Quality Assurance Project Plan

For

Fisheries of the Salton Sea

Dr. Barry A. Costa-Pierce
Principal Investigator

Section A: PROJECT MANAGEMENT

Objectives

The overall objective is to investigate the fish community composition, relative biomass, and fish population parameters (spawning, recruitment, growth, mortalities); and to examine the reproductive biology of all captured fishes across nine stations that encompass the entire range of salinities and available fishery habitats in the Salton Sea.

Specific Objectives

(1) Determine the dynamics of critical fish populations at nine stations in the Salton Sea: (a) the "freshwater" sections of the New and Alamo Rivers, (b) their "estuarine" sections, (c) in two shoreline areas distant from riverine inputs, and (d) at three pelagic stations using: replicate (a) multi-panel, multi-mesh gill nets, and (b) traps.

(2) Determine temporal changes in fish populations - relative biomasses, recruitment intensities, growth, ages, and mortalities - for all fishes across the entire salinity range of the Salton Sea.

(3) Investigate the reproductive biology of all captured fish - sex ratios, adult condition factors, maturation indices, and fecundities by conducting a rigorous bimonthly field sampling schedule of regular gill netting at each station.

(4) Correlate changes in fish biology and fish populations with changes in the physical and biological limnology of the Salton Sea by sampling stations and dates at the same times as the limnological reconnaissance group.

Sampling Stations and Sampling Times

Nine Salton Sea stations will be established in order to compare the importance of various fishery habitats in representative inlet, littoral zone and pelagic zones of the Sea:

- Two freshwater Alamo River and New River stations, both with salinities from 0-5 ppt;
- delta Alamo River and delta New River stations with brackishwater salinities (10-20 ppt) in an "estuarine mixing zone" that extends from the river mouths approximately 300 m offshore (unpublished field data, 1997-98);
- two Salton Sea littoral zone stations of about 3 m water depth outside of the influence of any inlet rivers or agricultural drains along the shorelines of the northern and southern part of the Sea;
- three Salton Sea pelagic zone stations greater than 5 m total depth in the middle, southern, and northern parts of the Salton Sea; all stations comprising representative portions of the pelagic zone.

These stations will be the same stations as the limnological reconnaissance group. Fishery stations will be resampled every other month starting in February 1999 by recording and returning to Global Positioning System (GPS) coordinates established by the limnological reconnaissance group.

All nets and traps will be set at dusk/sunset and pulled at sunrise the following day. In January 1999, an initial experiment will be done to examine different set times and biomass accumulation rates at pelagic and littoral zone stations in order examine the effects of set times on catch rates in order to avoid overloading of gill nets and increase catch bias.

Fish Biology and Fish Population Methods

Assessments of fish biology, community structure and fish populations will be accomplished at all nine stations by setting duplicate, multi-panel, multimesh gill nets every two months over 48-hour stations, throughout a 12-month period. Multi-panel, multi-mesh gill nets will catch recruits, juveniles, and adult fish. In addition, we will also set duplicate wire fish traps at each station.

Fish populations will be sampled at all stations by suspending two replicate 50 m long, multi-panel, multi-mesh gill nets of 2.5 m in depth. Nets will have five, 10 m long panels of 5 different mesh sizes (0.25", 0.5", 1.0", 2.0", 5.0") of knotted nylon netting. Gill nets will be set using standard lead and float lines, with each end floated by buoys and weighted by boat anchors. Nets will be set as fixed panels sampling the 0-2.5 m stratum of the fish community since oxygen concentrations drop rapidly below 3.0 m in the Salton Sea.

At the same time of the setting gill nets, duplicate 1/4" mesh wire fish traps of 18" x 24" size (Aquatic Ecosystems, Apopka, FL) will be set to capture juvenile fish at each station and obtain additional data on recruitment. Traps will be wired to stakes driven into the bottom at 1.0 m depth (for the littoral zone, delta, and riverine areas), or will be floated underneath anchored buoys at 1.0 m depth in the pelagic zone. We will bait all traps with perforated cans of sardines attached by wires to the insides of all traps.

