SALTON SEA AUTHORITY

REQUEST FOR PROPOSALS

On-water Fish Recovery System

Issued on May 2, 2001 by the

Salton Sea Authority

Responses Due: June 13, 2001

Project # EPA99-018

General Background

The Salton Sea Authority, in conjunction with the Bureau of Reclamation, is undertaking efforts to improve conditions at the Salton Sea (Sea), California. Our restoration objectives are:

- Maintaining the Sea as a repository of agricultural drainage from the Imperial and Coachella Valleys
- Providing a safe, productive environment for resident and migratory birds and endangered species
- Restoring recreational uses
- Maintaining a viable sport fishery
- Providing opportunities for economic development along the shoreline

The Sea is located in the southeastern desert of California and spans Riverside and Imperial Counties. The closest cities include Coachella, Calipatria and Westmoreland. The Sea, having a surface elevation of approximately 227 feet below sea level, is situated in a closed basin. It is sustained by inflow of drainage from irrigated agriculture in both the Coachella Valley to the north and the Imperial Valley to the south and by flows from Mexico, which consist mostly of agricultural drainage and some municipal and industrial wastewater.

The Salton Sea Authority is a regional agency. The Authority was formed as a Joint Powers Agency by the Coachella Valley Water District, the Imperial Irrigation District, the County of Riverside and the County of Imperial. Additional information about the Sea and restoration efforts is provided at www.saltonsea.ca.gov.

Summary

The Salton Sea is a large, saline lake located in southern California. It was created through a deliberate diversion of part of the Colorado River for irrigation purposes in 1905, which inadvertently caused extensive flooding of the Salton Basin.

The Lake is approximately 35 miles long by 10—13 miles wide. The average depth is 30', and at the deepest is about 50', with many very shallow areas. The surface elevation is 227' below sea level.

The Lake is presently sustained by about 1.3 million acre-feet of agricultural run-off from the Imperial Valley agricultural systems to the south. It has no outlet. About 1.3 million acre-feet of water simultaneously evaporate from the Salton Sea annually, hence the water level is essentially constant. However through this process the annual salt load accruing to the Salton Sea is approximately 4,000,000 tons. The salt content of the Salton Sea is approximately 44,000 mg/liter (ocean water is approximately 35,000 mg/liter).

Summer temperatures in the area can reach 128° Fahrenheit.

The Salton Sea is home to a very large (introduced) fish population, which in turn sustains one of the largest collection of migratory birds in the US. The ongoing accrual of salts in the Sea threatens the health of this vital resource. In addition, due to the eutrophic conditions in the lake and the hot climate, it becomes oxygen-depleted through algae blooms, which then in turn cause large-scale fish die-offs. Fish die-offs can also occur during cold water temperatures. If the dead fish are allowed to remain on the surface of the Sea, they foul the shorelines. Fish die-off events can exceed 10,000,000 lbs., however more typical events are die-offs of about 100,000 fish, or 150,000 to 200,000 lbs. The nature of the problems and the history of the Salton Sea are described on the Authority's website www.saltonsea.ca.gov. More details of the nature of the fish die-offs are attached as Appendix A.

In order to help mitigate the described problem, a system which is able to recover the fish die-offs before they either sink or drift onto the beaches may be desirable. In January 2001, a report prepared by Robert Allan Ltd. of Vancouver, Canada [1], was submitted to the Salton Sea Authority describing a water-borne system of components which could address the problem of fish removals.

The principal findings of the Robert Allen Ltd. report indicated that a full scale project may require the recovery of 100 tons of floating fish in a 10 hour period. In addition, the report identifies the following technical challenges that will need to be addressed for a full-scale project.

- Provide the capability to remove all floating components from the sea, and wash down with fresh water on a frequent basis in order to preclude barnacle accumulation.
- The ability to operate in a very corrosive environment
- Be able to transit to the recovery site at a speed of approximately 8-10 mph
- Have a propulsion system which is NOT raw water cooled (either direct raw water, as per an outboard motor, or a heat exchanger system using pumped raw water as the cooling medium), due to rapid fouling/clogging tendencies. Air-cooled systems or keel cooler systems are preferred.

As a result of this report, the Salton Sea Authority is exploring the feasibility of conducting a Pilot Project for an on-water fish recovery program to test and prove the viability of this process.

This Request for Proposal therefore defines the requirements of the Salton Sea Authority for a Pilot Project for an on-water fish recovery and ultimate disposal system.

