

State of Hawai'i  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
Division of Aquatic Resources  
Honolulu, Hawai'i 96813

July 13, 2007

Board of Land  
and Natural Resources  
Honolulu, Hawai'i

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to Dr. Stephen Karl, University of Hawai'i, Hawai'i Institute of Marine Biology (HIMB), for Access to State Waters to Conduct Coral Genetics Research Activities.

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of a Papahānaumokuākea Marine National Monument research permit to Dr. Stephen Karl, HIMB, pursuant to § 13-60.5, *Hawaii Administrative Rules*, and § 187A-6, *Hawaii Revised Statutes*, and all other applicable laws and regulations. The research permit, described below, will allow activity to occur in the NWHI State Marine Refuge (0-3 miles) waters surrounding French Frigate Shoals, and Pearl and Hermes Atoll. The activities will occur from August 13, 2007 through September 30, 2007, as outlined below and in the attached permit application.

INTENDED ACTIVITIES

The applicant proposes collect 3mm<sup>2</sup> coral samples for genetic analysis. The goal of this project is to assess the degree of genetic relatedness of individuals on patch reefs. The objective is to provide information on the diversity of coral reefs in the Monument. Coral diversity has direct bearing on reef health and robustness. The proposed activity will focus on basic habitat characterization to allow managers to determine the strategic value and vulnerability of coral reefs of the Monument. In any one region, all reefs are generally assumed to be equivalent, but the degree to which this is true is unknown.

PROCEDURES

A single, small patch reef will be selected at each site and will be the only site of potential impact. All collections will be done by divers working in teams of two. Divers will not touch the reef except to lay temporary transects and to collect coral samples. Small samples of less than 3mm<sup>2</sup> will be removed from the edge or terminal branchlets of the colonies. The amount and method of removal is equivalent or less in impact to natural predation (e.g., by parrot fish). Only the targeted species will potentially be impacted.

Species to be Collected:

Common name:

Lace coral  
Lobe coral

Scientific name:

*Pocillopora damicornis*  
*Porites lobata*

Number and size of specimens:

max 500 each species, samples no large than 3 mm

Collection location:

French Frigate Shoals -166° 15.78' W, 23° 49.94' N (reef 29). Coral patch reef in 6 to 15 meters.

Pearl and Hermes Atoll - exact site is to be determined but will be in the area bounded by 175° 49' W and 175° 44' W and 27° 58' N and 27° 49' N (i.e., inner lagoon). Coral patch reef at approximately 6 - 15 meters depth .

#### REVIEW PROCESS:

The permit application was sent out for review and comment to the following scientific entities: Division of Aquatic Resources staff, Papahānaumokuākea Marine National Monument, NOAA Pacific Islands Regional Office (NOAA-PIRO), and United States Fish and Wildlife Service. The Office of Hawaiian Affairs (OHA), and the Kahoolawe Island Reserve Commission (KIRC) were also consulted.

Comments received from the scientific community are summarized as follows:

1. If Hawaiian Monk Seals are in the area while performing any transect, camera drop, SCUBA operations, fishing activity, or sampling activity, the activity shall cease until the animal(s) depart the area.
2. The applicant and those listed on the permit shall view and be familiar with "marine Wildlife Viewing Guidelines" available at <http://www.nmfs.noaa.gov/pr/education/viewing.htm>
3. Applicants abide by new Disease Protocols

**Comments received from the Native Hawaiian community are summarized as follows:**

1. OHA requests that the research vessel have at least one cultural practitioner on board.
2. OHA urges the State to find all applications incomplete (and therefore will not be processed) if they do not include a reference to cultural research, consultation, and resulting protocol.
3. One reviewer requested that once a coral specimen is no longer required, that it be transferred to a Native Hawaiian Organization for a culturally appropriate method of disposal.

**RESPONSE:**

A meeting was held between HIMB researchers and administrators, and DAR staff, to discuss reviewer's (Scientific, Policy, and Cultural) concerns. The concerns raised by OHA were also discussed at the meeting. All applicants agreed to abide by the three comments received from the scientific community.

Additionally, it was the consensus of those in attendance, that in order to address the requests from OHA, more information is required from OHA. Specifically, a list of acknowledged cultural practitioners who are available to accompany specific research cruises should be provided by OHA; additionally, a briefing for science researchers should be arranged by OHA or a designate, to provide the information needed by individual applicants in order to address OHA's request for cultural impact analysis.

**IMPACT ANALYSIS**

Although some disturbances to Monument resources may be necessary to achieve the objective of this project, this research should have minimal impact on Monument resources. The effective management of marine protected areas requires detailed information regarding the species diversity of managed populations. This information is needed by the Co-Trustees to effectively manage the resources of the Monument. Therefore this study is important in defining the relevant units of management for the Monument and allow managers to determine the strategic value and vulnerability of coral reefs of the Monument. In any one region, all reefs are generally assumed to be equivalent, but the degree to which this is true is unknown. Therefore, the value of this research far outweighs the minimal effects of the research activities.

**FINAL STAFF RECOMMENDATIONS:**

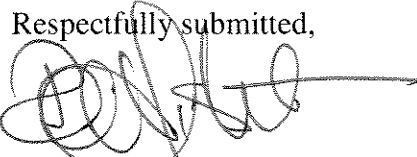
DAR staff is of the opinion that Applicant has properly demonstrated valid justifications for his application and should be allowed to enter the NWHI State waters and to conduct the activities therein as specified in the application with the following special instructions and conditions, which are in addition to the Papahānaumokuākea Marine National Monument Research Permit General Conditions:

1. Require Applicant to inform and consult with DAR regarding their cruise plan before each trip to the NWHI.
2. Research operations must cease if monk seals are present in the immediate vicinity.
3. No fishing is allowed in State Waters except as authorized under State law for subsistence, traditional, and customary practices by Native Hawaiians.
4. To prevent introduction of disease or the unintended transport of live organisms, the permittee must comply with the disease and transport protocol attached to this permit.
5. Tender and dive vessels operating within the Monument are encouraged to operate at slow speed and with a bow lookout in shallow water coral reef areas in order to minimize prop or bow damage to three dimensional coral reef habitat or endangered monk seals or sea turtles.
6. Tenders and small vessels must be equipped with engines that meet EPA emissions requirements.
7. Refueling of tenders and all small vessels must be done at the NOAA ship Hi'ialakai and outside the confines of the lagoons or near-shore waters.
8. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized research activity, including work involving a bioassay or bioprospecting, must be for non-commercial purposes, i.e., not involving the use or sale of any organisms, byproducts, or material collected within the Monument for obtaining patents or intellectual property rights for profit.
9. The permittee may not convey, transfer, or distribute, in any fashion (including, but not limited to, selling, trading, giving, or loaning) any coral, live rock, or organism collected under this permit without the express written permission of the Co-Trustees.


RECOMMENDATION:

“That the Board authorize and approve, with stated conditions, a Research Permit to Dr. Stephen Karl.”

Respectfully submitted,

  
for DAN POLHEMUS  
Administrator

APPROVED FOR SUBMITTAL

  
for ALLAN A. SMITH  
Interim Chairperson



Department of Land and Natural Resources  
Northwestern Hawaiian Islands Permit Application Review

Permit Type: Management  Recreation  Research   
Education  Cultural  Special Ocean Use

**Working Title:** Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to Dr. Stephen Karl, University of Hawai‘i, Hawai‘i Institute of Marine Biology (HIMB), for Access to State Waters to Conduct Coral Genetics Research Activities.

**Project Applicant:** Dr. Stephen Karl, HIMB

**Project Location(s) (Both State Waters and Monument):** French Frigate Shoals, and Pearl and Hermes Atoll.

**Project Dates and Duration:** August 13, 2007 through September 30, 2007

**Project Précis & Background** (*Summary of project and why this is proposed*):

The applicant proposes collect 3mm<sup>2</sup> coral samples for genetic analysis. The goal of this project is to assess the degree of genetic relatedness of individuals on patch reefs. The objective is to provide information on the diversity of coral reefs in the Monument. Coral diversity has direct bearing on reef health and robustness. The proposed activity will focus on basic habitat characterization to allow managers to determine the strategic value and vulnerability of coral reefs of the Monument. In any one region, all reefs are generally assumed to be equivalent, but the degree to which this is true is unknown.

**Are there other relevant permits that have/will be issued with regard to this project?** No

What is the relevance to management and/or the improved understanding of NWHI & MHI? this study is important in defining the relevant units of management for the Monument and allow managers to determine the strategic value and vulnerability of coral reefs of the Monument. In any one region, all reefs are generally assumed to be equivalent, but the degree to which this is true is unknown.

**Could work be conducted outside the NWHI?:** Yes  No

**Has Applicant been granted a permit from the State in the past?** Yes

**If so, please summarize past permits:**

Permit No. DLNR.NWHI06R009 was issued to the applicant in 2006 for similar research

**Have there been any a) violations:** Yes  No  **b) late/ incomplete reports:** Yes  No   
**Any other relevant concerns from previous permits?** No

**Recommendations:**

**DAR Staff:** Approve this permit application  Reject this permit application   
**NH CWG:** Approve this permit application  Reject this permit application

**Additional Comments:**

## Northwestern Hawaiian Islands Marine National Monument Permit Application

**NOTE: This Permit Application (and associated Instructions) are for activities to be conducted in the Northwestern Hawaiian Islands Marine National Monument, including Hawaiian Islands National Wildlife Refuge, the Midway Atoll National Wildlife Refuge, Battle of Midway National Memorial, Northwestern Hawaiian Islands State Marine Refuge, Kure Atoll Hawaii State Seabird Sanctuary, and the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, please provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historical and cultural resources of the NWHI Marine National Monument (Monument).**

### Summary Information

**Applicant name:**

Stephen A. Karl

**Permit categories:**

- Research – Please fill out Sections A-D (as applicable) and Appendix A
- Conservation and Management - Please fill out Sections A-D (as applicable) and Appendix A
- Education - Please fill out Sections A-D (as applicable) and Appendix B
- Native Hawaiian Practices - Please fill out Sections A-D (as applicable) and Appendix C
- Recreation (Midway ONLY) - Please fill out Sections A-D (as applicable) and Appendix D
- Special Ocean Use - Please fill out Sections A-D (as applicable) and Appendix E

**Briefly describe permit activity:**

collect 3cm<sup>2</sup> samples of the corals *Porites lobata* and *Pocilloproa damicornis*

- This application is for a RENEWAL of an existing permitted project.
- This application is for a NEW project.

**When will the activity take place?**

From: 08/01/2007 To:08/26/2007

**NOTE: INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED**

Please Send Permit Applications to:

NWHI Marine National Monument Permit Coordinator

6600 Kalaniana'ole Hwy. # 300

Honolulu, HI 96825

[nwhipermit@noaa.gov](mailto:nwhipermit@noaa.gov)

PHONE: (808) 397-2660 FAX: (808) 397-2662

**NOTE: SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR ADDITIONAL SUBMITTAL INSTRUCTIONS, PLEASE SEE PG 7.**

## **Section A - Applicant Information**

### **1. Applicant**

Name (last, first, middle initial): Karl, Stephen A.

Title: Associate Researcher

**2. Mailing address (street/P.O. box, city, state, country, zip):** P.O. Box 1346. Kaneohe, HI, 96744

Phone: 808-236-7478

Fax: 808-236-7443

Email: skarl@hawaii.edu

For students, major professor's name, telephone and email address:

**3. Affiliation (institution/agency/organization directly related to the proposed project):**

Hawaii Institute of Marine Biology, School of Earth Science and Technology, University of Hawaii, Manoa

**4. Additional persons to be covered by permit:**

Kelvin Gorospe, University of Hawaii/Hawaii Institute of Marine Biology, 808-236-7448, kgorospe@hawaii.edu

Jill Zamzow, Hawaii Division of Aquatic Resource, 808-721-6479, Jill.Zamzow@noaa.gov

Michael Stat, Hawaii Institute of Marine Biology, 808-236-7420, stat@hawaii.edu

other field assistants to be determined. Personnel list will be forwarded to the Monument Office when finalized.

**Section B: Project Information**

**5a. Project location(s):**

- |  |                                     |   |
|--|-------------------------------------|---|
| <input type="checkbox"/> Nihoa Island                      | <input type="checkbox"/> Land-based | <input type="checkbox"/> Ocean-based            |
| <input type="checkbox"/> Necker Island (Mokumanamana)      | <input type="checkbox"/> Land-based | <input type="checkbox"/> Ocean-based            |
| <input checked="" type="checkbox"/> French Frigate Shoals  | <input type="checkbox"/> Land-based | <input checked="" type="checkbox"/> Ocean-based |
| <input type="checkbox"/> Gardner Pinnacles                 | <input type="checkbox"/> Land-based | <input type="checkbox"/> Ocean-based            |
| <input type="checkbox"/> Maro Reef                         |                                     |   |
| <input type="checkbox"/> Laysan Island                     | <input type="checkbox"/> Land-based | <input type="checkbox"/> Ocean-based            |
| <input type="checkbox"/> Lisianski Island, Neva Shoal      | <input type="checkbox"/> Land-based | <input type="checkbox"/> Ocean-based            |
| <input checked="" type="checkbox"/> Pearl and Hermes Atoll | <input type="checkbox"/> Land-based | <input checked="" type="checkbox"/> Ocean-based |
| <input type="checkbox"/> Midway Atoll                      | <input type="checkbox"/> Land-based | <input type="checkbox"/> Ocean-based            |
| <input type="checkbox"/> Kure Atoll                        | <input type="checkbox"/> Land-based | <input type="checkbox"/> Ocean-based            |
| <input type="checkbox"/> Other                             |                                     |   |

NOTE: Please note there is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

**Location Description:**

French Frigate Shoals -166 °15.78' W, 23° 49.94' N (reef 29). Coral patch reef in 6 to 15 meters. Pearl and Hermes Atoll - exact site is to be determined but will be in the area bounded by 175° 49' W and 175° 44' W and 27° 58' N and 27° 49' N (i.e., inner lagoon).Coral patch reef at approximately 6 - 15 meters depth.