All captured fish will be taken from each net panel and trap and put into separate marked buckets and bins, and the total biomass of the individual panels and traps batch weighed. Relative fisheries efforts will be measured per meter of net set or per area of trap set. Fish from each gill net panel and trap will be identified to species, counted, measured for total length to the nearest millimeter and weighed individually to the nearest 0.1 gram in order to calculate fish condition indices, length-weight relationships, and construct size-frequency histograms. In order to analyze age-frequencies of fish populations, otoliths will be collected using standard methods from all fish in the large panels (1-5") and a sample of 5 to 10 fish taken from smaller panels (0.25-0.5") after morphometric measurements are taken.

At all 9 sampling stations a suite of routine water quality parameters (temperature, salinity, conductivity, oxygen, pH) will be measured using a refractometer, YSI oxygen meter, and field pH meter at the surface, 1.0 m, and at a depth interval 10 cm above the bottom.

All time series (bimonthly) fisheries data will be entered directly after field sampling into Excel^{R} spreadsheets by each sampling station. Each spreadsheet will be divided into sections for each species, and subdivided by gill net panel (mesh size). Each spreadsheet will contain data on total length, weight, and Fulton's condition factor (L/W^3).

Each captured fish in the large panels (and a sample in the small panels) will be sexed, and dissected to determine stage of maturation. Fish gonads will be removed and wet weighed in the field to determine gonadal somatic indices (GSIs) for each species over time. Liver color will be noted as an additional index of fish condition. For annual spawners showing single spawning periodicity (sciaenids and sargo), otoliths will be

taken from each fish, sectioned, stained and preserved. For the multiple spawning tilapia, daily growth rings will be measured using a digital camera.

GSIs, Fulton's and liver condition factors will be plotted over time to determine fish spawning times and to determine growth forms of fish species (isometric or non-isometric) over the entire sampling period at each station.

Changes in fish populations will be analyzed at each station at both levels of ecological organization, e.g. data analyses will be done for the entire multispecies fish community and for each individual population. For the population data, a set of spreadsheets will be organized by station, and subdivided by species, to store data on numbers (frequency), length, weight, and ages of fish caught in each net panel (mesh size) at each station.

Data will be analyzed using the age-based fish population assessment methods. The tilapias, however, have multiple spawning times in one year, and age-based population assessment methods cannot be used so data will be analyzed by length-frequency time series methods. Both length-based and age-based multi-stock fisheries assessments models on all four of the recreationally important fish species (tilapia, corvina, sargo, bairdiella). Doing both analyses will allow a second means of checking determinations of population recruitment intensities, growth, and fish mortalities for the mixed species composition of tropical and temperate species in the Salton Sea.

Data will be analyzed to determine size-frequency histograms (both length and weight histograms) at each sampling date. Migration biases in the data will be checked using Chapman's method. Estimation of catch curves and gill net selection curves will be done. For species with normal selection curves with constant standard deviations, catch curves will be determined according to Holt. For species where the standard deviation increases with increasing gill net mesh size, the methods of Regier and Robson will be used. Monthly size-frequency and age-frequency distributions will be divided by probabilities of capture in the gill nets to get estimates of the true size- and age-frequency distributions of fish stocks, using software routines available in the Electronic Length Frequency Analysis (ELEFAN) and FAO-ICLARM Stock Assessment Tools (FISAT).

Growth curves will be constructed after analyses of selection curves and modal progression analyses are completed. Estimates of growth parameters ($L_{infinity}$, K and t_o) of the von Bertalanffy growth curves will be made using FISAT software after analyzing data for linearity in the FISHPARM routine. For tilapia, we will use FISAT to determine $L_{infinity}$ and K then fix these values in the non-linear least squares fitting routine of Prager et al. to estimate t_o. Seasonalized von Bertalanffy growth equations will be used since our analyses will extend over one season. After determining von Bertalanffy growth parameters, total mortalities will be determined using the length-converted linearized catch curve method in the FISAT software package. Beverton and Holt yield per recruit and relative mean biomasses will be calculated by the Thompson and Bell methods. Catch per unit effort and effort data will also be plotted using Schaffer and Fox surplus production models.