Functional Requirements of the Pilot Project

Due to the large scale of the system described above and in the Robert Allen Ltd. report, it is desirable to prove the effectiveness of, and refine the detail of the fish-recovery process through the implementation of a Pilot Project without the initial large expense of the complete system. The Pilot Project system should have the following baseline capabilities. Higher capacities would be favourably considered:

- The ability to recover a minimum of 10,000—15,000 lbs. of fish per hour from the sea surface
- Have the capacity to recover and transfer to shore not less than 100,000 lbs. of dead fish in an 8—10 hour work shift
- Have capability to operate continuously in recovery mode for at least 8 hours
- Be able to work in very shallow waters, ideally less than 2' to enable recovery of fish close to the shoreline
- Be able to transfer the recovered fish from the sea to a land-based disposal system
- Be able to operate in the very corrosive, high saline environment of the Salton Sea
- Utilize a technology which is readily scalable up to the required capacity of the full-scale system

The above description can be applied to any one of a number of different recovery systems. The proponents are free to offer any type of technology which they believe can address the problem as described, and which will satisfy the basic requirements for recovery capacity and functional capability in the described environment.

For the purposes of this proposal, the following are simplifying assumptions that can be used to define the annual operation:

- Total fish mortalities (year 2000) - 14.2 million
- Average weight of fish - 1.2 lbs.
- Number of die-off events: - ranging from mild events of 5,000 to large events of 5.2 million
- Average float time for fish - 3—14 days, depending on Environmental conditions
- Location of die-offs - anywhere on the sea
- Die-off configurations - highly variable from dense accumulations to long uneven streaks

Scope of Services

1.0 General

The Pilot Project for fish recovery on the Salton Sea shall comprise the following:

- Provision of the necessary equipment and operating personnel for a trial period of 12 months (the historic periodic nature and variations in volume of fish-kills are described in Appendix A)
- Performance of all required fish-recovery operations on an "on-demand" basis
- Maintenance of all equipment in an active state of readiness
- Coordination with local agencies to identify the location of fish die-offs in a timely manner and respond accordingly
- Disposal of recovered fish to either land-fill or composting facilities
- Monitor the effectiveness of all aspects of the operation, and identify areas for necessary improvement
- Provide regular monthly reports to the Salton Sea Authority on the recovery operations

2.0 System Equipment

The operator shall provide all necessary equipment and personnel for the operation of a complete, "turn-key" Pilot Project. This must include:

- All on-water components
- Water-land transfer system
- Land-based transfer of fish waste for disposal or other disposition
- A shore-side facility equipped for the regular care and maintenance of the equipment, including frequent wash-down of components
- Sufficient qualified personnel to operate the system continuously (up to 16 hours per day) in the case of an "event". Assume that each "event" will last for 3 days (the historic periodic nature and variations in volume of fish-kills are described in Appendix A)
- The minimum number of full-time personnel required for the care and maintenance of the equipment for the duration of the project

3.0 System Operation

Robert Allan Ltd. Report describes one type of viable system proposed for fish recovery on the Salton Sea. A copy of that report is available by contacting dcain@saltonsea.ca.gov and may be used for background information.

The Pilot System can be based on any available existing technology with a proven capability for debris or pollution recovery which will satisfy the basic

recovery rate and throughput requirements.

The following describes the proposed Pilot Project in general terms. Bidders are asked to identify and describe their own interpretation of these functions based upon the specific equipment being offered:

- On-water recovery:
  May include one or more recovery vessels, each operated by a single person, capable of self-propulsion and equipped to recover the floating debris at the specified rate. Depending upon the recovery capacity and speed of the recovery vessel, it can either be the transfer vessel itself or be a dedicated recovery vessel, and then ultimately transfer that "cargo" to another vessel for transfer to shore

- Transfer to shore:
  the recovered fish waste may be transferred to shore by means of a simple barge type carrier or alternate efficient means. The barges can be self-propelled or towed/pushed by small workboats. Any alternative effective means of this transfer will be considered. Net-based systems are not believed to represent a viable method of fish recovery or transfer, due to the tendency of the fish (Tilapia) to become snagged in the net

- Transfer to land:
  the recovered fish may be transferred to shore with a minimum of handling. Ideally the container in which the fish are stored on the transfer vessel would be the same one transferred to shore for disposal. Due to the state of decomposition of the fish, and the high ambient temperatures it may be desirable to maintain the fish in a covered condition to the maximum extent possible

- Disposal:
  the successful contractor shall make disposal provisions. It is suggested that the County of Imperial's Department of Environmental Health, Local Enforcement Agency be contacted for disposal requirements (760) 482-4203. Potential disposal sites are located in Brawley and Salton City. The Authority is open to alternative methods of fish disposal or disposition.