**5b. Check all applicable regulated activities proposed to be conducted in the Monument:**

- Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving monument resource
- Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
- Anchoring a vessel
- Deserting a vessel aground, at anchor, or adrift
- Discharging or depositing any material or matter into the monument
- Touching coral, living or dead
- Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the monument
- Attracting any living monument resource
- Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
- Subsistence fishing (State waters only)
- Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

## **6. Purpose/Need/Scope *State purpose of proposed activities:***

To collect 3mm<sup>2</sup> coral samples for genetic analysis. The goal of this project is to assess the degree of genetic relatedness of individuals on patch reefs. The objective is to provide information on the diversity of coral reefs in the NWHIMNM. Coral diversity has direct bearing on reef health and robustness.

## **7. As explained further in the instructions, please provide any information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historical and cultural resources of the Monument:**

A single, small patch reef will be selected at each site and will be the only site of potential impact. All collections will be done by divers working in teams of 2. Divers will not touch the reef except to lay temporary transects and to collect coral samples. Small samples will be removed from the edge or terminal branchlets of the colonies. The amount and method of removal is equivalent or less in impact to natural predation (e.g., by parrotfishes). Only the targeted species will potentially be impacted.

The proposed activity will focus on basic habitat characterization to allow managers to gauge the strategic value and vulnerability of coral reefs of the NWHIMNM. In any one region, all reefs are generally assumed to be equivalent, but the degree to which this is true is unknown. Given the propensity for clonal reproduction and longevity of coral, however, this may not be the case. If individual reefs represent unique units then management decisions may need to be made on a reef by reef basis. Is the individual reef, the atoll, or the archipelagos the most appropriate management unit for coral reefs? If a reef is destroyed by a vessel grounding or killed by disease, have unique, valuable resources been lost or is the diversity preserved by unaffected neighboring reefs. If unique resources have been lost, what is the magnitude of the loss. This research aims to delineate the fundamental management unit of coral reefs. The research will have minimal direct and no indirect or secondary effects on Monument resources. This is a one-time effort and will not have accumulated effects. No longterm effects are anticipated.

Given that diversity can be controlled by highly localized processes, there is no practical alternative to conducting this research within the Monument. There is no basis on which to assume that the results of a similar study conducted outside the Monument will accurately inform management decisions within the Monument. I have previously conducted genetic research in the Caribbean, Main Hawaiian Islands, and the NWHI and have nearly 30 years experience working on genetics of marine systems. The activities for this research are financially supported by a NOAA-HIMB partnership grant and from the National Science Foundation and are more than adequate for the proposed activities.

## **8. Procedures:**

Map all individuals of *Porites lobata* and *Pocillopora damicornis* by intensive sampling of a patch reef at French Frigate Shoals (previously partially sampled) and one at Pearl & Hermes.

The coordinates of each individual colony will be recorded in a GIS database, using a Global Positioning System Intelligent Buoy system.

All individuals and the surrounding area will be photographed to be included in the GIS database, using high-resolution digital photography.

Genotype all individuals of both species on the reef.

Small samples (less than 3 cm<sup>2</sup>) of each individual will be collected during the mapping effort to be genotyped at a minimum of 10 microsatellite loci. These genetic markers are capable of producing a genetic fingerprint that is unique for each individual.

Development of genetic tools

To identify all individuals on the reef (i.e., genets and ramets), we have developed a microsatellite-enriched library for both species following procedures that have been successful for corals in my laboratory (Severance et al. 2004). Primers to a minimum of 10, unlinked microsatellite loci per species are being developed and tested on a sample of individuals (~15), to confirm reliability and variability. The few previous genetic studies of corals using microsatellite loci have found a significant amount of per locus variation. Our study on *Montastrea* spp. (Severance and Karl 2004, 2006) in the Caribbean found an average of 21 alleles per locus and an average heterozygosity of 63%; more than enough variation to accurately genetically identify individuals.

Coral samples will be collected by carefully removing a less than 3-cm<sup>2</sup> piece either at the base or edge of the colony. After collecting, samples will be stored in 95% EtOH. DNA will be extracted following standard procedures (Severance et al. 2004) in the laboratory at HIMB.

#### Surveying and sampling

We will near-saturation survey and sample *Porites lobata* and *Pocillopora damicornis* on a small patch reef. Initial sampling will target clearly separated individual colonies and 1-meter sampling of broadly encrusting individuals. Sampling is expected to amount to ~300-500 specimens of each species.

The Intelligent GPS Buoy System (GBS) consists of four buoys with underwater acoustic receivers connected to above water GPS units. The divers carry a small, depth-recording acoustic transmitter with which the receivers can triangulate a position. Although the system has demonstrated sub-meter accuracy (~20 cm), each coral colony also will be photographed and referenced relative to a minimum of three GPS points on the reef. Colonies of *Porites lobata* will be sexed with histology.

French Frigate shoals and Pear & Hermies are ideal spots because they are coral rich, accessible and have numerous localized patch reefs. This allows us to select a moderately small reef where we can survey all individuals in a discrete area without having to sample an inordinate or unmanageable number of individuals.

Divers will set up temporary transect markers at each side of a small patch reef. All colonies of *Porites lobata* and *Pocillopora damicornis* along the transect line will be located using underwater GPS system, photographed with size standard, and sampled by removing a small (less than 3 cm<sup>2</sup>) piece near the base or edge of the colony. Great care will be taken to minimally impact the individual. At the end of the dive, samples will be transferred to numbered vials and preserved with 95% Ethyl alcohol thus being rendered non-viable. Samples will be transported at the end of the cruise to the Hawaii Institute of Marine Biology. DNA will be extracted from each sample using standard procedures. DNA will be used in polymerase chain reaction amplification of 10 highly variable simple sequence loci. These loci are capable of identifying all genets uniquely.

The NOAA vessel *Hi'ialakai* will be used as transport to the NWHI. At each site, divers will be taken to the collecting site in an AMBAR Marine jet boat. The jet boat will be anchored in the sand near the reef. No other areas will need to be accessed. No assistant from Monument staff will be needed to maintain equipment or collect data or samples.

Severance, EG and SA Karl. 2006. Contrasting population genetic structures of sympatric mass-spawning Caribbean corals. *Marine Biology* 150:57-68.

Severance, EG, AM Szmant, and SA Karl. 2004. Microsatellite loci isolated from the Caribbean coral, *Montastraea annularis*. *Mol. Ecol. Note.* 4:74-76.

## **Section C: Logistics**

### **9. Other permits (list and attach documentation of all other related Federal or State permits):**

No other current permits. Previous permits in 2006: US Fish and Wildlife Service #12521-06029, State of Hawaii, Department of Land and Natural Resources #DLNR>NWHI06R009,

### **9a. For each of the permits listed, please identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Please explain the circumstances surrounding the violation or permit suspension, amendment, modification or revocation.**

none

### **10. Funding sources (Please attach copies of your budget, specific to proposed activities under this permit and include funding sources. Please see instructions for more information):**

Detailed budget information is available upon request from the Monument Permit Coordinators, and sufficient funding exists to complete the research outlined herein. This research is currently, or has been previously, funded by a combination of the following agency sources:

- 1) NWHIMNM-HIMB partnership
- 2) National Science Foundation
- 3) The University of Hawaii

### **11. Time frame:**

Activity start: 2006

Activity completion: 2008

**Dates actively inside the Monument:**

**From:** Planned 1 August 2007  
**To:** Planned 25 August 2007

**Please describe any limiting factors in declaring specific dates of the proposed activity at the time of application:**

We have provided the dates based on the draft NOAA cruise schedule for 2007. We are awaiting final word from the NOAA vessel Hi'ialakai regarding the exact dates of departure and return.

**Personnel schedule in the Monument:**

DAY	DATE	LOCATION	ACTIVITY
1	1-Aug	Honolulu	depart 0800, transit to FFS
2	2-Aug	transit	transit
3	3-Aug	arr FFS, SE corner	full day dive ops
4	4-Aug	FFS	full day dive ops
5	5-Aug	FFS	full day dive ops
6	6-Aug	FFS	full day dive ops
7	7-Aug	FFS	full day dive ops, depart 1830, transit to P&H
8	8-Aug	transit	transit
9	9-Aug	transit	transit
10	10-Aug	arr P&H early a.m.	full day dive ops
11	11-Aug	P&H	full day dive ops
12	12-Aug	P&H	full day dive ops
13	13-Aug	P&H	full day dive ops
14	14-Aug	P&H	full day dive ops, depart 1900, transit to MID
15	15-Aug	arr MID early a.m.	2/3 day dive ops
16	16-Aug	MID	2/3 day dive ops, depart 1800, transit to KUR
17	17-Aug	arr KUR early a.m.	full day dive ops
18	18-Aug	KUR	full day dive ops
19	19-Aug	KUR	full day dive ops
20	20-Aug	KUR	full day dive ops, depart 1830, transit to Honolulu
21	21-Aug	transit	transit
22	22-Aug	transit	transit
23	23-Aug	transit	transit
24	24-Aug	transit	transit
25	25-Aug	transit	arr Honolulu approx 1830

**12. Please indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument:**

All scientific personnel aboard the NOAA vessel Hi'ialakai will be covered by UH

**13. Please check the appropriate box to indicate how personnel will enter the Monument:**

- Vessel
- Aircraft

Provide Vessel and Aircraft information:

**14. What certifications/inspections do you have scheduled for your vessel? Please fill in scheduled date (attach documentation):**

- Rodent free, Date:
- Tender vessel, Date:
- Ballast water, Date:
- Gear/equipment, Date:
- Hull inspection, Date:

**15. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):**

Vessel name:

Vessel owner:

Captain's name:

IMO#:

Vessel ID#:

Flag:

Vessel type:

Call sign:

Embarkation port:

Last port vessel will have been at prior to this embarkation:

Length:

Gross tonnage:

Total ballast water capacity volume (m3):

Total number of ballast water tanks on ship:

Total fuel capacity:

Total number of fuel tanks on ship:

Marine Sanitation Device:

Type :

How will you comply with the 'No Discharge' regulations stipulated in Presidential Proclamation 8031? Describe in detail. If applicable, please attach schematics of the vessel's discharge and treatment systems:

Other fuel/hazardous materials to be carried on board and amounts:

Please provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Please provide the name and contact information of the contractor responsible for installing the VMS system. Please also describe unit name and type:

**16. Tender information:**

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? Please list the number of tenders/skiffs aboard and specific types of motors:

The Hi'ialakai tender vessels include:  
HI-1 (8m) in-board jetboat  
HI-2 (10m) in-board jetboat  
Inflatable/whaler with outboard motor

**Section D: Additional Information for Land Based Operations**

**17. Proposed movement of personnel, gear, materials, and, if applicable, samples:**

**18. Room and board requirements on island:**

**19. Work space needs:**

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**PLEASE SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE BELOW:**

NWHI Marine National Monument Permit Coordinator  
6600 Kalaniana'ole Hwy. # 300  
Honolulu, HI 96825  
FAX: (808) 397-2662

**DID YOU INCLUDE THESE?**

- Applicant CV/Resume/Biography
- Electronic and Hard Copy of Application with Signature
- Map(s) or GPS point(s) of Project Location(s), if applicable
- Funding Proposal(s)
- Funding and Award Documentation, if already received
- Documentation of Insurance, if already received
- Documentation of Inspections
- Documentation of all required Federal and State Permits or applications for permits
- Statement of information you wish to be kept confidential

## **Appendix A: Research OR Conservation and Management Application**

**NOTE: If land or marine archeological activities are involved, please contact the Monument Permit Coordinator at the address on the general application form before proceeding, as a customized application will be needed. For more information, please contact the Monument office on the first page of this application.**

**1a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):**

Removal of less than 3mm<sup>2</sup> pieces of coral colonies during SCUBA dive.

Common name:

Lace coral  
Lobe coral

Scientific name:

Pocillopora damicornis  
Porites lobata

# & size of specimens:

max 500 each species, samples no large than 3 mm<sup>2</sup>

Collection location:

French Frigate Shoals -166 °15.78' W, 23° 49.94' N (reef 29). Coral patch reef in 6 to 15 meters. Pearl and Hermes Atoll - exact site is to be determined but will be in the area bounded by 175° 49' W and 175° 44' W and 27° 58' N and 27° 49' N (i.e., inner lagoon). Coral patch reef at approximately 6 - 15 meters depth

Whole Organism  Partial Organism

**1b. What will be done with the specimens after the project has ended?**

Preserved non-viable tissue samples suitable for DNA work will be archived at HIMB for future permitted uses. PI Karl will be responsible for the database which will track each sample and will be the lead contact for persons wishing to access the tissue sample collection. No samples will be provided to researchers outside HIMB without prior consent of the Monument Permit Coordinators

**1c. Will the organisms be kept alive after collection?**  Yes  No

• Specific site/location:

• Is it an open or closed system?  Open  Closed

• Is there an outfall?  Yes  No

• Will these organisms be housed with other organisms? If so, what are the other organisms?

• Will organisms be released?