Schedule and Reporting Dates

Project dates will be 1 January 1999 to 1 May 2000.

An initial test field sampling will be done 10-17 January 1999.

Routine bimonthly field sampling will be done from Feb.-December 1999.

Sampling and Project Reporting dates will be:

Milestones	Action Date
1 January 1991	Synopsis Report
10-17 January 1999	Project Initiated
Feb. 1999	First Routine Sampling
March 1999	Monthly Report
April 1999	Second Sampling
May 1999	Monthly Report
June 1999	Third Sampling
July 1999	Monthly Report; Six Month Progress Report
August 1999	Fourth Sampling
September 1999	Monthly Report
October 1999	Fifth Sampling
October 1999	Monthly Report
December 1999	Sixth Sampling
January 2000	Monthly Report; One Year Progress Report
May 1, 2000	Final Report Submitted

A1 Fish Biology and Fisheries Ecology of the Salton Sea

Organization

_____

Dr. Barry A. Costa-Pierce
Principal Investigator
Institute of Marine Science
University of Southern Mississippi
Ocean Springs, MS 39566-7000
Tel: 228-875-9368
Fax: 228-875-0528
bcp@seahorse.ims.usm.edu

Technical Project Manager

_____

Dr. Richard Thiery
Project Officer
Salton Sea Science Subcommittee

QA Officer

_____

Dr. Barry Gump
QA/QC Officer

Project Staff

Dr. Barry A. Costa-Pierce, Institute of Marine Science, University of Southern Mississippi, Ocean Springs, MS 39566-7000 Tel: 228-875-9368, Fax: 228-875-0528, bcp@seahorse.ims.usm.edu

Dr. Stuart H. Hurlbert, Center for Inland Waters and Department of Biology, San Diego State University, San Diego, CA 92182-4614, Tel: 619-594-5409, Fax: 619-594-5676, shurlbert@sunstroke.sdsu.edu

Dr. Ralf Riedel, Center for Inland Waters and Department of Biology, San Diego State University, San Diego, CA 92182-4614, Tel: 619-594-5409, Fax: 619-594-5676, riedel@sunstroke.sdsu.edu

Dr. John Butler, National Marine Fisheries Service, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92038, Tel: 619-546-7149, jbutler@ucsd.edu

Ms. Lucy Helvenston, National Marine Fisheries Service, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92038, Tel: 619-546-5619, lucilleh@sgilj.ucsd.edu

A2 Table of Contents

A3 Distribution List

Richard Thiery, Coachella Valley

Tom Kirk, Salton Sea Authority

Stu Hurlbert, SDSU

John Butler, SW Fisheries Science Center

Ralf Riedel, SDSU

Barry Gump, DWR

A4 Project Organization and Responsibilities

Fisheries Staff Member	Roles and Responsibilities
Dr. Barry Costa-Pierce	Fish Biology and Fish Population Analyses by Netting Surveys
Dr. John Butler	Determination of Fish Ages; Assistance with Fisheries Data Analyses; Joint Supervision of Graduate Student
Dr. Stuart Hurlbert	Advising on Sampling Designs and Data Analyses; Integration of Fish Project with Limnological Reconnaissance Project; Logistical and Lab Space Support; Joint Supervision of Graduate Students
Dr. Ralf Riedel	Post Doc Fish Biology and Fish Population Analyses by Netting Surveys; Computer Programming and Database Maintenance; Field Assistance with Net and Trap Sampling; Fish Reproductive Biology.
Lucille Helvenston	Graduate Student with Field Assistance in Net and Trap Sampling; Data Entry and Analyses; Boats; Net Maintenance; Fish Otolith, Growth Analyses at SW Fisheries Center
Field Assistants (occasional)	Field Assistance with Net and Trap Sampling; Routine Data Entry; Boats; Net Maintenance.