- Environmental requirements:
  The potential project is likely subject to environmental review under the State's California Environmental Quality Act (CEQA). As

such, the selected contractor will be responsible for preparing an initial study/environmental assessment for the project. It is likely that a mitigated negative declaration will be prepared. The contractor is responsible for providing these services. For contractors unfamiliar with California environmental procedures, they may contact the Authority to get a list of potential consultants. Additional permits will be the responsibility of the contractor to prepare and process as necessary.

4.0 Documentation

An important element of the Pilot Project is the comprehensive monitoring and documentation of all aspects of the operations, so that the capacity and efficiency of a larger full-scale operation can be predicted with a reasonable degree of confidence. The successful proposal must provide the following accurate documentation of the operations, provided in a concise monthly report format:

- Number of hours/days worked per month
- Number of persons involved in every operation, and the hours worked
- Capital costs of the equipment provided
- Operating costs of the complete system and individual components of the system on a daily, weekly, and monthly basis
- Amount of fish recovery, by weighing all product recovered
- Rate of fish recovery on the recovery vessel (lbs. per hour or tons per hour)
    - Open water
    - Shore-side and beaches
    - Constricted areas, e.g. harbours
- Time taken to complete the total fish recovery/transfer/disposal function
- Time required to:
    a. identify and locate a die-off event
    b. mobilize and deploy the equipment to the on-water recovery site
    c. conduct the recovery event
    d. transfer fish from recovery site to shore
    e. move fish from shore site to ultimate disposal site
    d. de-mobilize and clean-up equipment

Potential contractor's are advised that an EPA approved Quality Assurance Project Plan relating to assuring the accuracy of information submitted in reports may be required. The contractor's records and the entire operation will be subject to occasional audit and scrutiny by the Salton Sea Authority or its authorized agents.

5.0 Performance Monitoring

5.1 Coordination With University of Redlands

The University of Redlands Salton Sea Database Program (SSDP) is a Congressionally funded program to facilitate restoration-planning efforts at the Salton Sea. The contractor should avail oneself of the bibliographic, GIS and other resources provided by the SSDP, generally at no cost to the contractor. For a review of information and program support available to the contractor, examine the SSDP web site: http://cem.uor.edu/salton.

The SSDP has consulted with personnel at the Sonny Bono National Wildlife Refuge and with State Parks to develop a conceptual early detection and reconnaissance program to identify and locate fish kills and other wildlife events. The event response plan will involve coordination between on-the-water observations by FWS personnel and aerial reconnaissance with a State Parks plane. Global positioning system (GPS) coordinates will be transmitted from the FWS and State Parks offices to the SSDP. The SSDP will analyze the GPS data, together with meteorological, hydrodynamic, and other information in their geographic information system (GIS) to generate location maps and coordinate clean-up response efforts. These output products can then be transmitted back to the reconnaissance program offices and to the contractor for mobilization the following morning.

5.2 Performance Monitoring Methods

Identify in the proposal the methods which will be used to monitor not only the percentage of the fish recovered, but to the maximum extent possible identify the impact that these recovery systems are having on the Sea and its shoreline. Methods may include any or all of the following, however the expected results and means of evaluating each are to be addressed.

Aerial photographs or other data collected by the University of Redlands SSDP may be made available to the Contractor upon request. These may provide some metrics for estimating aerial extent of fish kills, numbers of fish, and fish biomass, by which performance may be gauged.

- On water surveillance
- Aerial surveillance
- Shore surveillance of recovered quantities
- Ad-hoc reports from residents

5.3 Measures of Merit

The effectiveness of the on-water recovery system shall be measured using sensible and readily measured indices of performance. These shall include at least the following:

- Percentage of die-off recovered, by area or volume
- Area treated per hour
- Lbs. or tons of fish recovered per hour
- Cost per pound/ton of fish recovered
- Area of beach impacted by fish die-offs with/without recovery

Proponents are welcome to propose any alternative indices of performance, which can prove to be a reliable index of the merit of the system.

Proposal Requirements

Proponents shall submit a detailed proposal for the conduct of the proposed Pilot Project. Proposals must follow the format and content defined below. The total length of the proposal shall not exceed 20 pages. Supplementary information such as company brochures, equipment data sheets, resumes, etc., may be attached as appendices, and are not included in the above page limit.

