

**Eradication and Surveillance of *Caulerpa taxifolia* within
Agua Hedionda Lagoon, Carlsbad, California
Sixth Year Status Report**

January to December 2006

Prepared for:

Steering Committee of the Southern California *Caulerpa* Action Team

- California Regional Water Quality Control Board – San Diego Region
- California Regional Water Quality Control Board – Santa Ana Region
- California Department of Fish and Game
- National Marine Fisheries Service
- U.S. Department of Agriculture – Agricultural Research Service

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Eradication and Surveillance of *Caulerpa taxifolia* within Agua Hedionda Lagoon, Carlsbad, California Sixth Year Status Report

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EXECUTIVE SUMMARY

On June 12, 2000 the first known infestation in the Western Hemisphere of the invasive strain of the tropical marine alga, *Caulerpa taxifolia*, was discovered in Agua Hedionda Lagoon, in Carlsbad, California. This document reports the results of the sixth year of the eradication program undertaken by the Southern California *Caulerpa* Action Team (SCCAT). Merkel & Associates has been contracted to conduct the eradication under the oversight of the SCCAT, a broad-based task force assembled from federal and state resource and regulatory agencies, exotic species experts, and marine resource scientists.

The sixth year of the program marked a turning point in the eradication program with the declaration by the California Department of Fish and Game on July 12, 2006 that *Caulerpa taxifolia* had been successfully eradicated from Agua Hedionda Lagoon and from Huntington Harbour. This determination was based on the findings presented in the report prepared by Merkel & Associates entitled Final Report on Eradication of the Invasive Seaweed *Caulerpa taxifolia* from Agua Hedionda Lagoon and Huntington Harbour. The report found that the two criteria for successful eradication of the *C. taxifolia* infestations are 1) the containment and lethal treatment of *C. taxifolia* at the infestation site, and 2) verified absence of *C. taxifolia* from the infestation site. The data collected over the prior five years of the program indicated that these criteria had been met.

With the eradication work complete, field work turned to cleanup of the infestation sites. This involved removal of materials used in the mapping, containment, and treatment of *C. taxifolia* at Agua Hedionda Lagoon and Huntington Harbour, including survey line, PVC tarps, gravel bags used to secure the tarps, and all other materials deployed during the life of the project. This effort was started late in Year 6 (2006) and will continue through 2007.

Also undertaken during the sixth year was the initiation of the Outreach and Education Program, with implementation of the first three phases of the program which involves target audience identification, and strategy and materials development.

INTRODUCTION

The highly invasive Mediterranean strain of the tropical marine alga *Caulerpa taxifolia* was discovered in Agua Hedionda Lagoon, Carlsbad, California in June 2000 (Figure 1). Its discovery represented the first known occurrence of this strain within the Western Hemisphere and is believed to pose a major threat to coastal ecosystems and recreational and commercial uses dependent upon coastal resources. While the species was also identified at a second site in California (Huntington Harbour, Orange County), the Agua Hedionda Lagoon infestation is the larger of the two known infestations. It is likely that *C. taxifolia* had been in the lagoon for at least four years prior to its discovery. It is not known whether other infestations also exist elsewhere in the United States. The continued availability and use of this species by saltwater aquarists is cause for concern.

Since the discovery of *C. taxifolia* in Agua Hedionda Lagoon in June 2000, eradication, surveillance, public outreach efforts, eradication research, and legislative efforts have been initiated and are on-going. The primary goal of the Southern California *Caulerpa* Action Team (SCCAT), which is made up of resource managers, marine resource and pest control scientists, permitting agencies, marine biological consultants, land-owners and environmental stakeholder representatives, has been the eradication of the known infestations.

From the date of discovery (June 2000) until the end of the Summer 2001 survey, the eradication effort at Agua Hedionda Lagoon primarily involved the treatment of all detected *C. taxifolia*. The amount of *C. taxifolia* present in the lagoon at the time of discovery was estimated to be 1,047 m² (Merkel & Associates, 2001a). By the end of the second year of eradication efforts at Agua Hedionda Lagoon the amount of *C. taxifolia* discovered had been reduced to 0.4 m² (Merkel & Associates, 2003). The last discovery of *C. taxifolia* at Agua Hedionda Lagoon was on September 11, 2002. The location of all *C. taxifolia* discovered since the beginning of the eradication effort is indicated in Figure 1. No *C. taxifolia* was detected during repeated surveys during Years 3, 4, and 5.

