannery Row  
Monterey, CA 93940
10. Monterey Bay Aquarium Research Institute  
7700 Sandholt Road  
Moss Landing, CA 95039

11. Monterey Bay National Marine Sanctuary  
299 Foam Street, Suite D  
Monterey, CA 93940
12. Resource Assessment Program  
California Dept. of Fish and Game-Marine Region  
20 Lower Ragsdale Drive, Suite # 100  
Monterey, CA 93940
13. Moss Landing Marine Laboratories  
8272 Moss Landing Road  
Moss Landing, CA 95039-9647
14. National Marine Protected Area Center- Science Institute  
National Marine Fisheries Service Laboratory, NOAA  
110 Shaffer Road, Santa Cruz, CA 95060
15. \*National Undersea Research Program  
P.O. Box 475  
Moss Landing, CA 95039 (not included in our survey)
16. NOAA National Weather Service  
21 Grace Hopper Ave, Stop 5  
Monterey, CA 93943
17. Naval Research Laboratory  
Marine Meteorology Division  
7 Grace Hopper Avenue  
Monterey, CA 93943-5502
18. Department of Oceanography  
Naval Postgraduate School  
833 Dyer Road, Room 328  
Monterey, CA 93943-5193
19. Seymour Center at Long Marine Laboratory  
100 Shaffer Road  
Santa Cruz, CA 95060
20. Environmental Research Division  
NOAA Fisheries Services, Southwest Fisheries Science Center  
1352 Lighthouse Avenue  
Pacific Grove, CA 93950-2097
21. Southwest Fishery Science Center, NMFS  
110 Shaffer Road  
Santa Cruz, CA 95060
22. United States Geological Survey, Pacific Science Center  
400 Natural Bridges Drive  
Santa Cruz, CA 95060

## Appendix B

1. Name of Institution							
2. Marine/Watershed/Coastal Division							
3. Year of Data Provided							
*Preferably 2006							
4. Marine/Watershed/Coastal Students		Undergraduate	Graduate	<b>Total</b>			
5. Paid Employees		Research Staff	Education Staff	Administrative Staff	Technical Staff	Others	<b>Total</b>
*Double labeling some employees is acceptable, e.g. <b>Research Staff</b> may also be <b>Education Staff</b> , however be sure not to double count them in the <b>Total</b> cell.							
6. Total Annual <b>Wages (Payroll)</b> of Institution or Division				\$	-		
7. Total Annual <b>Budget (Expenses)</b> of Institution or Division				\$	-		

	Federal	State/Local	Industry	Foundations	Other please list	Total
8. Annual Funding	\$ -	\$ -	\$ -	\$ -		\$ -
						\$ -
						\$ -
* If funding sources cannot be separated, please list <b>Total</b> for institution, or division.						
** Please list subcontract funds separately below.						Total+Subcontracts
Total Funds Subcontracted Out	\$ -					\$ -

9. Foundations:	Name of Foundation	Dates of Fund.	Amount of Funding
* List five largest sources of funding and amount given.			\$ -
			\$ -
			\$ -
			\$ -
			\$ -



## Appendix C



### Instructions: NOEP Marine Research and Education Institution Survey

This document serves as instructions for the Excel spreadsheet survey, “Marine Institution Survey.” Please print this document to refer to while filling out the spreadsheet. The Marine Institution Survey is setup with eleven categories of input. Response areas are highlighted in yellow. Please complete all sections to the best of your ability. Any information is beneficial, so do not feel all sections need to be complete in order to return the survey. Leave sections blank where data cannot be obtained or fill in “N/A” where question do not apply.

1. **Institution:** The name of the marine research and/or education institution.
2. **Marine/Watershed/Coastal Division:** If entire institution is related to marine/watershed/coastal research or education this category is not necessary to complete. Otherwise name the specific division within the institution involved with marine/watershed/coastal studies. Furthermore, the rest of the survey relates only to the marine/watershed/coastal figures of the institution, if there is such division.
3. **Year:** The **fiscal year** of 2005-2006 is preferred. If any other year is provided please indicate.
4. **Marine Watershed, and Coastal Students:** The number of undergraduate and graduate students studying marine, watershed, or coastal science/policy in the institution or division. These students should be candidates for a degree at the institution. If students are obtaining degree elsewhere they should not be included. This also does not include student employees.
5. **Wage and Salary Employees:** The total number of marine/watershed/coastal employees, as well as the division of these employees between research staff, education staff, administrative staff, and technical staff. Employees may fall into more than one category or perhaps none of the categories. This is acceptable as long as all employees are counted once and only once in the **Total** cell.

6. **Total Annual Wages:** The total amount of annual wages for all employees in the institution or division. This **does not** include fringe benefits.
7. **Total Annual Budget:** The total annual budget of the institution or division. This **does** include employee wages, benefits and overhead costs.
8. **Annual Funding:** The total amount of funding, as well as the division of funding sources between federal, state/local, industry, and foundations. If funding does not fit into these categories list and label it in the “**Other**” category. If funding is subcontracted out to other institutions please list it separately in the space provided. Multiple year funds may be listed here if they apply to the year in question.
9. **Foundations:** The five largest sources of funding, the dates the funds apply to, and those amounts. If funding is awarded for multiple years, be sure to specify when it was awarded and for what time period.
10. **Research Focus:** The number of researchers and amount of budget allotted to different programs or projects for the year. Please attempt to categorize these programs/projects into one of our six themes of ocean research. Label the project by its primary focus. If research does not seem to belong to any category label it 7 for “Other Research,” and describe the program/project in number 11.

#### **Research Themes**

1. **Climate Change** – Research describing causes or effects of climate change
  2. **Biodiversity** – Research describing natural and human effects on biodiversity populations
  3. **Coastal Processes** – Research describing action of natural or human induced forces on near shore sea floor and coastline
  4. **Chemical Cycling** – Research describing the natural or human induced movements of elements
  5. **Marine Policy** – Research describing marine regulation or need there for
  6. **Ocean Engineering** – Research related to the design, analysis or implementation of ocean operating systems
11. **Description of Other Research:** Area to provide descriptions of the type of “Other Research.