## **2. If applicable, how will the collected samples or specimens be transported out of the Monument?**

Preserved in EtOH or salt saturated DMSO and transported aboard the NOAA vessel Hi'ialakai

## **3. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:**

Whenever possible, all researchers at HIMB share the same single collected sample. For example, research done by the Rappé, Karl, Gates and Toonen labs all rely on a single coral biopsy sample that is subsequently split among the labs for different genetic analyses. Further, we are developing a tissue sample bank that will be available for future research and will not require re-sampling of the individuals in our collection. An electronic database of all samples will be provided to the Monument upon completion of the studies outlined here. This database will be searchable against future permit requests and can reduce the need for return trips to collect tissue samples in the NWHI, and prevent duplicative sampling efforts.

### **4a. Gear and materials:**

We will collect samples by hand using hammer and chisel during SCUBA diving. Each collector will have standard SCUBA gear (mask, fins, snorkel, wetsuit, tank, BCD) and a collection bag in which to store gear and samples as they are collected. One diver will also have a high resolution digital camera in an underwater housing to photo-document the collections and any individuals that can be located from collections made in previous years. Standard nylon measuring tapes will be used as temporary transect lines to record the location of each colony samples. The transect lines will have GPS fixes using a portable underwater GPS system. This system consists of four or five buoys consisting of floats, a hydrophone, and a GPS unit. The location of the buoys is radioed to the tender vessel and recorded on a computer. Underwater locations are determined by triangulation from the buoy hydrophones to a pinger hand-held by the diver. GPS array is only deployed while active on site and is retrieved at the end of each dive day.

### **4b. Please list all Hazardous Materials you propose to take to and use within the Monument:**

Tissue preservative solutions for DNA analyses include: 95% ethanol (EtOH), MSDS attached, and saturated salt buffer with dimethylsulfoxide (DMSO), MSDS attached. Both EtOH and DMSO are of the grade commonly sold for human consumption, and should not pose a significant health or environmental risk. A maximum of 5 gal each of EtOH and DMSO as liquid will be stored in the original containers in a explosive proof cabinet. Additionally, small aliquotes (~5 ml) will be in sealed collecting vials. Approximately 1,100 vials will be on hand. All materials will be removed from the Monument at the completion of the cruise. Samples are placed directly into the liquid in the 5 ml vials and resealed. No EtOH or DMSO will be discarded in the Monument. The underwater GPS system includes one 12V marine, Wet Storage Battery (MSDS attached).

## **5. Fixed installations and instrumentation:**

none

**6. Provide a time line for sample analysis, data analysis, write-up and publication of information:**

Time to study completion depends on having a complete sampling of individuals and sites. Once sampling is complete (expected in 2008), then analysis of samples is usually completed within roughly a year. Data analysis and write-up usually take no more than an additional year, although the turn-around time for some journals now exceeds 800 days, so time to publication can still be considerable post-submission of the study.

Regardless of the time to publication, the results from these studies are made available to Monument managers as quickly as possible. Monthly brown-bag luncheons at HIMB allow researchers to highlight important or interesting new results and discuss them with the agency members responsible for the Monument. In addition, we hold biannual mini-symposia during which researchers present the most current findings from their ongoing research in the Monument. These efforts ensure that research results are provided to the Monument co-trustees almost as quickly as they become available.

**7. List all publications directly related to the proposed project:**

none as of this date

**DID YOU INCLUDE THESE?**

Material Safety Data Sheets for Hazardous Materials

## **Appendix B: Education Application**

**1. Are you collaborating with others in any way to reduce duplicative activities in the Monument or elsewhere?**

**2. Gear and materials:**

**3. Fixed installations and instrumentation:**

**4. Is your proposed activity based on a State Department of Education Standards Based Curriculum? If so, please describe:**

**5. What materials, products or deliverables will be developed as a result of your proposed activity? Provide a time line for write-up and publication of information or production of educational materials:**

**6. List all publications/references directly related to the proposed project:**

**7a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):**

Common name:

Scientific name:

# & size of specimens:

Collection location:

Whole Organism  Partial Organism

**7b. What will be done with the specimens after the project has ended?**

**7c. Will the organisms be kept alive after collection?**  Yes  No

• Specific site/location:

• Is it an open or closed system?  Open  Closed

• Is there an outfall?  Yes  No

• Will these organisms be housed with other organisms? If so, what are the other organisms?

• Will organisms be released?

**8. If applicable, how will the collected samples be transported out of the Monument?**

### **Appendix C: Native Hawaiian Practices Application**

**1. Please state how the purpose and intent of the activity are appropriate and deemed necessary by traditional standards in the Native Hawaiian culture (pono), and demonstrate an understanding of, and background in, the traditional practice, and its associated values and protocols:**

**2. Please state how the activity benefits the resources of the Northwestern Hawaiian Islands and the Native Hawaiian community:**

**3. Please state how the activity supports or advances the perpetuation of traditional knowledge and ancestral connections of Native Hawaiians to the Northwestern Hawaiian Islands:**

**4. Will you be collecting any Monument resource?  Yes  No**  
**If so, please provide the following information:**

**4a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):**

Common name and/or Scientific name:

# & size of specimens:

Collection location:

Whole Organism  Partial Organism

**4b. What will be done with the specimens after the Native Hawaiian cultural practice is complete?**

**4c. Will organisms be kept alive after collection?  Yes  No**

• Specific site/location:

• Is it an open or closed system?  Open  Closed

• Is there an outfall?  Yes  No

• Will these organisms be housed with other organisms? If so, what are the other organisms?

• Will organisms be released?

**NOTE: Any Monument resource harvested from the Monument for the purpose of Native Hawaiian practices will be consumed in the Monument.**

**5. Are you collaborating with others in any way to reduce duplicative activities in the Monument or elsewhere?**

**6. Gear and materials:**

**7. Will you erect any Native Hawaiian cultural structures or leave any offerings in the Monument?**  Yes  No

**If so, please describe:**

**8. Will you produce any publications, educational materials or other deliverables?**  
 Yes  No

**Provide a time line for write-up and publication of information or production of materials:**

**Appendix D: Recreation Application**

For Activities in the Midway Atoll Special Management Area Only

**1. Please explain how the activity is for the purpose of recreation as defined: An activity conducted for personal enjoyment that does not result in the extraction of Monument resources and that does not involve a fee-for-service transaction:**

**2. Other Associated Monument Permits:**

**3. Gear and materials:**

**4. Fixed installations and instrumentation:**

### **Appendix E: Special Ocean Use Application**

**NOTE: If this is a first time Special Ocean Use activity, it will be subject to a pilot project.**

**1. Please provide proof of general liability insurance, or indicate that you will be posting an equivalent bond against claims arising out of activities conducted under the permit:**

**2. Are you collaborating with others in any way to reduce duplicative activities in the Monument or elsewhere?**

**3. Gear and materials:**

**4. Fixed installations and instrumentation:**

**5. List all publications directly related to the proposed project:**

For projects occurring with the Midway Atoll Special Management Area answer the following questions:

**6. Please explain how your activity has been found compatible with the purposes for which the Midway Atoll National Wildlife Refuge was designated?**

**7. Please explain how your activity meets the requirement of furthering conservation and management of the Monument:**

For projects occurring outside of the Midway Atoll Special Management Area answer the following questions:

**8. Please explain how the proposed activity will directly benefit the conservation and management of the Monument:**

**9. Please explain how the purpose of the proposed activity is for research and education related to resources or qualities of the Monument:**

**NOTE: SPECIAL OCEAN USE PERMITS OUTSIDE THE MIDWAY ATOLL SPECIAL MANAGEMENT AREA DO NOT ALLOW THE USE OF A COMMERCIAL PASSENGER**

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**VESSEL.** A commercial passenger vessel is defined by the monument regulations as a vessel that carries individuals who have paid for such carriage.

## Stephen A. Karl

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<b>EMPLOYMENT</b>	08/05 – Present	Associate Research Professor, HIMB
	08/99 – 08/05	Associate Professor, University of South Florida
	12/93 – 08/99	Assistant Professor, University of South Florida
<b>POST-GRADUATE TRAINING</b>	04/92 - 12/93	Post-Doctoral Fellow, Rutgers University Center for Theoretical & Applied Genetics New Brunswick, New Jersey Advisor: Robert Vrijenhoek
<b>GRADUATE TRAINING</b>	09/87 - 04/92	Ph. D. Genetics, awarded March 1992 University of Georgia, Athens, GA Dissertation Advisor: John C. Avise
	07/88 - 04/92	NIH Training Grant in Genetics University of Georgia, Athens, GA
	07/87 - 07/88	Teaching Assistant, General Biology University of Georgia, Athens, GA
	09/86 - 08/87	Ph. D. Genetics, Transferred University of California, Davis CA Dissertation Advisor: Francisco Ayala
	09/86 – 08/87	Teaching Assistant, General and Population Genetics University of California, Davis CA
	12/83 - 09/86	Research Assistant Hubbs-Sea World Research Institute, San Diego, CA Marine Fish Stock Assessment and Marine Mammal Demography.
<b>POST BACCALAUREATE TRAINING</b>	06/83 - 12/83	Field Research Assistant Marine Review Committee, San Diego, CA Ecological Studies of Near Shore Kelp Forests.
	05/82 - 06/83	Database Manager Neushul Mariculture Inc., Santa Barbara, CA Use of Near Shore Kelp Forests for Biomass Energy.

**REFEREED PUBLICATIONS**

1. Jansen, K.J. and S.A. Karl. Population genetics of the mangrove salt marsh snake, Nerodia clarkii compressicauda, in a fragmented, linear habitat. Submitted 11/2006 *Conservation Genetics*.
2. Rice, S.A., S.A. Karl, and K.A. Rice. 2007. The Polydora cornuta complex (Annelida: Polychaeta) in North America contains populations that are reproductively isolated and genetically distinct. Accepted with revisions 11/2006 *Invertebrate Biology*.
3. Curtis, C., B.S. Stewart, and S.A. Karl. 2007. Molecular identification of the sex of pinnipeds. Accepted with revisions 10/2006 *Conservation Genetics*.
4. Schwartz, T.S. and S.A. Karl. 2007. Population genetic assignment and the origin of confiscated gopher tortoises, (Gopherus polyphemus). Accepted with revisions 10/2006 *Biological Conservation*.
5. Severance, E.G. and S.A. Karl. 2006. Contrasting population genetic structure of sympatric mass-spawning Caribbean corals. *Marine Biology* 150:57-68.
6. Pierce, S.K., N.E. Curtis, S.E. Massey, A.L. Bass, S.A. Karl, and C.M. Finney. 2006. A morphological and molecular comparison between Elysia crispata and a new species of kleptoplastic sacoglossan sea slug (Gastropoda: Opisthobranchia from the Florida Keys, USA. *Molluscan Research* 26:23-38.
7. Moon, J.C., E.D. McCoy, H.R. Mushinsky, and S.A. Karl. 2006. Multiple Paternity and Breeding System in the Gopher Tortoise, Gopherus polyphemus. In Press. *Journal of Heredity* 97:150-157.
8. Bass, A.L., H. Dewar, T. Thys, J.T. Streebman, and S.A. Karl. 2005. Evolutionary divergence among lineages of the ocean sunfish family, Molidae. *Marine Biology* 148:405-414.
9. Bass, A.L. and S.A. Karl. 2005. Molecular phylogenetic analysis of the genera in the family Plakobranchidae (Mollusca: Opisthobranchia: Sacoglossa). In press, 2005. *Proceedings of the Special Symposium on the Biology and Systematics of Opisthobranch Mollusks, The World Congress Of Malacology*.
10. Schwartz, T.S. and S.A. Karl. 2006. Population and Conservation Genetics of the Gopher Tortoise (Gopherus polyphemus). In press, *Conservation Genetics* DOI 10.1007/S10592-005-9078-5.
11. Cattell, M. and S.A. Karl. 2004. Genetics and morphology in a Borrchia frutescens and B. arborescens (Asteraceae) hybrid zone. *American Journal of Botany* 91:1757-1766
12. Hayes, K. and S.A. Karl. 2004. Characterization of microsatellite markers from the gastropod genus Melongena. *Molecular Ecology Primer Notes* 4:755-757/
13. Roberts, M., T. Schwartz and S.A. Karl. 2004. Global population structure and male-mediated gene flow in the green turtle (Chelonia mydas): Microsatellite analysis. *Genetics* 166:1857-1870.
14. Seminoff, J.A., S.A. Karl, T. Schwartz, and A. Resendiz. 2004. Hybridization of Chelonia mydas and Eretmochelys imbricata in the Pacific Ocean: Indication of an absence of gender bias in the directionality of crosses. In press, *Bulletin of Marine Science* 73:643-652.