As outlined in the fifth year report (Merkel & Associates, 2006a) completion of seven negative surveys over three years since the last detection of *C. taxifolia*, marked the end of the follow-up surveillance work at Agua Hedionda Lagoon.

This document provides a synopsis of the Eradication Program's efforts and costs during Year 6, including the Outreach and Education Program. Please refer to the Year 1, Year 2, Year 3, Year 4, and Year 5 reports for details on survey and treatment actions completed during those years.

ERADICATION DETERMINATION

The primary task during Year 6 was to review all data collected on the eradication status and determine if eradication had been achieved, based on the criteria established.

The criteria for successful eradication of the *C. taxifolia* infestations were 1) the containment and lethal treatment of *C. taxifolia* at the infestation site, and 2) verified absence of *C. taxifolia* from the infestation site. Treatment efforts consisted of covering *C. taxifolia* with heavy black PVC tarps under which chlorine was either injected as sodium hypochlorite, or placed as a solid, pelleted formulation, which provided full containment of *C. taxifolia* while minimizing the water quality impacts of the treatment on the surrounding waters. The containment and treatment efforts lasted approximately two years, with divers undertaking intensive surveillance concurrently to search for remaining *C. taxifolia*. *Caulerpa taxifolia* was last detected in Agua Hedionda Lagoon in September 2002 and in Huntington Harbour in November 2002. No *C. taxifolia* has been discovered at either site during intensive, systematic surveillance conducted through December 2005.

Evaluations of the treatment effectiveness were performed both in the laboratory and at both infestation sites. The laboratory experiments involved the collection of previously infested sediment from under the treatment tarps. The sediment cores were planted into laboratory aquariums and monitored in a controlled study for regrowth of *C. taxifolia*. No *C. taxifolia* grew from any of the treated cores. Additionally, removal of portions of the treatment tarps at the infestation sites resulted in no regrowth of *C. taxifolia* after four years of monitoring. These data indicated that the treatment approach used was lethal to *C. taxifolia* and that Eradication Criterion 1 was met at both sites.

The second criterion was evaluated by quantifying the confidence in the surveillance efforts at both infestation sites. Patches of artificial *Caulerpa* were placed within each of the two sites during the regular diver surveys. Confidence in the results of each survey for live *C. taxifolia* could then be quantitatively estimated based on the amount of artificial *Caulerpa* found during the surveys. The results of these consecutive assessments of the surveys ultimately allowed for an estimation of the eradication certainty, the certainty that all real *C. taxifolia* existing at the two sites had been found and that eradication had been achieved. The assessments determined that there is a 97.71% certainty that eradication has been achieved at Agua Hedionda Lagoon, assuming the worst conditions, and a 99.86% certainty if the average conditions are assumed. There is a 99.99% certainty that eradication has been achieved at Huntington Harbour under all conditions. These results indicate that Criterion 2 had also been met at both sites with a high degree of certainty.

Based on these results, we believe that the criteria necessary to verify and document eradication of *Caulerpa taxifolia* at Agua Hedionda Lagoon and Huntington Harbour have been met.

Having met these criteria, M&A prepared a final document outlining the justification for determining that eradication had been achieved and recommending that the California Department of Fish and Game make such a determination. M&A produced this document in early 2006, in anticipation of a formal declaration in July 2006, entitled Final Report on Eradication of the Invasive Seaweed *Caulerpa taxifolia* from Agua Hedionda Lagoon and Huntington Harbour, California (M&A 2006b).

M&A coordinated the planning of an Eradication Declaration ceremony, including preparing invitations, a program, press materials, refreshments, and public relations support. The event was held on July 12, 2006 at the Agua Hedionda Lagoon Foundation Discovery Center in Carlsbad, CA. The eradication announcement was made by Mr. Ryan Broddrick, Director of the California Department of Fish and Game. A copy of the event program is included in the appendix of this document.

ONGOING ERADICATION PROGRAM WORK

Tarp Removal

A major remaining task is the removal of treatment materials from the lagoon. The tarps were left in place to this point to discourage regrowth of any material that may have not been treated by the chlorine. Based on the studies outlined above, removal of the treatment tarps will not result in regrowth of *C. taxifolia*. Removal of the tarps will facilitate the recovery of the flora and fauna present prior to the introduction of *C. taxifolia*.