A. Understanding of Project Objectives:

- Demonstrate that the proponent has reviewed the Request for Proposal and all referenced background documents, and understands the challenges presented by the requirement to perform the Pilot Project

B. Experience:

- Describe projects similar in scope/complexity that your firm has accomplished. Identify references and phone numbers for each project identified.

C. Qualifications:

- Describe your firm's qualifications related to this project .
- Identify your firm's certifications or membership in any professional associations (naval architecture, marine engineering or other)

- Acknowledge any relationship that you have with any major Salton Sea stakeholder/interest group. If there are no relationships, please state so.

D. Technical:

- Describe the proposed marine equipment, and demonstrate how the proposed equipment satisfies the defined technical capabilities and operating requirements
- Describe other areas or applications where the proposed equipment is operating, and provide references and contact information (names, addresses, and phone/fax numbers)
- Describe the method of proposed operation, demonstrating that the required recovery rates can be achieved and maintained
- Describe the method of transferring recovered fish from the transfer vessels to the shore vehicles
- Describe the means of ultimate disposal or disposition of recovered fish
- Describe the facilities to be provided and methods used for the regular care and maintenance of the vessels
- Describe any shore-side infrastructure that will be needed to support this on-water effort
- Describe the proposed base of operations/staging area
- Describe the efforts/activities needed to validate the accuracy of all operational information submitted in reports.

E. Personnel:

- Identify key personnel and their relevant expertise.

F. Performance Monitoring:

- Describe in detail the processes that will be followed to provide the level of performance monitoring required, as described in Section 5.2 of this Request for Proposal

G. Budget:

The proponent must identify the cost of providing and operating the Pilot Project for a continuous period of 12 months. This shall include at least the following individual breakdown of costs:

- the cost to provide, mobilize, and assemble the required components at the Salton Sea

- the cost to prepare a base of operations on the shores of the Salton Sea. The area for this base will be procured by the successful contractor

- the cost to maintain a base staff to care for the operations base and the equipment

- the cost per hour of operating the entire system in "recovery mode".

- the cost per ton to dispose of the fish waste

- the proposed reimbursement method

There is the possibility that additional services may be required beyond the project scope. The Authority reserves the right to extend or amend the contract with a successful bidder.

H. Insurance Requirements:

Time for Compliance*:*
The Contractor shall not commence work under this contract until he has provided evidence satisfactory to the Authority that he has secured all insurance required under this section. In addition, Contractor shall not allow any subcontractor to commence work on any subcontract until he has provided evidence satisfactory to the Authority that the subcontractor has secured all insurance required under this section.

Minimum Requirements: Contractor shall, at his expense, procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors. Contractor shall also require all of his subcontractors to procure and maintain the same insurance for the duration of the contract. Such insurance shall meet at least the following minimum levels of coverage:

Minimum Scope of Insurance: Coverage shall be at least as broad as the latest version of the following:

1. General Liability*:* Insurance Services Office Commercial General Liability coverage (occurrence form CG 0001).

2. Automobile Liability*:* Insurance Services Office Business Auto Coverage (form number CA 0001, code 1 (any auto).

3. Workers' Compensation and Employers' Liability*:* Workers' Compensation insurance as required by the State of California and Employer's Liability Insurance.

4. Contractor's Pollution Liability Insurance*:* Coverage for bodily and property damage (including cleanup of pollution conditions) arising out of operations for this contract.

***Minimum Limits of Insurance*:** Contractor shall maintain limits no less than:

General Liability*:* $1,000,000 per occurrence for bodily injury, personal injury and property damage. If Commercial General Liability Insurance or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit.

Automobile Liability: $1,000,000 per accident for bodily injury and property damage.

Workers' Compensation and Employer's Liability*:* Workers' compensation limits as required by the Labor Code of the State of California. Employers Liability limits of $1,000,000 per accident for bodily injury or disease.

Contractor's Pollution Liability Insurance*:* $10,000,000 per accident for bodily injury and property damage, which shall apply to this project/location only.

Insurance Endorsements*:* The insurance policies shall contain the following provisions, or Contractor shall provide endorsements on forms supplied or approved by the Authority to add the following provisions to the insurance policies:

General Liability: (1) The Authority, its directors, officers, employees, agents and volunteers shall be covered as additional insured with respect to the work or operations performed by or on behalf of the Contractor, including materials, parts or equipment furnished in connection with such work; and (2) the insurance coverage shall be primary insurance as respects the Authority, its directors, officers, employees, agents and volunteers, or if excess, shall stand in an unbroken chain of coverage excess of the Contractor's scheduled underlying coverage. Any insurance or self-insurance maintained by the Authority, its directors, officers, employees, agents and volunteers shall be excess of the Contractor's insurance and shall not be called upon to contribute with it in any way.