15. Severance, E.G., A.M. Szmant, and **S.A. Karl**. 2004. Single-copy gene markers isolated from the Caribbean coral, Montastraea annularis. *Molecular Ecology Primer Notes* 4:167-169.
16. Severance, E.G., A.M. Szmant, and **S.A. Karl**. 2004. Microsatellite loci isolated from the Caribbean coral, Montastraea annularis. *Molecular Ecology Primer Notes* 4:74-76.
17. Streebman, J.T., C. Puchlutegui, A.L. Bass, T. Thys, H. Dewar, and **S.A. Karl**. 2003. Microsatellites from the world's heaviest bony fish, the giant Mola mola. *Molecular Ecology Primer Notes* 3: 247-249.
18. Schwartz, T.S., M. Osentoski, T. Lamb, and **S.A. Karl**. 2003. Microsatellite loci for the genus Gopherus (Testudines: Testudinidae) and their applicability to other turtle species. *Molecular Ecology Primer Notes* 3: 283-286
19. Streebman, J.T., M. Alfaro, M.W. Westneat, D.R. Bellwood, and **S.A. Karl**. 2002. Evolutionary history of the parrotfishes: Biogeography, ecomorphology, and comparative diversity. *Evolution* 56:961-971.
20. **Karl, S.A.** and D.S. Wilson. 2001. Phylogeography and systematics of the mud turtle, Kinosternon baurii. *Copeia* 101:797-801.
21. Schulze, S.R., S.A. Rice, J. L. Simon, and **S.A. Karl**. 2000. Evolution of poecilogony and the biogeography of North American populations of the polychaete, Streblospio. *Evolution* 54:1247-1259.
22. **Karl, S.A.** and B.W. Bowen. 1999. Evolutionary significant units versus geopolitical taxonomy: Molecular systematics of an endangered sea turtle (genus Chelonia). *Conservation Biology* 13:990-999
23. Garzon, M., N. Jonoska, and **S.A. Karl**. 1999. The bounded complexity of DNA computing. *Biosystem* 52:63-72.
24. Streebman, J.T., R. Zardoya, A. Meyer, and **S.A. Karl**. 1998. Multilocus phylogeny of cichlid fishes (Pisces: Perciformes): Evolutionary comparison of microsatellite and single-copy nuclear loci. *Molecular Biology and Evolution* 15:798-808.
25. Jonoska, N. and **S.A. Karl**. 1998. Molecular computation of the road-coloring problem. In: *DIMACS Series in Discrete Mathematics and Theoretical Computer Science*. Landweber, L.F. and E.B. Baum (eds.) 44:87-96.
26. Jonoska, N., **S.A. Karl**, and M. Saito. 1998. Graph structures in DNA computing. In: *Computing with Bio-Molecules: Theory and Experiments*. Paun, G. (ed.) Springer-Verlag Singapore Pte. Ltd., Singapore.
27. Streebman, J. T. and **S.A. Karl**. 1997. Paradigms and the rise (or fall?) of molecular biology. *Nature Biotechnology* 15:696-697.
28. Streebman, J. T. and **S.A. Karl**. 1997. Reconstructing labroid evolution with single-copy nuclear DNA. *Proceedings of the Royal Society, London, Series B* 264:1011-1020.
29. Jonoska, N. and **S.A. Karl**. 1997. Ligation experiments in computing with DNA. In: *Proceedings of 1997 IEEE International Conference on Evolutionary Computation (ICEC 1997)*. 13-16 April. Pp. 261-265.

30. Jonoska, N., **S.A. Karl**, and M. Saito. 1997. Creating 3-dimensional graph structures with DNA. *DIMACS Series in Discrete Mathematics and Theoretical Computer Science* 48:123-135.
31. Hare, M.P., **S.A. Karl** and J.C. Avise. 1996. Anonymous nuclear DNA markers in the American oyster and their implications for the heterozygote deficiency phenomenon in marine bivalves. *Molecular Biology and Evolution* 13:334-345.
32. **Karl, S.A.**, S. Schutz, D. Desbruyères, R.C. Vrijenhoek and R. Lutz. 1996. Molecular analysis of gene flow in the hydrothermal-vent clam, *Calyptogena magnifica*. *Molecular Marine Biology and Biotechnology* 5:193-202.
33. Zardoya, R., D.M. Vollmer, C. Craddock, J.T. Streebman, **S.A. Karl** and A. Meyer. 1996. Evolutionary conservation of microsatellite flanking regions and their utility in resolving the phylogeny of cichlid fishes (Pisces: Perciformes). *Proceedings of the Royal Society, London, Series B* 263:1611-1618.
34. **Karl, S.A.**, B.W. Bowen and J.C. Avise. 1995. Hybridization among the ancient mariners: Molecular genetic identification and characterization of marine turtle hybrids. *Journal of Heredity* 86:262-268.
35. **Karl, S.A.** and J.C. Avise. 1993. PCR-based assays of polymorphisms from anonymous single-copy nuclear DNA: Techniques and applications. *Molecular Biology and Evolution* 10:342-361.
36. **Karl, S.A.**, B.W. Bowen, and J.C. Avise. 1992. Global population structure and male-mediated gene flow in the green turtle (*Chelonia mydas*): RFLP analysis of anonymous nuclear DNA regions. *Genetics* 131:163-173.
37. **Karl, S.A.** and J.C. Avise. 1992. Balancing selection at allozyme loci in oysters: Implications from nuclear RFLPs. *Science* 256:100-102.
38. **Karl, S.A.**, R.M. Zink and J.J. Jehl, Jr. 1987. Allozyme analysis of the California gull (*Larus californicus*). *The Auk* 104:767-769.
39. **Karl, S.A.** 1986. Observation of predation on a Pleuronectid fish by *Navanax inermis*. *Veliger* 28:460.

#### NON-REFEREED PUBLICATIONS

40. Wilson, D.S. and **S.A. Karl**. 2001. Genetic relatedness of populations of the mud turtle, *Kinosternon baurii*, from mainland Florida and the upper and lower Florida Keys. *Chelonia Conservation and Biology* 4:228-230
41. Bowen B.W. and **S.A. Karl**. 2000. Meeting report: Taxonomic status of the East Pacific green turtle (*Chelonia agassizii*). *Marine Turtle Newsletter* 89:20-22.
42. Bowen, B.W. and **S.A. Karl**. 1999. In war, truth is the first casualty. *Conservation Biology* 13:1013-1016.
43. Bowen, B.W. and **S.A. Karl**. 1996. Population genetics, phylogeography, and molecular evolution. In: *Biology of Sea Turtles*. P. Lutz (ed.) CRC Press. Boca Raton, Florida. Pp. 29-50.
44. **Karl, S.A.** 1996. Hybridization and taxonomy of marine turtles: Anonymous nuclear DNA sequence analyses. In: *Proceeding of the International Symposium on Sea Turtle*

*Conservation Genetics*. B.W. Bowen and W.N. Witzell (eds.) NOAA Technical Memorandum, NMFS-SEFSC-396. Pp. 99-108.

45. **Karl, S.A.** 1996. Application of anonymous nuclear loci to conservation biology. In: *Molecular genetic approaches in conservation*. R. Wayne and T. Smiths (eds.) Oxford University Press. Pp. 38-53.
46. **Karl, S.A.** 1992. 1001 Molecular approaches. *Trends in Genetics* 8:295.

#### PUBLICATIONS IN PREPARATION

47. **Castro, A.L.F, B.S. Stewart, S.G. Wilson, M.G. Meekan, R.H. Hueter, P.J. Motta, B.W. Bowen, S.A. Karl.** Population genetics structure of the worlds' largest fish, the whale shark (Rhinocodon typus). In preparation, *Molecular Ecology*.
48. **Williams, J.D. and S.A. Karl.** Genetic analysis of Lampsilis teres populations in the eastern Gulf of Mexico drainages of Mississippi, Alabama, Florida, and Georgia. In preparation,
49. Dewar, H., T. Thys, J. O'Sullivan, C. Farwell, A. Wallis, T. Tobayama, Y. Kondo, J.T. Streelman, A.L. Bass, C. Puchulutegui & **S.A. Karl.** Basking and diving in Japanese waters: movements and behaviors of the ocean sunfish (Mola mola). In preparation, *Marine Biology*.
50. Severance, E.G. and **S.A. Karl.** Reconstructing gene flow and evolution in the Caribbean coral, Montastraea faveolata. In preparation, *Conservation Genetics*.
51. **Karl, S.A.,** C. Curtis, and M. Cattell. Molecular phylogenetics and evolution of the surfperch family (Embiotocidae). In preparation, *Molecular Phylogenetics and Evolution*.
52. Hayes, K. and **S.A. Karl.** Mitochondrial phylogeny of crown conchs: The Corona complex simplified. In preparation, *Molecular Phylogenetics and Evolution*.

#### PRESENTATIONS (presenter listed first)

##### Invited

1. Karl, S.A. **B.W. Bowen.** 2006. Systematics of Bonefish. 2<sup>nd</sup> International Tarpon-Bonefish Symposium. Dana Beach, FL, USA 9-10 January 2006.
2. **Karl, S. A.** 2004. Complex population structure in turtles. Workshop on the Use of molecular markers for the study of marine biodiversity. Horta, Azores. July 2004
3. **Karl, S. A.** 2002. A talk in two parts: Evolution of larval life history in a Polychaete worm, and genetics and the ocean sunfish, Mola mola: Millstone or milestone?" Presented to the University of South Carolina, Marine Science Program. Columbia, SC, USA, 5 April.
4. **Karl, S. A.,** A.L. Bass, M.H. Zacks. 2000. Marine turtles and international considerations for listing ESUs. Presented to the Society for Conservation Biology. Missoula, MT, USA, 8-12 June.
5. Zacks, M.H. and **S.A. Karl.** 2000. [De]constructing archetypes of the pristine. Presented to the Latin American Studies Association, 12<sup>th</sup> International Congress. Miami, FL, USA, 16-18 March.

6. **Karl, S.A.** 2000. Evolutionary genetics of Chelonia. Special Symposium at the XX Presented to the International Symposium on Turtle Biology, Orlando, FL, USA, 29 February - 4 March.
7. **Karl, S.A.** 1999. Living by the numbers: The commingling of mathematics and biology. Keynote Address. Presented to the 24<sup>th</sup> Annual Sun Coast Regional Meeting of the Florida Section of the Mathematical Association of America. Tampa, FL, USA, 3 December.
8. **Karl, S.A.** 1999. Blending the alphabet soups: PCR meets ESUs. Presented to A Second Symposium on the Status and Conservation of Florida Turtles. St. Petersburg, FL, USA, 8-11 October.
9. **Karl, S.A.** 1999. Getting our bearings in DNA computing, Panelist. Presented to the Genetic and Evolutionary Computation Conference. Orlando, FL, USA, 13 July.
10. **Karl, S.A.** 1995. Hybridization and taxonomy of marine turtles: Anonymous nuclear DNA sequence analyses. Presented to the Sea Turtle Genetics Workshop, National Marine Fisheries Service, Miami, FL, USA, 12-14 September.
11. **Karl, S. A.** 1995. From Playa Grande to the stygian deep-sea: Gene flow in the marine environment. Presented to the Florida International University Graduate Seminar Series. Miami, FL, USA, 19 September.
12. **Karl, S.A.** 1994. Genetic variation at anonymous nuclear DNA loci. Presented to the American Association for the Advancement of Science, Molecular Conservation Genetics Symposium. San Francisco, CA, USA, 19-22 June.
13. **Karl, S.A.** 1994. Nuclear DNA analysis of the green turtle (*Chelonia mydas*). Presented to the University of Florida, BEECS Genetics Core, Conservation Genetics Symposium. Gainesville, FL, USA, 21-26 February.
14. **Karl, S.A.** 1994. Dispersal of hydrothermal vent organisms in the stygian deep-sea. Presented to the Archbold Biological Station. Lake Placid, FL, USA, 5 May.
15. **Karl, S.A.** 1994. Genetic issues in conservation biology. Symposium on the Status and Conservation of Florida Turtles. St. Petersburg, FL, USA, 2-3 April.
16. **Karl, S.A.** 1992. PCR-based assays of polymorphisms from anonymous single-copy nuclear DNA: Techniques and applications to green turtles and American oyster. Presented to the Haskins Shellfish Research Center. Bivalve, NJ, USA, 15 February.

#### Other

17. **Karl, S.A. 2006. Evolution and speciation in Marine Fish. Presented to the University of Hawaii Zoology Department, Manoa, Hawaii. February 2006.**
18. Karl, S.A. and T.S. Schwartz. 2005. Population and conservation genetics of the gopher tortoise (*Gopherus polyphemus*). Presented at the 85<sup>th</sup> Annual meeting of the American Society of Ichthyologists and Herpetologists. Tampa, FL 6-11 July.
19. Hayes, K. and **S.A. Karl.** 2002. Evolution of the "Corona Complex" in the genus *Melongena* (Gastropoda: Melongenidae). Presented at the 16th Annual Meeting of Florida Association of Benthologists. St. Augustine, Florida. 21 November.

20. Hayes, K. and **S.A. Karl**. 2001. Evolution of the "Corona Complex" in the genus Melongena (Gastropoda: Melongenidae). Presented to the 14<sup>th</sup> International Congress of Unitas Malacologica and the 67<sup>th</sup> Annual Meeting of the American Malacological Society. Vienna, Austria. 19-25. August.
21. Schwartz, T. and S.A. Karl. 2001. Population genetics of the gopher tortoise (Gopherus polyphemus) in Florida. Presented to the Annual Society for Integrated and Comparative Biology. Chicago, IL, USA, 3-7 January.
22. Schwartz, T. and **S.A. Karl**. 2000. Genetic Structure of the gopher tortoise (Gopherus polyphemus) populations in Florida using microsatellites. Poster presented to the Annual Suncoast Biomolecular Symposium. Tampa, FL, USA, 20 October.
23. Hayes, K. and **S.A. Karl**. 2000. Evolution of the "Corona Complex" in the genus Melongena (gastropoda: melongenidae): Patterns from internal transcribed spacer regions and microsatellite data. Poster presented to the Annual Suncoast Biomolecular Symposium. Tampa, FL, USA, 20 October.
24. Severance, E. and **S.A. Karl**. 2000. Molecular evolution of Scleractinian diversity: How panmictic are coral populations of the Western Atlantic? Presented to the Annual Meeting of the Society for the Study of Evolution, Bloomington. ID, USA, 23-27 June.
25. Schwartz, T., **S.A. Karl**, H. Mushinsky, and E. McCoy. 2000. Genetic Structure of the gopher tortoise (Gopherus polyphemus) populations in Florida using microsatellites. Poster presented to the Annual Meeting of the Society for the Study of Evolution. Bloomington, ID, USA, 23-27 June.
26. Hayes, K. and **S.A. Karl**. 2000. Evolution of the "Corona Complex" in the genus Melongena (Gastropoda: Melongenidae): Evidence from internal transcribed spacer regions and microsatellite data. Poster presented to the Annual Meeting of the Society for the Study of Evolution. Bloomington, ID, USA, 23-27 June.
27. Strelman, J.T., M.E. Alfaro, M.W. Westneat, and **S.A. Karl**. 1999. Molecular phylogeny and evolution of parrotfishes. Presented to the Annual Meeting of the Society for the Study of Evolution. Madison, WI, USA, 22-26 June.
28. Schultze, S.R., **S.A. Karl**, S.A. Rice, and J.L. Simon. 1999. Biogeography and evolution of poecilogony in the polychaete genus Streblospio: Evidence from molecular genetics and reproductive compatibility trials. Presented to the Annual Meeting of the Society for the Study of Evolution. Madison, WI, USA, 22-26 June.
29. Severance, E.G. and **S.A. Karl**. 1999. Estimating molecular biodiversity through gene flow analysis of coral from the Florida Keys. Presented to the International conference on the Scientific Aspects of Coral Reef Assessment, Monitoring, and Restoration. Ft. Lauderdale, FL, USA, 14-16 April.
30. Jansen, K.P., **S.A. Karl**, and H. Mushinsky. 1998. Molecular systematics and phylogeography of the salt-marsh snakes, Nerodia clarkii, using mtDNA d-loop sequences. Presented to the 78<sup>th</sup> Annual Meeting of the American Society of Ichthyologists and Herpetologists. University of Guelph, Guelph, Canada, 16-22 July.
31. **Karl, S.A.** and J.T. Strelman. 1998. Are microsatellite loci really neutral genetic markers? Presented to the Annual Meeting of the Society for the Study of Evolution. Vancouver, Canada, 10-24 June.