In anticipation of this work, pilot studies on removal methodology were undertaken. Following onto techniques explored in Year 5, methods for removal of the gravel bags that secure the tarps were tested during January of Year 6.

The methodology testing involved first swimming the perimeter of each tarp to search for the gravel bags used to secure the tarps. As each bag was encountered, two techniques were tested: 1) cutting open the nylon bag underwater, dumping the gravel, and collecting the bag; and 2) collecting all of the bags into a basket to be winched to the surface, where a deckhand would cut open the bags, dump the gravel, and dispose of the bag. The trial demonstrated the work to be very labor intensive, and it was anticipated to require regular replacement of diver work gloves, collection bags, and dive knives.



After testing both methods it was determined that both techniques were equally efficient, however the first method required less mechanical assistance and was therefore less expensive and safer to conduct. Based on this work it was determined to be feasible to remove the gravel bags as well as the tarps.

Following the eradication declaration, efforts to remove the treatment tarps were initiated. The first phase of work was initiated in November 2006, and involved the removal of the gravel bags from the tarps in Huntington Harbour and Agua Hedionda Lagoon.

At Huntington Harbour, each tarp was checked for the presence of *C. taxifolia* on or near it, then the gravel bags were cut open, the gravel dumped out, and the nylon bag retrieved for disposal. Approximately 3,733 bags were retrieved from the east and west ponds of the infestation site. The total eventually increased with additional work conducted in current Year 7 (2007).

Gravel bag removal was initiated at Agua Hedionda Lagoon in December, with approximately 2,047 bags removed by the end of the year.

COORDINATION WITH LAGOON USERS

During the sixth year of the eradication program, the limited activities on the lagoon continued to be coordinated through the Interim Management Plan (Plan), a document drafted and adopted by the SCCAT, the Agua Hedionda Lagoon User Representatives, and the City of Carlsbad. This plan partitioned the lagoon into management units and established safety guidelines for both the eradication crew and recreational users of the lagoon. To coordinate the activities of all users, informational signage at access points around the lagoon was posted with regular activity updates, and a recorded phone message with schedule updates was maintained. This Plan allows eradication work to be conducted more safely and efficiently than before the adoption of the plan. The City of Carlsbad and SCCAT review the Plan annually to assess its efficacy and consider modifications.

The first version of the Plan originally adopted in June 2002 included the following restrictions on the lagoon relating to the control of *C. taxifolia*: a ban on anchoring and fishing throughout the east basin, a prohibition of wake height by boats in excess of 0.3 m (12 inches) when measured from the undisturbed water surface to the top of crest, and continued exclusion of all unauthorized vessels from most of Snug Harbor, the most infested area of the lagoon.

These restrictions were regularly reviewed by SCCAT in the context of the progress of eradication efforts. In November of 2002, SCCAT recommended the re-opening of the eastern portion of the east basin to fishing, given that after two years of survey, no *C. taxifolia* had been found there. The following year, in May 2003, SCCAT also recommended that the previously closed area in Snug Harbor be opened to passive use vessels (non-motorized vessels). In fall of 2003, SCCAT further recommended that Snug Harbor be returned to its original use as the operational area for the vessels of Carlsbad Watersports, located in Snug Harbor. The Carlsbad City Council approved and adopted each of these changes, which were implemented throughout the fourth year.

The plan was extended for an additional year in April 2005, with a new expiration of June 30, 2006. The only remaining restriction was the prohibition of anchoring in the east basin, the limitation of fishing to the passive use area, and the closure of zones to facilitate eradication activities. The plan was extended for an additional year in April 2006, with a new expiration of June 30, 2006. At that time the prohibition on fishing was lifted. It is anticipated that zone closures will be needed to carry out the tarp removal work in 2007. SCCAT will continue to revisit the Plan annually with the goal of eventually recommending the complete return to pre-*C. taxifolia* uses.