A5 Project Definition and Background

Objectives

The overall objective is to investigate the fish community composition, relative biomass, and fish population parameters (spawning, recruitment, growth, mortalities); and to examine the reproductive biology of all captured fishes across nine stations that encompass the entire range of salinities and available fishery habitats in the Salton Sea.

Specific Objectives

1. Determine the dynamics of critical fish populations at nine stations in the Salton Sea: (a) the “freshwater” sections of the New and Alamo Rivers, (b) their “estuarine” sections, (c) in two shoreline areas distant from riverine inputs, and (d) at three pelagic stations using: replicate (a) multi-panel, multi-mesh gill nets, and (b) traps.
2. Determine temporal changes in fish populations - relative biomasses, recruitment intensities, growth, ages, and mortalities - for all fishes across the entire salinity range of the Salton Sea.

3. Investigate the reproductive biology of all captured fish - sex ratios, adult condition factors, maturation indices, and fecundities by conducting a rigorous bimonthly field sampling schedule of regular gill netting at each station.
4. Correlate changes in fish biology and fish populations with changes in the physical and biological limnology of the Salton Sea by sampling stations and dates at the same times as the limnological reconnaissance group.

Nine Salton Sea stations will be established in order to compare the importance of various fishery habitats in representative inlet, littoral zone and pelagic zones of the Sea:

- Two freshwater Alamo River and New River stations, both with salinities from 0-5 ppt;
- delta Alamo River and delta New River stations with brackishwater salinities (10-20 ppt) in an "estuarine mixing zone" that extends from the river mouths approximately 300 m offshore (unpublished field data, 1997-98);
- two Salton Sea littoral zone stations of about 3 m water depth outside of the influence of any inlet rivers or agricultural drains along the shorelines of the northern and southern part of the Sea;
- three Salton Sea pelagic zone stations greater than 5 m total depth in the middle, southern, and northern parts of the Salton Sea; all stations comprising representative portions of the pelagic zone.

These stations will be the same stations as the limnological reconnaissance group. Fishery stations will be resampled every other month starting in February 1999 by recording and returning to Global Positioning System (GPS) coordinates established by the limnological reconnaissance group.

A6 Project/Task Description

Fish Biology and Fish Population Methods

Assessments of fish biology, community structure and fish populations will be accomplished at all nine stations by setting duplicate, multi-panel, multimesh gill nets every two months over 48-hour stations, throughout a 12-month period. Multi-panel, multi-mesh gill nets will catch recruits, juveniles, and adult fish. In addition, we will also set duplicate wire fish traps at each station.

Fish populations will be sampled at all stations by suspending two replicate 50 m long, multi-panel, multi-mesh gill nets of 2.5 m in depth. Nets will have five, 10 m long panels of 5 different mesh sizes (0.25", 0.5", 1.0", 2.0", 5.0") of knotted nylon netting. Gill nets will be set using standard lead and float lines, with each end floated by buoys and weighted by boat anchors. Nets will be set as fixed panels sampling the 0-2.5 m stratum of the fish community since oxygen concentrations drop rapidly below 3.0 m in the Salton Sea.

At the same time of the setting gill nets, duplicate 1/4" mesh wire fish traps of 18" x 24" size (Aquatic Ecosystems, Apopka, FL) will be set to capture juvenile fish at each station and obtain additional data on recruitment. Traps will be wired to stakes driven into the bottom at 1.0 m depth (for the littoral zone, delta, and riverine areas), or will be floated underneath anchored buoys at 1.0 m depth in the pelagic zone. We will bait all traps with perforated cans of sardines attached by wires to the insides of all traps.