Automobile Liability*:* (1) The Authority, its directors, officers, employees, agents and volunteers shall be covered as additional insured with respect to the ownership, operation, maintenance, use, loading or unloading of any auto owned, leased, hired or borrowed by the Contractor or for which the Contractor is responsible; and (2) the insurance coverage shall be primary insurance as respects the Authority, its directors, officers, employees, agents and volunteers, or if excess, shall stand in an unbroken chain of coverage excess of the Contractor's scheduled underlying coverage. Any insurance or self-insurance maintained by the Authority, its directors, officers, employees, agents and volunteers shall be excess of the Contractor's insurance and shall not be called upon to contribute with it in any way.

Workers' Compensation and Employers Liability Coverage: The insurer shall agree to waive all rights of subrogation against the Authority, its directors, officers, employees, agents and volunteers for losses paid under the terms of the insurance policy which arise from work performed by the contractor.

Contractor's Pollution Liability Insurance*:* (1) The Authority, its directors, officers, employees, agents and volunteers shall be covered as additional insured with respect to the work or operations performed by or on behalf of the Contractor, including materials, parts or equipment furnished in connection with such work; and (2) the insurance coverage shall be primary insurance as respects the Authority, its directors, officers, employees, agents and volunteers, or if excess, shall stand in an unbroken chain of coverage excess of the Contractor's scheduled underlying coverage. Any insurance or self-insurance maintained by the Authority, its directors, officers, employees, agents and volunteers shall be excess of the Contractor's insurance and shall not be called upon to contribute with it in any way.

All Coverage's*:* Each insurance policy required by this contract shall be endorsed to state that: (1) coverage shall not be canceled except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the Authority; and (2) any failure to comply with reporting or other provisions of the policies, including breaches of warranties, shall not affect coverage provided to the Authority, its directors, officials, officers, employees, agents and volunteers.

Separation of Insured; No Special Limitations: All insurance required by this Section shall contain standard separation of insured provisions. In addition, such insurance shall not contain any special limitations on the scope of protection afforded to the Authority, its directors, officers, employees, agents and volunteers.

Environmental/Pollution Errors and Omissions Insurance: Contractor shall also procure and maintain, for a period of five (5) years following completion of the contract, environmental/pollution errors and omissions liability insurance, covering pollution arising our of services rendered by the insured, with a limit of not less than

$1,000,000 per claim. This insurance shall be endorsed to include all contractual liability.

Deductibles and Self-Insurance Retentions: Any deductibles or self-insured retentions must be declared to and approved by the Authority. Contractor shall guarantee that, at the option of the Authority, either: (1) the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the Authority, its directors, officers, employees, agents and volunteers; or (2) the Contractor shall procure a bond guaranteeing payment of losses and related investigation costs, claims and administrative and defense expenses.

Acceptability of Insurers*:* Insurance is to be placed with insurers with a current A.M. Best's rating no less than A:VIII, licensed to do business in California, and satisfactory to the Authority.

Verification of Coverage*:* Contractor shall furnish Authority with original certificates of insurance and endorsements effecting coverage required by this contract. The certificates and endorsements for each insurance policy shall be signed by a person authorized by that insurer to bind coverage on its behalf, and shall be on forms supplied or approved by the Authority. All certificates and endorsements must be received and approved by the Authority before work commences. The Authority reserves the right to require complete, certified copies of all required insurance policies, at any time.

Subcontractors*:* All subcontractors shall meet the requirements of this Section before commencing work. In addition, Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverage for subcontractors shall be subject to all of the requirements stated herein.

Legal Requirements

The following is a summary of legal requirements, which may impact your proposal and budget:

1) Buy American (Section 31.36 © (5) of 40 C.F.R. 31)
In accordance with Section 215 of the Clean Water act (33 U.S.C. 1251 etseq.) and implementing EPA regulations, the contractor agrees that the contractor, subcontractors, material suppliers and other suppliers in the performance of this contract will give preference to domestic materials.

2) Prevailing Wages
Proponents are advised that this contract may be classified as public work for purposes of the California Labor Code, which requires payment of prevailing wages. The successful proponent must comply with applicable provisions of state law.