OUTREACH AND EDUCATION

Phase 1

The Southern California Outreach and Education Program was initiated during Year 6. Phase 1 involved the identification and prioritization of target audience groups, which was completed in the Plan for Southern California *Caulerpa* Outreach and Education Program (M&A 2005). The audience types that fell into the Priority 1 level were categorized as Saltwater Aquarium, Harbors/Bays/Boating/Fishing, Stewards, and Diving. Only those that occurred in Los Angeles, Orange, and San Diego counties were included as Priority 1 (Table 1).

Table 1. Prioritized target audiences for outreach.

Audience Category	Audience Type	Priority	County				
			Orange	San Diego	Los Angeles	Ventura	Santa Barbara
			1		2		3
Saltwater Aquarium	Saltwater Aquarist Clubs	1		1	2	3	
	Aquarist Newsletters/Magazines						
	Public Aquariums						
	Aquarium Maintenance Providers						
	Retail Pet Shops with Aquarium Supplies						
	Retail Aquarium Supply Shops						
	Online Retail Aquarium Suppliers						
	Wholesale Aquarium Suppliers						
Harbors/Bays/Boating/Fishing	Marinas & Anchorages						
	Harbor Masters/Port Captains						
	Marine Construction						
Stewards	Educators						
	Non-profit Environmental Groups						
	Coastal Reserves						
Diving	Dive Clubs - University/Scientific						
Harbors/Bays/Boating/Fishing	Yacht Clubs	2					
	Research Institutes						
Stewards	Science Newsletters/Magazines	2		2	3	4	
	Governmental Organizations						
	Dive Clubs - Recreational						
Diving	Dive Clubs - Online						
	Diving Newsletters/Magazines						
	Homeowners / Residents						
Harbors/Bays/Boating/Fishing	Boating/Fishing Newsletters/Magazines	3			4	5	
	Dive Charters						
Diving	Diving Equipment Suppliers	3		3	4	5	
	Diver Trainers						
	Fishing Charters						
Harbors/Bays/Boating/Fishing	Bait & Tackle Suppliers	4		4	5	6	
	Boat Maintenance Providers						
	Hull Cleaners						

Phase 2

The second phase of the program involved the identification of specific target audiences in each of the Priority 1 audience groups. These data were collected through a variety of sources including the Internet, phone books, word or mouth, and existing contact data gathered throughout the eradication effort. A database was developed to manage contact information and outreach records. The information recorded included name, address, affiliation, contact person, phone numbers, outreach objective (i.e., pathways, detection, and/or stewardship). Fields were included for recording the outreach conducted including: method used, materials presented or distributed, evaluation activities conducted, and outcome notes. The database has 916 targets identified. It is continually updated and maintained as outreach activities are conducted or as contact information needs to be changes.

Phase 3

Phase 3 of the outreach program involves developing specific outreach strategies for each Priority 1 audience group and creating the materials needed to conduct the outreach. The strategies drafted during this reporting period are listed below. These strategies are revised and updated as research and experience provides updated information and additional insight.

Table 2. Audience group outreach strategies.

Audience Group:	Saltwater Aquarist Clubs – Orange, San Diego and Los Angeles counties
Objective(s):	Pathways and Education: (1) Use clubs as means to disseminate information and educate the general public. Outreach efforts will raise awareness so that members can help spread the word to colleagues and contacts about <i>Caulerpa</i> and its effects. (2) Outreach to help change behavior of club leaders in order to influence members and prevent new infestations.
Specific Target Audiences:	See Database
Key Messages:	<i>Caulerpa</i> info (threat, legal status, biology), proper disposal of aquarium contents, alternatives to <i>Caulerpa</i> , economic and biological cost of eradicating infestations resulting from inadvertent release, importance of raising awareness of the issue.
Actions:	<ul style="list-style-type: none"> • Develop speakers bureau program and offer presentations for club meetings • Contact club newsletter editor for placement of template articles • Contact club webmaster for posting information or survey on website • Contact club webmaster for creating <i>Caulerpa</i> forum on club website • Research and attend club social functions to informally meet members and discuss <i>Caulerpa</i> • Contact club president for distributing information flyer with new member packets • Contact club president for distributing surveys to members • Keep website (SCCAT.net) updated and cite it on materials
Materials:	Cover letter, fact sheet, pamphlet, slide presentation, giveaways with info
Audience Group:	Aquarist Newsletters/Magazines – Orange, San Diego and Los Angeles counties
Objective(s):	Education - Outreach efforts will raise awareness and change behaviors in order to prevent both new introductions and the spread of existing infestations of invasive species of <i>Caulerpa</i> .