32. Streelman, J.T. and **Karl, S.A.** 1998. Timing the divergence of cichlid major groups. Presented to the Annual Meeting of the Society for the Study of Evolution. Vancouver, Canada, 10-24 June.
33. Schulze, S.R., **S.A. Karl**, J.L. Simon, S.A. Rice. 1998. Reproductive compatibility and genetic relatedness of the polychaete Streblospio benedicti species complex. Presented to the 27th Annual Benthic Ecology Meetings. Melbourne, FL, USA, 13-15 March.
34. Bowen, B.W. and **S.A. Karl**. 1998. The gods of conservation biology. Presented to the XVIII International Symposium on Turtle Biology. La Paz, Mexico, 2-7 March.
35. **Karl, S.A.**, D. Sweger, and E. Severance. 1997. Molecular systematics of marine turtles using single-copy nuclear DNA sequence data. Presented to the 77th annual meeting of the American Society of Ichthyologists and Herpetologists. University of Washington, Seattle, WA, USA, 26 June-2 July.
36. Streelman, J.T., and **S.A. Karl**. 1997. Nuclear DNA phylogeny and evolution of labroid fishes. Presented to the 77th annual meeting of the American Society of Ichthyologists and Herpetologists. University of Washington, Seattle, WA, USA, 26 June-2 July.
37. **Karl, S.A.** 1997. Taxonomic distinctiveness of the black turtle, Chelonia agassizii: From green to black and back. Presented to the XVII International Symposium on Turtle Biology. Orlando, FL, USA, 4-8 March.
38. Streelman, J.T., and **S.A. Karl**. 1996. Evolution of nuclear DNA in cichlid fishes. Presented to the 76th annual meeting of the American Society of Ichthyologists and Herpetologists. New Orleans, LA, USA, 13-19 June.
39. Jonoska, N. and **S.A. Karl**. 1996. A molecular computation of the road-coloring problem. Presented to the 2<sup>nd</sup> DIMACS annual workshop on DNA Based Computer. Princeton, NJ, USA, 10-12 June (all authors presented).
40. **Karl, S.A.** 1994. Genetic issues in conservation biology. Presented to the Symposium on the Status and Conservation of Florida Turtles. St. Petersburg, FL, USA, 2-3 April.
41. **Karl, S.A.**, S. Schutz and R.C. Vrijenhoek. 1993. Population genetics and gene flow in the deep-sea-hydrothermal vent clam Calyptogena magnifica. Presented to the Society for Molecular Biology and Evolution. Irvine, CA, USA, 7-10 July.
42. **Karl, S.A.** 1993. Population genetics and gene flow in the deep-sea-hydrothermal vent clam Calyptogena magnifica. Presented to the Society for the Study of Evolution. Snowbird, UT, USA, 10-14 June.
43. **Karl, S.A.**, B.W. Bowen and J.C. Avise. 1992. Global population structure and male-mediated gene flow in the green turtle (Chelonia mydas): RFLP Analyses of anonymous nuclear DNA regions. Presented to the XII International Symposium on Turtle Biology. Jekyll Island, SC, USA, 24-29 February.
44. **Bowen, B.W.**, S.A. Karl and M. Marcovaldi. 1992. Molecular confirmation of marine turtle hybrids. Poster presented to the XII International Symposium on Turtle Biology. Jekyll Island, SC, USA, 24-29 February.
45. **Karl, S.A.**, B.W. Bowen and J.C. Avise. 1991. Global population structure and male-mediated gene flow in the green turtle (Chelonia mydas): RFLP Analyses of anonymous

nuclear DNA regions. Presented to the Society for the Study of Evolution. Hilo, Hawaii, USA, 28 July - 3 August.

46. **Karl, S.A.**, B.W. Bowen and J.C. Avise. 1990. Genetic analysis of the green turtle, Chelonia mydas. Presented to the Tenth Annual Workshop on Sea Turtle Conservation and Biology. Hilton Head Island, South Carolina, USA, 20-24 February.
47. **Karl, S.A.** 1987. Genetic analysis of the chukar partridge (Alectoris chukar) from San Nicolas Island, CA. Presented to the Channel Island Symposium. Santa Barbara CA, USA, 2-6 March.

#### GRANTS AWARDED

1. 01/07 – 12/07 Arcadia Wildlife Preserve, Inc. PI: **S.A. Karl**. “Micro-spatial scale assessment of the genetic architecture of coral reef.” \$2,400
2. 05/06 – 04/08 National Science Foundation, Biological Oceanography. PI: **S.A. Karl**. “SGER: Micro-spatial scale assessment of the genetic architecture of coral reef.” \$99,197.
3. 01/05 to 12/05 Arcadia Wildlife Preserve, Inc. PI: **S.A. Karl**. “Conservation of an open ocean giant: telemetry and genetics of the ocean sunfish (Molidae).” \$6,000
4. 10/04 to 09/06 International Game Fish Association. PI: **S.A. Karl**. “Resolving Evolutionary Lineages of Bonefish (Albula spp.).” \$9,000.
5. 08/04 to 11/04 Florida Fish and Wildlife Conservation Corp. PI: **S.A. Karl**. “Consultation on genetics of Dinoflagellates for ECOHAB.” \$21,000.
6. 03/04 to 02/05. Arcadia Wildlife Preserve, Inc. PI: **S.A. Karl**. “Conservation of an open ocean giant: telemetry and genetics of the ocean sunfish (Molidae).” \$2,000.
7. 06/03 to 05/05. National Science Foundation, Systematic and Population Biology. PI: **S.A. Karl**, CoPI (RUI): S. Rice. “Collaborative Research: Molecular phylogenetics of the globally distributed polychaete, Polydora cornuta.” est. \$100,000.
8. 06/03 to 05/04 Arcadia Wildlife Preserve, Inc. PI: **S.A. Karl**, CoPI: T. Schwartz “Population genetics of the gopher tortoise (Gopherus polyphemus) in Florida.” \$5,000.
9. 01/03 to 07/04. National Geographic Society. PI: T. Thys, CoPIs: H. Dewar, **S.A. Karl**, and J.T. Streebman. “Conserving an open ocean giant: telemetry and genetics of Mola mola.” \$25,000.
10. 04/02 to 05/02 Florida Institute of Oceanography. Suncoaster ship time grant. PI: **S.A. Karl**. “Molecular ecology and evolution of coral and coral reef fish.” \$16,000.
11. 08/01 to 07/03 Florida Fish and Wildlife Service. PI: **S.A. Karl**. “Genetic analysis of Cape Sable seaside sparrow populations.” \$57,120.

12. 01/01 to 02/01 Florida Institute of Oceanography. Bellows ship time grant. PI: **S.A. Karl**. "Molecular ecology and evolution of coral and coral reef fish." \$14,000.
13. 08/00 to 07/03 Arcadia Wildlife Preserve, Inc. PI: S.A. Karl, CoPI: T. Schwartz. "Population genetics of the gopher tortoise (Gopherus polyphemus) in Florida." \$4,200.
14. 05/00 to 06/02 National Geographic Society. PI: H. Dewar, CoPI: **S.A. Karl**, J.T. Streebman, and T. Thys. "Conserving an open-ocean giant: telemetry and genetics of Mola mola." \$30,000.
15. 01/00 to 02/00 Florida Institute of Oceanography. Bellows ship time grant. PI: **S.A. Karl**. "Molecular ecology and evolution of coral and coral reef fish." \$14,000.
16. 06/99 - 05/00 Department of Environmental Protection. PI: B. W. Bowen, CoPI: **S.A. Karl**. "Systematics and ecology of bonefish (Albula spp.) in Florida waters." \$76,880.
17. 08/98 - 07/01 National Science Foundation, Systematic and Population Biology. PI: **S.A. Karl**. "Molecular phylogeny and evolution of labroid fishes." \$180,000.
18. 02/97 - 01/01 Florida Game and Fresh Water Fish Commission, PI: **S.A. Karl**, CoPI: K. P. Jansen and H. R. Mushinsky. "Ecological genetics of the saltmarsh snake, Nerodia clarkii." \$5,600.
19. 04/95 - 03/96 USF Research and Creative Scholarship, PI: **S.A. Karl**. "Fine-scale molecular genetic analysis of the deep-sea hydrothermal vent tube worm, Riftia pachyptilia." \$7,500.
20. 03/92 - 06/95 National Science Foundation, Dissertation Improvement Grant. PI: **S.A. Karl**. "Single copy nuclear DNA genetic assessment of natural populations." \$6,750 (declined due to graduation).
21. 09/92 09/94 National Science Foundation, Post Doctoral Marine Biotech Fellowship, PI: **S.A. Karl**, CoPI: R. Vrijenhoek and R. Lutz. "Population genetics and gene flow in hydrothermal vent communities: Molecular assessment of genetic variation." \$86,000.

#### PAST POSTDOCTORAL ADVISEES

Dr. Clark Craddock, 7/1/95 to 6/30/96

#### CURRENT GRADUATE STUDENTS (\*co-chair of committee)

Ph. D.

M. S.

1. **K. Grospe, Genetics coral**
2. A. Castro: Pop. Genetics, Sharks
3. C. Curtis: Pop. Genetics, Seals

**PAST GRADUATE STUDENT ADVISEES** (graduated: F=Fall, S=Spring, Sm=Summer)Ph. D.

1. A. Bass; F06: Systematics, Sea slugs
2. M. Cattell\*; S01: Plant Hybridization
3. A. Jackson: Pop. Genetics, Shrimp
4. K. Jansen\*; S01: Mol. Conserv., Snakes
5. E. Severance: Phylogeography, Coral
4. JT. Strelman\*§; F98: Systematics, Fish
5. M. Tringalli: S04: Pop. Genetics, Fish

M. S.

6. K. Hayes: S04: Phylogeography, Snails
7. M. Roberts; F98: Genetics, Sea Turtles
8. S. Schulze\*; S99: Genetics, Polychaetes
9. T. Schwartz: S04: Mol. Conserv., Tortoises
10. M. Stone; S99: Invert. Community Ecol.

\*co-chair of committee §awarded a NSF/Sloan Postdoctoral Fellowship.

**CURRENT GRADUATE STUDENT COMMITTEES**Ph. D.

- Y. Papastamatiou (UH)**  
**J. Schultz (UH)**

M. S.**PAST GRADUATE STUDENT COMMITTEES** (graduated: F=Fall, S=Spring, Sm=Summer)Ph. D.

1. T. Campbel (USF)
2. P. Delis (USF); S01
3. K. Donaldson (Dept. Mar. Sci.); S01
4. O. Hernandez (USF); S98
5. A. Matos (USF); S00
6. B. Warwick (Dept. Mar. Sci.)
7. K. McCarthy (FL Int. Uni.)
8. L. Rocha (Univ. FL)

M. S.

9. S. Hosain (USF)
10. C. Crawford (Dept. Mar. Sci.); S01
11. L. S. Cho Chung Hing (USF); S95
12. L. Dryden (USF); S97
13. J. Kirsten (USF); F96
14. A. Morales (USF); S95
15. C. Steffen (USF); Sm98
16. B. Warwick (USF); S99
17. J. Colson (USF)
18. H. Hamilton (USF)

**UNDERGRADUATE HONORS THESIS COMMITTEES**

Heather Stevens; S95  
 Amanda Ellerd; S99

**UNDERGRADUATE ADVISEES**

1. A. Balar; Sm95
2. B. Boss; F94, Sm94
3. R. Brachmann; S01, Sm01
4. M. Evans; Sm97
5. S. Jones; F97, S98
6. R. Juemankhan; Sm95
7. A. Ledger; Sm99, F99, S00
8. S. Lutz; Sm96, F96, S96
9. M. Moody; S02, Sm02, F02
10. S. Nyland; F94
11. F. Pirone; F94
12. E. Ponty; S96
13. C. Puchulutegui; S00 - S02
14. J. Rifkin; Sm97
15. M. Stabinski; S95
16. M. Smith; F00, S01, Sm01
17. D. Sweger; F94, Sm94
18. B. Wawrik; Sm96
19. V. Rusin-West; S98
20. J. Wittkopp; Sm96, F96
21. C. M. Zajac; Sm95

**PROFESSIONAL SERVICE**

Associate Editor for *Evolution*, 1 January 2000 – 31 December 2003.