All captured fish will be taken from each net panel and trap and put into separate marked buckets and bins, and the total biomass of the individual panels and traps batch weighed. Relative fisheries efforts will be

measured per meter of net set or per area of trap set. Fish from each gill net panel and trap will be identified to species, counted, measured for total length to the nearest millimeter and weighed individually to the nearest 0.1 gram in order to calculate fish condition indices, length-weight relationships, and construct size-frequency histograms. In order to analyze age-frequencies of fish populations, otoliths will be collected using standard methods from all fish in the large panels (1-5") and a sample of 5 to 10 fish taken from smaller panels (0.25-0.5") after morphometric measurements are taken.

At all 9 sampling stations a suite of routine water quality parameters (temperature, salinity, conductivity, oxygen, pH) will be measured using a refractometer, YSI oxygen meter, and field pH meter at the surface, 1.0 m, and at a depth interval 10 cm above the bottom.

All time series (bimonthly) fisheries data will be entered directly after field sampling into Excel^{R} spreadsheets by each sampling station. Each spreadsheet will be divided into sections for each species, and subdivided by gill net panel (mesh size). Each spreadsheet will contain data on total length, weight, and Fulton's condition factor (L/W^3).

Each captured fish in the large panels (and a sample in the small panels) will be sexed, and dissected to determine stage of maturation. Fish gonads will be removed and wet weighed in the field to determine gonadal somatic indices (GSIs) for each species over time. Liver color will be noted as an additional index of fish condition. For annual spawners showing single spawning periodicity (sciaenids and sargo), otoliths will be taken from each fish, sectioned, stained and preserved. For the multiple spawning tilapia, daily growth rings will be measured using a digital camera.

GSIs, Fulton's and liver condition factors will be plotted over time to determine fish spawning times and to determine growth forms of fish species (isometric or non-isometric) over the entire sampling period at each station.

Changes in fish populations will be analyzed at each station at both levels of ecological organization, e.g. data analyses will be done for the entire multispecies fish community and for each individual population. For the population data, a set of spreadsheets will be organized by station, and subdivided by species, to store data on numbers (frequency), length, weight, and ages of fish caught in each net panel (mesh size) at each station.

Data will be analyzed using the age-based fish population assessment methods. The tilapias, however, have multiple spawning times in one year, and age-based population assessment methods cannot be used so data will be analyzed by length-frequency time series methods. Both length-based and age-based multi-stock fisheries assessments models on all four of the recreationally important fish species (tilapia, corvina, sargo, bairdiella).

Data will be analyzed to determine size-frequency histograms (both length and weight histograms) at each sampling date. Migration biases in the data will be checked using Chapman's method. Estimation of catch curves and gill net selection curves will be done. For species with normal selection curves with constant standard deviations, catch curves will be determined according to Holt. For species where the standard deviation increases with increasing gill net mesh size, the methods of Regier and Robson will be used. Monthly size-frequency and age-frequency distributions will be divided by probabilities of capture in the gill nets to get

estimates of the true size- and age-frequency distributions of fish stocks, using software routines available in the Electronic Length Frequency Analysis (ELEFAN) and FAO-ICLARM Stock Assessment Tools (FISAT).

Growth curves will be constructed after analyses of selection curves and modal progression analyses are completed. Estimates of growth parameters ($L_{infinity}$, K and t_o) of the von Bertalanffy growth curves will be made using FISAT software after analyzing data for linearity in the FISHPARM routine. For tilapia, we will use FISAT to determine $L_{infinity}$ and K then fix these values in the non-linear least squares fitting routine of Prager et al. to estimate t_o. Seasonalized von Bertalanffy growth equations will be used since our analyses will extend over one season. After determining von Bertalanffy growth parameters, total mortalities will be determined using the length-converted linearized catch curve method in the FISAT software package. Beverton and Holt yield per recruit and relative mean biomasses will be calculated by the Thompson and Bell methods. Catch per unit effort and effort data will also be plotted using Schaffer and Fox surplus production models.

Schedule and Reporting Dates

Project dates will be 1 January 1999 to 1 May 2000.