Specific Target Audiences:	See Database
Key Messages:	<i>Caulerpa</i> info (threat, legal status, biology), proper disposal of aquarium contents, alternatives to <i>Caulerpa</i> , economic and biological cost of eradicating infestations resulting from inadvertent release.
Actions:	<ul style="list-style-type: none"> • Contact newsletters and magazines for placement of editorials or feature articles and advertisements • Contact newsletters and magazines for distributing information flyer with newsletter/magazine to subscribers • Contact newsletters and magazines for developing “information request” postcard to be inserted in newsletter/magazine • Contact webmaster to post information or surveys on website • Keep website (SCCAT.net) updated and cite it on materials
Materials:	Advertisements and technical articles

Audience Group:	Public Aquariums – Orange, San Diego and Los Angeles counties
Objective(s):	Education - Outreach efforts will raise awareness and educate patrons about the invasive species <i>Caulerpa</i> .
Specific Target Audiences:	See database
Key Messages:	<i>Caulerpa</i> info (threat, legal status, biology), proper disposal of aquarium contents, alternatives to <i>Caulerpa</i> , economic and biological cost of eradicating infestations resulting from inadvertent release, importance of raising awareness.
Actions:	<ul style="list-style-type: none"> • Contact aquarium manager for posting displays or holding exhibits • Contact aquarium manager for enclosing information flyers with facility map, or disseminating at ticket booth or entrance • Explore possibility of having an information booth outside/near the entrance of the aquarium • Contact program editor for advertisement opportunities in program or aquarium booklet • Contact aquarium manager about distributing surveys to patrons • Keep website (SCCAT.net) updated and cite it on materials
Materials:	Cover letter, fact sheet, pamphlet, poster

Audience Group:	Aquarium Maintenance Providers – Orange, San Diego and Los Angeles counties
Objective(s):	Pathways – Outreach efforts will raise awareness and change behaviors in order to prevent both new introductions and the spread of existing infestations of invasive species of <i>Caulerpa</i> .
Specific Target Audiences:	See Appendix A.4
Key Messages:	<i>Caulerpa</i> info (threat, legal status, biology), proper disposal of aquarium contents, alternatives to <i>Caulerpa</i> , economic and biological cost of eradicating infestations resulting from inadvertent release.
Actions:	<ul style="list-style-type: none"> • Contact wholesalers or manufacturers for obtaining samples of alternatives and send free samples to aquarium maintenance providers • Contact wholesalers for offering discount coupons and distribute to maintenance providers • Provide literature through mail and email • Conduct surveys by mail, email or phone contact • Keep website (SCCAT.net) updated and cite it on materials
Materials:	Cover letter, fact sheet

Audience Group:	Retail Pet Shops with Aquarium Supplies – Orange, San Diego and Los Angeles counties
Objective(s):	Pathways and Education – Outreach efforts will raise awareness and change behaviors in order to prevent both new introductions and the spread of existing infestations of invasive species of <i>Caulerpa</i> .
Specific Target Audiences:	See database

Key Messages:	<i>Caulerpa</i> info (threat, legal status, biology), proper disposal of aquarium contents, alternatives to <i>Caulerpa</i> , economic and biological cost of eradicating infestations resulting from inadvertent release.
Actions:	<ul style="list-style-type: none"> • Coordinate with California Department of Fish and Game regarding past outreach efforts to this audience • Visit aquarium stores to speak with owner/manager and drop off materials • Explore potential for including disposal note on bags used in the sale of aquarium plants and fish • Keep website (SCCAT.net) updated and cite it on materials • Contact store owner/manager for displaying information boards, having a small exhibit or table of information and representative • Explore possibility of distributing aquarium reminder stickers to purchasers of aquariums • Contact store owner/manager for distributing surveys to aquarium supply buyers or conducting in-store surveys
Materials:	For distribution/posting at aquarium stores: introductory letter to manager/owner, poster, 9 species brochure, pamphlet, aquarium supply bags printed with <i>Caulerpa</i> information.