Reviewer for numerous manuscripts and grants from national and international Journals and organizations.

National Science Foundation, Population Biology Grant Panel, 17 – 19 October 2001.

National Science Foundation, National Ecological Observatory Network Workshop, 10 - 11 March 2000.

National Science Foundation Dissertation Improvement Grant Panelist, February 1998.

**PROFESSIONAL SOCIETY AFFILIATIONS**

American Association for the Advancement of Science.

Genetics Society of America

Sigma Xi.

Society for the Study of Evolution.

**Section 1 - Product and Company Identification**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Product Identification:** ETHANOL,200 PROOF;ETHYL ALCOHOL  
**Date of MSDS:** 01/01/1987 **Technical Review Date:** 07/19/1999  
**FSC:** 6810 **NIIN:** 00-127-4532  
**Submitter:** D DG  
**Status Code:** C  
**MFN:** 01  
**Article:** N  
**Kit Part:** N

**Manufacturer's Information**

**Manufacturer's Name:** DECAL CHEMICAL CORP  
**Post Office Box:** 131  
**Manufacturer's Address1:** 333 RT 9W  
**Manufacturer's Address2:** CONGERS, NY 10920  
**Manufacturer's Country:** US  
**General Information Telephone:**  
**Emergency Telephone:** NONE  
**Emergency Telephone:** NONE  
**MSDS Preparer's Name:** N/P  
**Proprietary:** N  
**Reviewed:** Y  
**Published:** Y  
**CAGE:** 7L402  
**Special Project Code:** N

**Item Description**

**Item Name:** ETHYL ALCOHOL,ABSOLUTE,ACS  
**Item Manager:** S9G  
**Specification Number:** O-E-760  
**Type/Grade/Class:** TY I, GR A  
**Unit of Issue:** GL  
**Unit of Issue Quantity:** 0  
**Type of Container:** CAN

**Contractor Information**

**Contractor's Name:** DECAL CHEMICAL CORP  
**Post Office Box:** 131  
**Contractor's Address1:** 333 RT 9W  
**Contractor's Address2:** CONGERS, NY 10920

**Contractor's Telephone:** 914-268-9258

**Contractor's CAGE:** 7L402

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**Section 2 - Composition/Information on Ingredients**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Ingredient Name:** ETHYL ALCOHOL (ETHANOL)

**Ingredient CAS Number:** 64-17-5 **Ingredient CAS Code:** M

**RTECS Number:** KQ6300000 **RTECS Code:** M

**=WT: =WT Code:**

**=Volume: =Volume Code:**

**>WT: >WT Code:**

**>Volume: >Volume Code:**

**<WT: <WT Code:**

**<Volume: <Volume Code:**

**% Low WT: % Low WT Code:**

**% High WT: % High WT Code:**

**% Low Volume: % Low Volume Code:**

**% High Volume: % High Volume Code:**

**% Text:** 100

**% Environmental Weight:**

**Other REC Limits:** N/P

**OSHA PEL:** 1000 PPM **OSHA PEL Code:** M

**OSHA STEL:** **OSHA STEL Code:**

**ACGIH TLV:** 1000 PPM; 9192 **ACGIH TLV Code:** M

**ACGIH STEL:** N/P **ACGIH STEL Code:**

**EPA Reporting Quantity:**

**DOT Reporting Quantity:**

**Ozone Depleting Chemical:** N

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**Section 3 - Hazards Identification, Including Emergency Overview**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Health Hazards Acute & Chronic:** N/P

**Signs & Symptoms of Overexposure:**

SWALLOWING LIQ.CAUSES INEBRIATION,HEADACHE,NAUSEA AND  
VOMITING,EYE IRRITATION;BREATHING CAUSES DROWS

**Medical Conditions Aggravated by Exposure:**

N/P

**LD50 LC50 Mixture:** N/P

**Route of Entry Indicators:**

**Inhalation:** N/P

**Skin:** N/P

**Ingestion:** N/P  
**Carcenogenicity Indicators**  
**NTP:** N/P  
**IARC:** N/P  
**OSHA:** N/P  
**Carcinogenicity Explanation:** N/P

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**Section 4 - First Aid Measures**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**First Aid:**  
INHALE:REMOVE TO FRESH AIR, GIVE CPR/O\*2 IF NEED;EYES/SKIN:FLUSH  
W LG AMTS H\*2O FOR 15 MIN;INGEST:RINSE MOUTH; GET MEDICAL  
ATTENTION FOR EYES, BREATHING DIFFICULTY, OR OTHER SYMPTOMS OF  
OVEREXPOSURE.

---

**Section 5 - Fire Fighting Measures**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Fire Fighting Procedures:**  
NONE SPECIFIED.USE SCBA IN FIRES AND IN CONFINED AREA.  
**Unusual Fire or Explosion Hazard:**  
NONE SPECIFIED USE REASONABLE CARE,FLAMMABLE LIQUID.  
**Extinguishing Media:**  
FOAM,CO\*2,DRY CHEMICAL.  
**Flash Point:** **Flash Point Text:** 58F/14.4C (T.C.C)  
**Autoignition Temperature:**  
**Autoignition Temperature Text:** 793F  
**Lower Limit(s):** 3.31  
**Upper Limit(s):** 9.00

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**Section 6 - Accidental Release Measures**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Spill Release Procedures:**  
USE PROPER PERSONAL PROTECTION.ELIMINATE ALL SOURCES OF  
IGNITION.USE ABSORBENT MATERIAL OR DILUTE WITH LARGE AMOUNTS  
OF WATER AND RECOVER FOR PROPER DISPOSAL.

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**Section 7 - Handling and Storage**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Handling and Storage Precautions:**

**Other Precautions:**

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**Section 8 - Exposure Controls & Personal Protection**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Respiratory Protection:**

USE NIOSH/MSHA APPROVED RESPIRATOR FOR ORGANIC VAPORS IF IN EXCESS TLV

**Ventilation:**

PROVIDE MECHAN(GEN/LOCAL EXHAUST)VENT TO MAINTN <TLV

**Protective Gloves:**

PV/RUBBER

**Eye Protection:** SAFETY/CHEM GOGGLES

**Other Protective Equipment:** SAFETY SHOWER & EYE BATH

**Work Hygienic Practices:** N/P

**Supplemental Health & Safety Information:** MSDS UNDATED.

---

**Section 9 - Physical & Chemical Properties**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**HCC:** F2

**NRC/State License Number:**

**Net Property Weight for Ammo:**

**Boiling Point:** Boiling Point Text: 173F/78C

**Melting/Freezing Point:** Melting/Freezing Text: N/A

**Decomposition Point:** Decomposition Text: N/A

**Vapor Pressure:** 44 Vapor Density: 1.6

**Percent Volatile Organic Content:**

**Specific Gravity:** 0.7905

**Volatile Organic Content Pounds per Gallon:**

**pH:** N/P

**Volatile Organic Content Grams per Liter:**

**Viscosity:** N/P

**Evaporation Weight and Reference:** 3.3 (BUT ACET=1)

**Solubility in Water:** COMPLETE

**Appearance and Odor:** CLEAR,COLORLESS LIQUID,CHARACTERISTIC ODOR.

**Percent Volatiles by Volume:** 100

**Corrosion Rate:** N/P

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**Section 10 - Stability & Reactivity Data**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Stability Indicator:** YES

**Materials to Avoid:**

NONE SPECIFIED

**Stability Condition to Avoid:**

HEAT,SPARKS,OPEN FLAMES

**Hazardous Decomposition Products:**

THERMAL DECOMPOSITION OR BURNING MAY GIVE CO AND/OR CO\*2

**Hazardous Polymerization Indicator:** NO

**Conditions to Avoid Polymerization:**

NONE SPECIFIED

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**Section 11 - Toxicological Information**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Toxicological Information:**

N/P

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**Section 12 - Ecological Information**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Ecological Information:**

N/P

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**Section 13 - Disposal Considerations**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Waste Disposal Methods:**

DISPOSE OF COLLECTED MATERIAL IN ACCORDANCE WITH LOCAL,STATE AND FEDERAL REGULATIONS.

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**Section 14 - MSDS Transport Information**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**Transport Information:**

N/P

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**Section 15 - Regulatory Information**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

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**SARA Title III Information:**

N/P

**Federal Regulatory Information:**

N/P

**State Regulatory Information:**

N/P

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**Section 16 - Other Information**  
**ETHANOL,200 PROOF;ETHYL ALCOHOL**

---

**Other Information:**

N/P

**HMIS Transportation Information**

**Product Identification:** ETHANOL,200 PROOF;ETHYL ALCOHOL  
**Transportation ID Number:** 49058  
**Responsible Party CAGE:** 7L402  
**Date MSDS Prepared:** 01/01/1987  
**Date MSDS Reviewed:** 10/29/1986  
**MFN:** 10/29/1986  
**Submitter:** D DG  
**Status Code:** C

**Container Information**

**Unit of Issue:** GL  
**Container Quantity:** 0  
**Type of Container:** CAN  
**Net Unit Weight:** 1.0GL

**Article without MSDS:** N  
**Technical Entry NOS Shipping Number:**  
**Radioactivity:**  
**Form:**  
**Net Explosive Weight:**  
**Coast Guard Ammunition Code:**  
**Magnetism:** N/P  
**AF MMAC Code:**  
**DOD Exemption Number:**  
**Limited Quantity Indicator:**  
**Multiple Kit Number:** 0  
**Kit Indicator:** N  
**Kit Part Indicator:** N  
**Review Indicator:** Y  
**Additional Data:**

**Department of Transportation Information**

**DOT Proper Shipping Name:** ETHANOL OR ETHYL ALCOHOL OR ETHANOL SOLUTIONS OR ETHYL ALCOHOL SOLUTIONS  
**DOT PSN Code:** FTN  
**Symbols:**  
**DOT PSN Modifier:**  
**Hazard Class:** 3  
**UN ID Number:** UN1170  
**DOT Packaging Group:** II  
**Label:** FLAMMABLE LIQUID  
**Special Provision(s):** 24,T1  
**Packaging Exception:** 150  
**Non Bulk Packaging:** 202  
**Bulk Packaging:** 242  
**Maximum Quantity in Passenger Area:** 5 L  
**Maximum Quantity in Cargo Area:** 60 L

**Stow in Vessel Requirements: A**  
**Requirements Water/Sp/Other:**

**IMO Detail Information**

**IMO Proper Shipping Name:** ETHYL ALCOHOL  
**IMO PSN Code:** GPL  
**IMO PSN Modifier:**  
**IMDG Page Number:** 3219  
**UN Number:** 1170  
**UN Hazard Class:** 3.2  
**IMO Packaging Group:** II  
**Subsidiary Risk Label:** -  
**EMS Number:** 3-06  
**Medical First Aid Guide Number:** 305

**IATA Detail Information**

**IATA Proper Shipping Name:** ETHANOL  
**IATA PSN Code:** KXQ  
**IATA PSN Modifier:**  
**IATA UN Id Number:** 1170  
**IATA UN Class:** 3  
**Subsidiary Risk Class:**  
**UN Packaging Group:** II  
**IATA Label:** FLAMMABLE LIQUID  
**Packaging Note for Passengers:** 305  
**Maximum Quantity for Passengers:** 5L  
**Packaging Note for Cargo:** 307  
**Maximum Quantity for Cargo:** 60L  
**Exceptions:** A3, A58

**AFI Detail Information**

**AFI Proper Shipping Name:** ETHANOL OR ETHANOL SOLUTIONS OR ETHYL ALCOHOL OR ETHYL ALCOHOL SOLUTIONS  
**AFI Symbols:**  
**AFI PSN Code:** KXQ  
**AFI PSN Modifier:**  
**AFI UN Id Number:** UN1170  
**AFI Hazard Class:** 3  
**AFI Packing Group:** II  
**AFI Label:**  
**Special Provisions:** P5  
**Back Pack Reference:** A7.3

**HAZCOM Label Information**

**Product Identification:** ETHANOL,200 PROOF;ETHYL ALCOHOL  
**CAGE:** 7L402  
**Assigned Individual:** N  
**Company Name:** DECAL CHEMICAL CORP  
**Company PO Box:** 131  
**Company Street Address1:** 333 RT 9W

**Company Street Address2:** CONGERS, NY 10920 US

**Health Emergency Telephone:**

**Label Required Indicator:** Y

**Date Label Reviewed:** 12/16/1998

**Status Code:** C

**Manufacturer's Label Number:**

**Date of Label:** 12/16/1998

**Year Procured:** N/K

**Organization Code:** F

**Chronic Hazard Indicator:** N/P

**Eye Protection Indicator:** N/P

**Skin Protection Indicator:** N/P

**Respiratory Protection Indicator:** N/P

**Signal Word:** N/P

**Health Hazard:**

**Contact Hazard:**

**Fire Hazard:**

**Reactivity Hazard:**

Aldrich Chemical Co., Inc.  
1001 West St. Paul  
Milwaukee, WI 53233 USA  
Tel: 414-273-3850

M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - CHEMICAL IDENTIFICATION- - - - -  
CATALOG #: D8418  
NAME: DIMETHYL SULFOXIDE MOLECULAR  
BIOLOGY REAGENT

SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - -  
CAS #: 67-68-5  
MF: C2H6OS  
EC NO: 200-664-3

SYNONYMS  
A 10846 \* DELTAN \* DEMESO \* DEMASORB \* DEMAVET \* DEMSODROX \*  
DERMASORB \* DIMETHYL SULFOXIDE \* DIMETHYL SULPHOXIDE \* DIMEXIDE \*  
DIPIRARTRIL-TROPICO \* DMS-70 \* DMS-90 \* DMSO \* DOLICUR \* DOMOSO \*  
DROMISOL \* DURASORB \* GAMASOL 90 \* HYADUR \* INFILTRINA \* M 176 \*  
METHANE, SULFINYLBIS- \* METHYLSULFINYLMETHANE \* NSC-763 \* RIMSO-50 \*  
SOMIPRONT \* SQ 9453 \* SULFINYLBIS(METHANE) \* SYNTEXAN \* TOPSYM \*

SECTION 3. - - - - - HAZARDS IDENTIFICATION - - - - -  
LABEL PRECAUTIONARY STATEMENTS

IRRITANT  
IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.  
COMBUSTIBLE LIQUID.  
READILY ABSORBED THROUGH SKIN.  
TARGET ORGAN(S):  
EYES  
SKIN  
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF  
WATER AND SEEK MEDICAL ADVICE.  
WEAR SUITABLE PROTECTIVE CLOTHING.  
DO NOT BREATHE VAPOR.