3) Substitution and Retention

Proponents are advised that if awarded this Contract they will be permitted, at their request and expense and in accordance with Section 22300 of the California Public Contract Code, to substitute securities equivalent to monies withheld by the Authority to ensure performance under the Contract

4) Performance and Payment Bonds

The successful proponent will be required to furnish, prior to the award of the Contract, a Performance Bond and a Labor and Material Bond, each in an amount equal to one hundred (100%) of the Contract Price (as provided in the Agreement Form). Only bonds executed by admitted Surety insurers, as defined in Code of Civil Procedure 995.120, with a current A.M. Best's rating no less than A:VII and satisfactory to the Owner shall be accepted.

5) Equal Opportunity and Utilization of Small, Minority, and Women's Business Enterprises in Procurement: Federal requirements regarding utilization of Small, Minority and Women's Business enterprises in procurements related to this proposal will be required. Potential contractors need to briefly describe what their good faith efforts will be towards awarding a fair share of any sub-contracts and procurements to Small Business (SBE), Minority Business (MBE), and Women's Business (WBE) Enterprises. All Salton Sea Authority contractors will be obligated to retain all records documenting their MBE/WBE efforts. A fair share objective imposes an obligation on the recipient or contractor to exercise good faith efforts. Good faith efforts by a recipient or prime contractor mean efforts to attract and utilize SBEs. MBEs and WBEs, primariliy through outreach, recruitment and race/gender neutral activities.

Submittal Requirements

Responses are due on or before June 13, 2001 at 5:00 PM, to the following address:

Dan Cain, Staff Analyst
Salton Sea Authority
78-401 Highway 111, Suite T
La Quinta, CA 92253-2066
Phone (760) 564-4888
Fax: (760) 564-5288
dcain@saltonsea.ca.gov

Questions may be directed in writing (via fax or e-mail). All relevant questions and responses will be posted on the following website: http://www.lc.usbr.gov/~saltnsea/current_rfp.html

Please submit (6) copies of your proposal on 8.5" x 11" paper (stapled not bound). The proposals should be no more than 20 pages, excluding appendices that may contain qualifications, resumes and promotional materials.

Selection Process

The Salton Sea Authority will use the following criteria in the selection process:

- Qualifications & Relevant Experience
- Responsiveness to this RFP
- Ability to perform needed services
- Cost

The Authority encourages small, minority and women-owned businesses to submit proposals.

The Authority reserves the right, at its sole discretion, to reject any or all proposal(s) received as a result of this request, to negotiate with any qualified source, and to cancel in part or in its entirety this request for proposal. The receipt of proposals shall not in any way obligate the Authority to enter into a contract of any kind with any proponent(s). The Authority will not be responsible in any manner for the costs associated or incurred with the preparation and submission of the proposals.

References:

[1]Allan, R.G., *Report: A Viable Fish Recovery System for the Salton Sea*, Robert Allan Ltd. Project 200-097, dated January 4, 2001

Appendix A

Thirty-five different species of marine fish from the Gulf of California were introduced into the Salton Sea between the years of 1948 and 1951. Of these 35, the orange-mouth corvina (*Cynoscion xanthulus*), sargo (*Anisotremus davidsoni*), gulf croaker (*Bairdiella icista*), and tilapia (*Oreochromis mossambicus*) are the most abundant in

the Salton Sea today. Each year aquatic life at the Sea may be affected by a variety of life threatening conditions such as depletion of dissolved oxygen, low water temperatures, increasing salinity, bacteria and ecto-parasites.

Fish die-offs have occurred each year at the Salton Sea since the 1930's, often the result of depleted dissolved oxygen or low water temperatures in the Sea. Low water temperatures were most likely the cause of death for 2.6 million tilapia in February of 2000. Depleted dissolved oxygen levels were likely responsible for the deaths of 7.6 million fish in August 1999. Bacteria related fish deaths have also occurred at the Sea, but not on an annual basis. In September of 1997 bacteria killed more than one million fish. Carcasses of this kill covered more than 3 miles of shoreline. Laboratory analysis by the Northwest Biological Sciences Center diagnosed the cause of death as *Vibrio alginolyticus,* a bacterial infection causing lesions, swelling of the body cavity, and major, fatal changes in the internal organs.

Although the Salton Sea continues to have large-scale fish die-offs it is still one of the most productive sport fisheries in California. And, in past years the fishery at the Salton Sea has been called one of the most productive in the world.