Audience Group:	Retail Aquarium Supply Shops – Orange, San Diego and Los Angeles counties
Objective(s):	Pathways and Education– Outreach efforts will raise awareness and change behaviors in order to prevent both new introductions and the spread of existing infestations of invasive species of <i>Caulerpa</i> .
Specific Target Audiences:	See database
Key Messages:	<i>Caulerpa</i> info (threat, legal status, biology), proper disposal of aquarium contents, alternatives to <i>Caulerpa</i> , economic and biological cost of eradicating infestations resulting from inadvertent release.
Actions:	<ul style="list-style-type: none"> • Coordinate with California Department of Fish and Game regarding past outreach efforts to this audience • Visit aquarium stores to speak with owner/manager and drop off materials • Explore potential for including disposal note on bags used in the sale of aquarium plants and fish • Keep website (SCCAT.net) updated and cite it on materials • Contact store owner/manager for displaying information boards, having a small exhibit or table of information and representative • Explore possibility of distributing aquarium reminder stickers to purchasers of aquariums • Contact store owner/manager for distributing surveys to aquarium supply buyers or conducting in-store surveys
Materials:	For distribution/posting at aquarium stores: introductory letter to manager/owner, poster, 9 species brochure, pamphlet, aquarium supply bags printed with <i>Caulerpa</i> information.

Audience Group:	Online Retail Aquarium Suppliers – Orange, San Diego and Los Angeles counties
Objective(s):	Pathways – Outreach efforts will raise awareness and change behaviors in order to prevent both new introductions and the spread of existing infestations of invasive species of <i>Caulerpa</i> .
Specific Target Audiences:	See database
Key Messages:	<i>Caulerpa</i> info (threat, legal status, biology), proper disposal of aquarium contents, alternatives to <i>Caulerpa</i> , economic and biological cost of eradicating infestations resulting from inadvertent release.
Actions:	<ul style="list-style-type: none"> • Contact webmaster or advertising department for posting advertisements

	<ul style="list-style-type: none"> • Contact webmaster for creating pop up windows when clicking on <i>Caulerpa</i>-related information • Contact webmaster to post more information about not shipping to California and the <i>Caulerpa</i> threat • Contact webmaster for creating chat room or forum • Contact webmaster for creating links to <i>Caulerpa</i> websites (SCCAT website, NOAA, USFWS, etc) • Contact webmaster for posting online surveys
Materials:	TBD

Audience Group:	Wholesale Aquarium Suppliers – Orange, San Diego and Los Angeles counties
Objective(s):	Pathways – Outreach efforts will raise awareness and change behaviors in order to prevent both new introductions and the spread of existing infestations of invasive species of <i>Caulerpa</i> .
Specific Target Audiences:	See database
Key Messages:	<i>Caulerpa</i> info (threat, legal status, biology), proper disposal of aquarium contents, alternatives to <i>Caulerpa</i> , economic and biological cost of eradicating infestations resulting from inadvertent release.
Actions:	<ul style="list-style-type: none"> • Research trade shows and possibility of having booth • Obtain samples of alternatives and provide trial samples to wholesalers, along with benefits - cost benefits/profits and available market • Provide literature to distribute to buyers.
Materials:	TBD

Audience Group:	Scientific Divers – Orange, San Diego and Los Angeles counties
Objective(s):	Detection – Outreach efforts will raise awareness about <i>Caulerpa</i> and provide identification and survey technique information to research and scientific divers to detect undiscovered infestations.
Specific Target Audiences:	See database
Key Messages:	<i>Caulerpa</i> info (threat, legal status, biology), identification and reporting protocols
Actions:	<ul style="list-style-type: none"> • give presentations to universities offering scientific diving certifications or conducting scientific diving • pursue inclusion of <i>Caulerpa</i> ID into SCUBA training • provide information for posting on university SCUBA websites • Provide identification and contact literature
Materials:	ID info, presentation on ID and contact procedures, fact sheet, poster

In anticipation of outreach to all of these groups, a general informational brochure that could be distributed to all audiences was drafted and reviewed by the SCCAT Outreach Committee. With final printing of this pamphlet completed in Spring 2006.

Phase 4

Phase 4 of the outreach program involves conducting the outreach actions identified in Phase 3. Limited actions were initiated during this reporting year and are summarized by below. During this time period, a professional outreach/public relations firm was contracted to provide a focused strategy to provide outreach to audiences perceived to be more challenging, specifically the aquarium trade. Outreach activities intensified once they joined the effort and those actions will be reported on in the next annual outreach report covering 2007.