SECTION 4. - - - - - FIRST-AID MEASURES- - - - -  
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.  
CALL A PHYSICIAN.  
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL  
RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.  
IN CASE OF CONTACT, IMMEDIATELY WASH SKIN WITH SOAP AND COPIOUS  
AMOUNTS OF WATER.  
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH COPIOUS AMOUNTS OF  
WATER FOR AT LEAST 15 MINUTES.

SECTION 5. - - - - - FIRE FIGHTING MEASURES - - - - -  
EXTINGUISHING MEDIA  
WATER SPRAY.  
CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

SPECIAL FIREFIGHTING PROCEDURES  
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO  
PREVENT CONTACT WITH SKIN AND EYES.  
UNUSUAL FIRE AND EXPLOSIONS HAZARDS  
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.  
COMBUSTIBLE LIQUID.  
METHYL SULFOXIDE (DMSO) UNDERGOES A VIOLENT EXOTHERMIC REACTION ON  
MIXING WITH COPPER WOOL AND TRICHLOROACETIC ACID. ON MIXING WITH  
POTASSIUM PERMANGANATE IT WILL FLASH INSTANTANEOUSLY. IT REACTS  
VIOLENTLY WITH: ACID HALIDES, CYANURIC CHLORIDE, SILICON TETRACHLORIDE,  
PHOSPHORUS TRICHLORIDE AND TRIOXIDE, THIONYL CHLORIDE, MAGNESIUM  
PERCHLORATE, SILVER FLUORIDE, METHYL BROMIDE, IODINE PENTAFLUORIDE,  
NITROGEN PERIODATE, DIBORANE, SODIUM HYDRIDE, PERCHLORIC AND PERIODIC  
ACIDS. WHEN HEATED ABOVE ITS BOILING POINT METHYL SULFOXIDE DEGRADES  
GIVING OFF FORMALDEHYDE, METHYL MERCAPTAN, AND SULFUR DIOXIDE.

SECTION 6. - - - - - ACCIDENTAL RELEASE MEASURES- - - - -

WEAR RESPIRATOR, CHEMICAL SAFETY GOGGLES, RUBBER BOOTS AND HEAVY RUBBER GLOVES.  
ABSORB ON SAND OR VERMICULITE AND PLACE IN CLOSED CONTAINERS FOR DISPOSAL.  
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.  
EVACUATE AREA.

SECTION 7. - - - - - HANDLING AND STORAGE- - - - -  
REFER TO SECTION 8.

SECTION 8. - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - -  
MECHANICAL EXHAUST REQUIRED.  
SAFETY SHOWER AND EYE BATH.  
WASH THOROUGHLY AFTER HANDLING.  
NIOSH/MSHA-APPROVED RESPIRATOR.  
COMPATIBLE CHEMICAL-RESISTANT GLOVES.  
CHEMICAL SAFETY GOGGLES.  
DO NOT BREATHE VAPOR.  
AVOID CONTACT WITH DMSO SOLUTIONS CONTAINING TOXIC MATERIALS OR MATERIALS WITH UNKNOWN TOXICOLOGICAL PROPERTIES. DIMETHYL SULFOXIDE IS READILY ABSORBED THROUGH SKIN AND MAY CARRY SUCH MATERIALS INTO THE BODY.  
AVOID PROLONGED OR REPEATED EXPOSURE.  
KEEP TIGHTLY CLOSED.  
KEEP AWAY FROM HEAT AND OPEN FLAME.  
STORE IN A COOL DRY PLACE.

SECTION 9. - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - -  
PHYSICAL PROPERTIES

BOILING POINT: 189 C  
MELTING POINT: 18.4 C  
FLASHPOINT 188.6 F  
87 C  
EXPLOSION LIMITS IN AIR:  
LOWER 42 %  
VAPOR PRESSURE: 0.42 MMHG  
SPECIFIC GRAVITY: 1.1 G  
VAPOR DENSITY: 2.7 G/L  
SWISS POISON CLASS: --

SECTION 10. - - - - - STABILITY AND REACTIVITY - - - - -  
STABILITY

STABLE.  
INCOMPATIBILITIES  
PROTECT FROM MOISTURE.  
ACID CHLORIDES  
PHOSPHORUS HALIDES  
STRONG ACIDS  
STRONG OXIDIZING AGENTS  
STRONG REDUCING AGENTS  
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS  
CARBON MONOXIDE, CARBON DIOXIDE  
SULFUR OXIDES  
HAZARDOUS POLYMERIZATION  
WILL NOT OCCUR.

SECTION 11. - - - - - TOXICOLOGICAL INFORMATION - - - - -  
ACUTE EFFECTS

CAUSES SKIN IRRITATION.  
READILY ABSORBED THROUGH SKIN.  
MAY BE HARMFUL IF ABSORBED THROUGH THE SKIN.  
CAUSES EYE IRRITATION.  
MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.  
MAY BE HARMFUL IF INHALED.  
MAY BE HARMFUL IF SWALLOWED.  
AVOID CONTACT WITH DMSO SOLUTIONS CONTAINING TOXIC MATERIALS OR MATERIALS WITH UNKNOWN TOXICOLOGICAL PROPERTIES. DIMETHYL SULFOXIDE IS READILY ABSORBED THROUGH SKIN AND MAY CARRY SUCH MATERIALS INTO THE BODY.

CHRONIC EFFECTS  
TARGET ORGAN(S):  
EYES  
SKIN

RTECS #: PV6210000

METHYL SULFOXIDE

IRRITATION DATA

SKN-RBT 10 MG/24H OPEN MLD	AIHAAP 23,95,1962
SKN-RBT 500 MG/24H MLD	85JCAE -,1044,1986
EYE-RBT 100 MG	TXAPA9 39,129,1977
EYE-RBT 500 MG/24H MLD	85JCAE -,1044,1986

TOXICITY DATA

ORL-RAT LD50:14500 MG/KG	TXAPA9 15,74,1969
SKN-RAT LD50:40 GM/KG	ANYAA9 141,96,1967
IPR-RAT LD50:8200 MG/KG	FCTOD7 22,665,1984
SCU-RAT LD50:12 GM/KG	ARZNAD 14,1050,1964
IVN-RAT LD50:5360 MG/KG	TXAPA9 7,104,1965
UNR-RAT LD50:1300 MG/KG	NTIS** AD-A159-418
ORL-MUS LD50:7920 MG/KG	CHTPBA 3,10,1968
SKN-MUS LD50:50 GM/KG	ANYAA9 141,96,1967
IPR-MUS LD50:2500 MG/KG	RPTOAN 35,300,1972
SCU-MUS LD50:14 GM/KG	ANYAA9 141,96,1967
IVN-MUS LD50:3100 MG/KG	TXAPA9 15,74,1969
UNR-MUS LD50:12 GM/KG	USXXAM #4767763
ORL-DOG LD50:>10 GM/KG	ANYAA9 141,96,1967
IVN-DOG LD50:2500 MG/KG	CNCRA6 31,7,1963
ORL-CKN LD50:12 GM/KG	JPPMAB 15,688,1963
ORL-MAM LD50:21400 MG/KG	GISAAA 39(4),86,1974
ORL-BWD LD50:100 MG/KG	TXAPA9 21,315,1972

TARGET ORGAN DATA

BEHAVIORAL (ALTERED SLEEP TIME)  
LUNGS, THORAX OR RESPIRATION (DYSPPNAE)  
LUNGS, THORAX OR RESPIRATION (CYANOSIS)  
GASTROINTESTINAL (NAUSEA OR VOMITING)  
LIVER (JAUNDICE, OTHER OR UNCLASSIFIED)  
BLOOD (OTHER CHANGES)  
EFFECTS ON FERTILITY (PRE-IMPLANTATION MORTALITY)  
EFFECTS ON EMBRYO OR FETUS (FETOTOXICITY)  
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)  
ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES  
(RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR  
COMPLETE INFORMATION.

SECTION 12. - - - - - ECOLOGICAL INFORMATION - - - - -  
DATA NOT YET AVAILABLE.

SECTION 13. - - - - - DISPOSAL CONSIDERATIONS - - - - -  
CONTACT A LICENSED PROFESSIONAL WASTE DISPOSAL SERVICE TO DISPOSE OF  
THIS MATERIAL.  
THIS COMBUSTIBLE MATERIAL MAY BE BURNED IN A CHEMICAL INCINERATOR  
EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.  
OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - TRANSPORT INFORMATION - - - - -  
CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - REGULATORY INFORMATION - - - - -  
EUROPEAN INFORMATION

IRRITANT  
R 36/37/38  
IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.  
S 26  
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF  
WATER AND SEEK MEDICAL ADVICE.  
S 36  
WEAR SUITABLE PROTECTIVE CLOTHING.  
S 23  
DO NOT BREATHE VAPOR.  
REVIEWS, STANDARDS, AND REGULATIONS  
OEL=MAK  
OEL-GERMANY: NO MAK ESTABLISHED, JAN1999  
OEL-RUSSIA: STEL 20 MG/M3, JAN1993  
OEL-SWEDEN: TWA 50 PPM (150 MG/M3), KTV 150 PPM (500 MG/M3), SKIN,  
JAN1999  
OEL-SWITZERLAND: MAK-W 50 PPM (160 MG/M3), SKIN, JAN1999  
NOHS 1974: HZD 80564; NIS 11; TNF 476; NOS 25; TNE 22461  
NOES 1983: HZD 80564; NIS 29; TNF 3507; NOS 40; TNE 44947; TFE 16837  
EPA GENETOX PROGRAM 1988, POSITIVE: ASPERGILLUS-ANEUPLOIDY; S  
CEREVISIAE GENE CONVERSION

EPA GENETOX PROGRAM 1988, NEGATIVE: SHE-CLONAL ASSAY; CELL  
TRANSFORM.-MOUSE EMBRYO  
EPA GENETOX PROGRAM 1988, NEGATIVE: CELL TRANSFORM.-RLV F344 RAT EMBRYO  
EPA GENETOX PROGRAM 1988, NEGATIVE: D MELANOGASTER-WHOLE SEX CHROM.  
LOSS; HOST-MEDIATED ASSAY  
EPA GENETOX PROGRAM 1988, NEGATIVE: N CRASSA-ANEUPLOIDY; E COLI POLA  
WITH S9  
EPA GENETOX PROGRAM 1988, NEGATIVE: HISTIDINE REVERSION-AMES TEST; IN  
VITRO SCE-NONHUMAN  
EPA GENETOX PROGRAM 1988, NEGATIVE: D MELANOGASTER SEX-LINKED LETHAL  
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: ASPERGILLUS-RECOMBINATION;  
CARCINOGENICITY-MOUSE/RAT  
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: D MELANOGASTER-RECIPROCAL  
TRANSLOCATION  
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: RODENT DOMINANT LETHAL; B  
SUBTILIS REC ASSAY  
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: E COLI POLA WITHOUT S9  
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY  
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES  
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, OCTOBER 2000  
SECTION 16. - - - - - OTHER INFORMATION- - - - -  
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**SECTION I**

MANUFACTURER'S NAME: Delphi Energy and Chassis Systems  
 ADDRESS: Division of Delphi Automotive Systems  
 4800 S. Saginaw St.  
 Flint, MI 48501-1360  
 INFORMATION: 317-579-3355 Hrs. 8 - 4; M - F  
 EMERGENCIAS - INFOTRAC: 1-800-535-5053

PREPARED BY: Delphi Automotive Systems  
 CREATION DATE: January 1, 1985  
 REVISED DATE: June 4, 2003

TRADE NAME: Storage Battery, Wet  
 SYNONYMS: Lead/Acid Battery  
 CHEMICAL FAMILY: Liquid content - sulfuric acid  
 VOL/WGT: Varies with model

MSDSNet FID #: 121229

PRODUCT DESCRIPTION/USE: Electric Storage Battery

**SECTION II  
 COMPOSITION & INFORMATION ON INGREDIENTS**

CAS #	COMMON NAME	WT%	TLV mg/m <sup>3</sup> ACGIH	PEL mg/m <sup>3</sup> OSHA	OTHER in mg/m <sup>3</sup>
7439-92-1	Lead	50	0.05	0.05	MSHA - air 0.15 TWA
7664-93-9	Sulfuric acid	15	1	1	ACGIH STEL 3
7732-18-5	Water	25	None	None	None
Mixture	Polypropylene/polyethylene	Balance	Not Est.	Not Est.	Not Est.

**SECTION III  
 HAZARDS IDENTIFICATION**

Emergency Overview: Danger! Explosive gases. Poison causes severe burns.

Wet Storage Battery is a manufactured article composed of lead and acid encased in polypropylene, sealed and vented with a flame arrestor to reduce flashback potential. The case color varies. These batteries contain dilute sulfuric acid, a corrosive substance, and may expel explosive gases.