Research and Scientific Divers

All research diving programs in San Diego, Orange, and Los Angeles county were contacted about distributing informational materials or giving a presentation on surveillance for *Caulerpa*. Response was limited due to the small and highly transitory nature of these groups. Attempts will be made to re-contact them in the following school year.

In June and August 2006, the general informational brochure was distributed at the San Diego Oceans Foundation underwater training classes for volunteer divers conducting research on local reefs. At the June class, a brief explanation of the *Caulerpa* issue was given and a request made for a show of hands from people who had heard of *Caulerpa*. Twenty out of 65 were familiar with *Caulerpa*. An outreach representative did not attend the August class, however pamphlets were provided to the instructor for distribution. Brochures were also passed out to the 25 attendees of a San Diego Oceans Foundation presentation to volunteer research SCUBA divers on rockfish identification in August 2005.

Outreach presentations were also given to the San Diego Dive Club, Blue Water Dive Club, and the San Diego Council of Divers, an umbrella group for dive associations in San Diego County. Identification materials were provided to several diving websites and dive club newsletters to reach a wider audience.

Other Audiences

Preliminary outreach was conducted toward aquarium hobbyists by contacting all known saltwater hobbyist magazines regarding article submissions. Advanced Aquarist, an online magazine, agreed to publish an article about *Caulerpa* written by the outreach team and the circulation magazines agreed to allow us to submit an article for consideration. Hobbyist groups in Orange and LA counties were also contacted with requests to present at club meetings, with limited response.

Involvement in on-line saltwater aquarium discussions was also explored by registering as users and reviewing on-going discussions about *Caulerpa*. Standard informational responses will be prepared for posting in on-line forums that discuss *Caulerpa*.

Other environmental stewards regularly requested informational materials for distribution to their audiences. The informational pamphlet is the only material distributed during this reporting period, however supplemental materials will be distributed as they are developed. All materials distributed are tracked in a database by target group.

Evaluation

Evaluation of outreach efforts during this reporting period was focused on obtaining “pre-outreach” baseline information. One target audience are on-line sellers of aquarium supplies. In order to determine the availability of banned *Caulerpa* species on the Internet, an investigation into the ease or difficulty of obtaining *Caulerpa* was initiated in December 2006, to be completed in January 2007. Initial results suggest that *Caulerpa* is less popular than it has been in the past, is often substituted for by the seaweed *Chaetomorpha*, and that some vendors refuse to sell to California addresses. Final results will be used to target outreach efforts, which will likely take the form of paper and electronic letters to on-line sellers of *Caulerpa*, coordination with Ebay regarding their policy on sale of prohibited or restricted items, and possibly an insertion of an informational “pop-up” on reputable on-line vendor websites that would appear when buyers

search for *Caulerpa*. This survey will be repeated near the end of the outreach program to see if availability has decreased.

Outreach Costs

Quarterly spending on the Outreach and Education program during Year 6 totaled: January to March- \$9,281, April to June- \$11,027, July to September- \$11,122, and October to December- \$5,126. This funding was provided by the California Coastal Conservancy (through a Southern California Wetlands Recovery Project grant).

ERADICATION COSTS

During the sixth year of the eradication program at Agua Hedionda Lagoon, M&A performed many tasks, including SCCAT coordination and presentations, outreach, program development, reporting, and a variety of other tasks, as assigned. Expenses were considerably less than in prior years due the limited amount of field work. During the sixth year (January to December 2006), approximately \$145,500 was expended on the above-described work. This funding was provided by the California Coastal Conservancy (through a Southern California Wetlands Recovery Project grant). Since June 2000, eradication efforts at Agua Hedionda Lagoon have cost approximately \$3.49 million.

Additional costs of eradication not accounted for above include the contributions of all active SCCAT members including the California Department of Fish and Game, National Marine Fisheries Service, the San Diego and Santa Ana Regional Water Quality Control Boards, U.S. Department of Agriculture, UC Davis, Agua Hedionda Lagoon Foundation, and Cabrillo Power I LLC.

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APPENDIX – Eradication Declaration Ceremony Program