Routes of Entry: Skin: Yes Eye: Yes Inhalation: Yes Ingestion: Yes

Acute/Chronic Health Effects:

Skin: Sulfuric acid mists or liquid irritates the skin and may cause chemical burns. Severity depends on acid concentration and duration of contact.

Eyes: Sulfuric acid mists or liquid irritates the eyes and may cause chemical burns. Severity depends on acid concentration and duration of contact. Scarring of the cornea is possible.

Inhalation: Sulfuric acid mists irritate the nose and throat and may cause respiratory difficulty.

Ingestion: Sulfuric acid mists or liquid irritates the mucous membrane and may cause chemical burns. Repeated prolonged exposure may damage tooth enamel.

Medical Conditions Aggravated by Exposure to Sulfuric Acid: Pulmonary edema, bronchitis, emphysema, eczema, contact dermatitis, dental erosion and traceobronchitis.

#### **SECTION IV FIRST-AID MEASURES**

Skin: Flush the exposed skin with large amounts of water for 15 minutes. Remove contaminated clothing. Seek medical attention.

Eyes: Force eyes open and rinse with clean, cool, running water for 15 minutes. Do not use eye drops or other medication unless advised to do so by a doctor. Seek medical attention immediately after rinsing.

Inhalation: Remove from exposure. Seek medical attention.

Ingestion: Do not induce vomiting. If conscious, drink large quantities of milk or water. Follow with milk of magnesia, beaten egg, egg whites or vegetable oil. Seek medical attention immediately.

#### **SECTION V FIRE-FIGHTING MEASURES**

Flash Point:	Not applicable	Flammable Limits: (Hydrogen Gas) 4.1 % LEL, 74.2% UEL
Autoignition Temperature:	Not applicable	Fire Point: Not applicable

Extinguishing Media: Class ABC extinguisher, carbon dioxide, foam, halon, water spray.

Special Fire Fighting Procedures: Cool exterior of battery if exposed to fire to prevent rupture. Acid mists and vapors in a fire are corrosive. Wear protective clothing and use self-contained breathing apparatus (SCBA).

Unusual Fire and Explosion Hazards:

- Hydrogen and oxygen gases are produced during normal battery operation and charging. These gases escape through the battery vents and may form an explosive atmosphere around the battery if ventilation is poor. Avoid open flame, sparks and other ignition sources in areas where batteries are used or stored.
- Sulfuric acid is an oxidizer and can ignite combustibles upon contact.

Hazardous Combustion Products: Acid mists and vapors, toxic fumes from burning plastic.

HMIS Codes: Not determined

NFPA Codes: H = 3 F = 0 R = 2 (Sulfuric acid component only)

#### **SECTION VI ACCIDENTAL RELEASE OF MATERIAL**

**Spill and Leak Procedures:**

Small spill: Neutralize the spill with baking soda, household ammonia and/or water. Rinse clean.

Large spill: Remove combustible materials and all sources of ignition. Contain spill by diking with soda ash (sodium carbonate) or quicklime (calcium oxide). Cover spill with neutralizing agent such as soda ash or quicklime. Mix well. When mixture is neutral collect the residue in a suitable container and dispose of per local, state and federal waste regulations. Wear acid resistant boots, face shield, chemical splash goggles, and acid resistant gloves. Do not release unneutralized acid.

## **SECTION VII HANDLING AND STORAGE**

**Storage Temperature:**

Min: -20°F (-28°C) for fully charged batteries. 20°F (-6°C) for completely discharged batteries.

Max: 80°F (26°C) for low shelf discharge but up to 100°F (38°C) is safe.

**Shelf Life:** Not determined.

**Special Sensitivity:** Avoid direct conductive connection across positive and negative terminals to prevent short circuit.

**Storage Precautions:** Batteries must be kept in an upright position away from ignition sources. Stack batteries so as to prevent accidental contact between terminal and/or other damage to terminals or containers. Whenever feasible, store on shipping pallet or rack. Do not stack loaded pallets or racks on top of other batteries. Store batteries in cool, well-ventilated location. Keep a supply of neutralizing agent in or near the storage area for emergency use. Avoid storage in areas exposed to heat or solar buildup. When batteries are completely discharged, the electrolyte will freeze when stored below 20°F. Fully charged batteries may be stored at temperatures as low as -20°F.

**Handling Precautions:** Use a battery carrier to lift battery or place hands at opposite corners to avoid spilling acid through the vents. Avoid contact with internal components of batteries. Do not tilt batteries to an angle greater than 45 degrees. Do not smoke when working near a battery.

## **SECTION VIII EXPOSURE CONTROLS**

**Eye Protection:** Chemical splash goggles or a full-face shield with safety glasses.

**Skin Protection:** Acid resistant clothing with rubber/neoprene boots for major spill clean up.

**Respiratory Protection:** Use NIOSH approved respiratory protection when concentrations exceed exposure guidelines.

**Ventilation:** Must be provided when charging in an enclosed area (29 CFR 1910.178 (g) and .305 (j)(7)).

**Personal Protective Equipment:** Lab apron, acid resistant steel-toed boots and protective clothing.

**Engineering Controls:** Local/building/fire codes may require explosion proof fans and equipment.

**Workplace/Hygienic Practices:** Upon skin contact, wash thoroughly with soap and water. Keep work areas clean.

Protective Gloves: Acid resistant gloves such as rubber, neoprene, vinyl coated, PVC.

## SECTION IX PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point: Not applicable	Melting Point: >300°F/149°C for case
Vapor Pressure at: Not applicable	Specific Gravity: 1.280 at 77°F/25°C (electrolyte)
Solubility in Water: miscible (sulfuric acid)	pH: < 1.0 (dilute sulfuric acid)
Appearance: A manufactured article cased in plastic with a sealed case, terminals and flame arrestor vent caps. Case color varies. Product is essentially odorless.	

## SECTION X STABILITY AND REACTIVITY

Stable: Yes

Stability - Conditions to Avoid: Use only approved charging methods. Avoid overcharging. Avoid short-circuiting. Avoid sparks and other ignition sources. Keep away from oxidizing and reducing materials. Do not open, break or melt the casing.

Incompatible Materials: Heat, open flames, sparks, strong oxidizing or reducing agents.

Hazardous Decomposition Products: Can emit highly toxic fumes when heated. Combustion can produce carbon dioxide and carbon monoxide. Will release an explosive hydrogen/oxygen gas mixture. Oxides of lead, lead and/or lead compounds may be released. Sulfuric acid may release sulfur dioxide and/or sulfur trioxide.

Hazardous Polymerization: Will not occur

Hazardous Polymerization - Conditions to Avoid: Not applicable

## SECTION XI TOXICOLOGY INFORMATION

Toxicology Data: Wet storage batteries are sealed articles. Exposure to lead, acid and lead contaminated acid is not anticipated during normal storage, handling and intended use or maintenance of the battery. Battery recycling personnel should carefully follow established employer protocols when processing batteries and battery components.

Eye Effects:

Sulfuric Acid - Severe eye irritant

Skin Effects:

Sulfuric Acid - Extremely irritating, corrosive, and toxic to tissue, resulting in rapid destruction of tissue, causing severe burns. If much skin is involved, exposure is accompanied by shock, collapse and symptoms similar to those seen in severe burns. Repeated contact with dilute solutions can cause dermatitis.

Ingestion Effects:

- Lead - Poison by ingestion in large dosages and with prolonged exposure leading to the same effects as seen in exposure by inhalation. Adults absorb 5-15% of ingested lead and retain less than 5%. Children absorb about 50% and retain about 30%.
- Sulfuric Acid - Moderately toxic by ingestion.

**Inhalation Effects:**

- Lead - For industry, inhalation is much more important than is ingestion. Systemic effects include loss of appetite, anemia, malaise, insomnia, headache, irritability, muscle and joint pains, tremors, flaccid paralysis without anesthesia, hallucinations and distorted perceptions, muscle weakness, gastritis and liver changes. Major organ systems affected are the nervous system, blood system and kidneys. Experimental evidence suggests that blood levels of lead below 10 µg/dL can lower the IQ scores of children. Low levels of lead impair neurotransmission and immune system function and may increase systolic blood pressure. Reversible kidney damage can occur from acute exposure. Chronic exposure can lead to irreversible vascular sclerosis, tubular cell atrophy, interstitial fibrosis, and glomerular sclerosis. Very heavy intoxication can sometimes be detected by formation of a dark line on the gum margins.
- Sulfuric Acid - Experimental poison by inhalation. Repeated or prolonged inhalation of sulfuric acid mist can cause inflammation of the upper respiratory tract, leading to chronic bronchitis. Severe exposure may cause chemical pneumonitis. Erosion of tooth enamel due to strong acid fume exposure has been observed in industry. Workers exposed to low concentrations of the vapors gradually lose their sensitivity to its irritating action.

**Carcinogenicity:**

CAS #	Name	OSHA Listed	NTP Listed	IARC
7439-92-1	Lead	Yes	No	2B, Human Limited Evidence
7664-93-9	Sulfuric acid*	Yes	No	1, Human Sufficient Evidence

\* Occupational exposures to strong-acid mists containing sulfuric acid have been associated with several respiratory tract cancers. However, there is no animal data supporting the carcinogenicity of sulfuric acid. Sulfuric acid has been found to be non-mutagenic, and in two studies of workers employed in lead acid battery manufacture, no association between sulfuric acid mist exposure and respiratory tract cancers was observed.

**Mutagenicity:**

Lead - Human mutation data reported.

**Reproductive Effects:**

- Lead - Severe toxicity can cause sterility, abortion, and neonatal mortality and morbidity. Experimental teratogen. Experimental reproductive effects. Pathological lesions have been found on male gonads.
- Sulfuric Acid - Experimental teratogen.

**SECTION XII  
ECOLOGICAL INFORMATION**

Ecotoxicological Information: Not applicable.

Distribution: Not determined.

Chemical Fate Information: Not determined.

### **SECTION XIII DISPOSAL CONSIDERATIONS**

RCRA Hazard Class: D002

Waste Disposal Method: Wet storage batteries are recyclable and should be turned over to a licensed battery recycler. Do not incinerate.

Sulfuric acid: Neutralize as for a spill; collect residue and place in suitable container; dispose as hazardous waste in accordance with local, state and federal regulations. Do not flush lead contaminated acid into the sewer.

### **SECTION XIV TRANSPORT INFORMATION**

#### Canadian TDG Information

TDG Shipping Name: Batteries, Wet Filled with Acid  
Hazard Class: 8  
ID Number: UN 2794  
Packing Group: III  
Special Label or Marking Requirements: Corrosive

#### U.S DOT Information

Proper Shipping Name: Batteries, Wet Filled with Acid  
Hazard Class: 8  
ID Number: UN 2794  
Packing Group: III  
RQ: N.A.  
Special Label or Marking Requirements: Corrosive

#### International Air Information (IATA Classification)

Proper Shipping Name: Batteries, Wet Filled with Acid  
Hazard Class: 8  
ID Number: UN 2794  
Packing Group: III  
Special Label or Marking Requirements: Corrosive

#### International Ocean Information (IMO Classification)

Proper Shipping Name: Batteries, Wet Filled with Acid  
Hazard Class: 8  
ID Number: UN 2794  
Packing Group: III  
Marine Pollutant: No  
Special Label or Marking Requirements: Corrosive

### **SECTION XV REGULATORY INFORMATION**

TSCA Inventory Status: All ingredients are listed on the EPA TSCA Inventory

## EPA Hazard Categories:

Immediate (acute) health hazard: Yes  
 Delayed (chronic) health hazard: Yes  
 Fire hazard: No  
 Sudden release of pressure hazard: No  
 Reactive hazard: No

## SARA 311/312: Extremely Hazardous Substances

CAS #	Name	RQ	TPQ
7664-93-9	Sulfuric acid	1000 lbs	1000 lbs

## SARA 313: Specific Toxic Chemical Listings

CAS #	Name	Percent
7439-92-1	Lead	50%
7664-93-9	Sulfuric acid	15%

## CERCLA Section 103: Hazardous Substances List

CAS #	Name	Percent	RQ
7439-92-1	Lead	50%	10 lbs
7664-93-9	Sulfuric acid	15%	1000 lbs

## Great Lakes Persistent Toxics - Metals:

CAS #	Name	Percent
7439-92-1	Lead	50%

Volatile Organic Compound (VOC): Not applicable

WHMIS: Controlled as a manufactured article.

## Canadian Environmental Protection Act (CEPA):

CAS #	Name	Schedule
7439-92-1	Lead	I and III part II

## California Proposition 65 - Reproductive Toxicants

CAS #	Name	Percent
7439-92-1	Lead	50%

## Proposition 65 Warning:

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

## New Jersey Right-to-Know Hazardous Substances

CAS #	Name	Percent
7439-92-1	Lead	50%
7664-93-9	Sulfuric acid	15%

## Massachusetts Substance List

CAS #	Name	Percent
7439-92-1	Lead	50%
7664-93-9	Sulfuric acid	15%

## Pennsylvania Hazardous Substances

CAS #	Name	Percent
7439-92-1	Lead	50%
7664-93-9	Sulfuric acid	15%

## Ontario Designated Substance

CAS #	Name	Percent
7439-92-1	Lead	50%

EINECS: Not determined

**SECTION XVI  
OTHER INFORMATION**

## Label Information:

**DANGER!** Explosive Gases: Always shield eyes and face from battery. Cigarettes, flames, sparks could cause battery to explode. Do not charge or use booster cables or adjust post connections without proper instruction and training.

**POISON!** Causes severe burns: Contains sulfuric acid. Avoid contact with skin, eyes or clothing. In event of accident flush with water and call a physician immediately. Do not tip. Keep out of reach of children.

*End of MSDS*