An initial test field sampling will be done 10-17 January 1999.

Routine bimonthly field sampling will be done from Feb.-December 1999.

Sampling and Project Reporting dates will be:

Milestones	Action Date
1 January 1999	Synopsis Report
10-17 January 1999	Project Initiated
5 Feb. 1999	Interim Report on First Field Experiences
Feb. 1999	First Routine Sampling
March 1999	Monthly Report
April 1999	Second Sampling
May 1999	Monthly Report
June 1999	Third Sampling
July 1999	Monthly Report; Six Month Progress Report
August 1999	Fourth Sampling
September 1999	Monthly Report
October 1999	Fifth Sampling
October 1999	Monthly Report
December 1999	Sixth Sampling
January 2000	Monthly Report; One Year Progress Report
May 1, 2000	Final Report Submitted

A7 Quality Objectives and Criteria for Measurement Data

Data to be collected

Stations will be located by using a GPS system.

All captured fish will be taken from each net panel and trap and put into separate marked buckets and bins, and the total biomass of the individual panels and traps batch weighed. Species identifications will be checked by referencing standard keys to the marine and freshwater fishes of the region (Miller and Lea, 1972).

Relative fisheries efforts will be measured per meter of net set or per area of trap set. Fish from each gill net panel and trap will be identified to species, counted, measured for total length to the nearest millimeter and weighed individually to the nearest 0.1 gram in order to calculate fish condition indices, length-weight relationships, and construct size-frequency histograms. To assure counting and weighing accuracy, staff will double check every count, and balances will be re-tared at every weight interval. In order to analyze age-frequencies of fish populations, otoliths will be collected using standard methods from all fish in the large panels (1-5") and a sample of 5 to 10 fish taken from smaller panels (0.25-0.5") after morphometric measurements are taken. Duplicate otoliths will be taken from each fish to ensure accuracy and adequate sample sizes. Duplicate counts should be 100% accurate.

At all 9 sampling stations a suite of routine water quality parameters (temperature, salinity, conductivity, oxygen, pH) will be measured using a refractometer, YSI oxygen meter, and field pH meter at the surface, 1.0 m, and at a depth interval 10 cm above the bottom.

A8 Special Training Requirements/Certification

All personnel have prior academic training in fisheries assessments, population dynamics modeling; fisheries database construction and management; and preparation of technical reports.

A9 Documentation and Records

Section B: MEASUREMENT/DATA ACQUISITION

B1 Sampling Process Design (Experimental Design)

Assessments of fish biology, community structure and fish populations will be accomplished at all nine stations by setting duplicate, multi-panel, multimesh gill nets every two months over 48-hour stations, throughout a 12-month period. Multi-panel, multi-mesh gill nets will catch recruits, juveniles, and adult fish. In addition, we will also set duplicate wire fish traps at each station.

Fish populations will be sampled at all stations by suspending two replicate 50 m long, multi-panel, multi-mesh gill nets of 2.5 m in depth. Nets will have five, 10 m long panels of 5 different mesh sizes (0.25", 0.5", 1.0", 2.0", 5.0") of knotted nylon netting. Gill nets will be set using standard lead and float lines, with

each end floated by buoys and weighted by boat anchors. Nets will be set as fixed panels sampling the 0-2.5 m stratum of the fish community since oxygen concentrations drop rapidly below 3.0 m in the Salton Sea.

At the same time of the setting gill nets, duplicate 1/4" mesh wire fish traps of 18" x 24" size (Aquatic Ecosystems, Apopka, FL) will be set to capture juvenile fish at each station and obtain additional data on recruitment. Traps will be wired to stakes driven into the bottom at 1.0 m depth (for the littoral zone, delta, and riverine areas), or will be floated underneath anchored buoys at 1.0 m depth in the pelagic zone. We will bait all traps with perforated cans of sardines attached by wires to the insides of all traps.

All captured fish will be taken from each net panel and trap and put into separate marked buckets and bins, and the total biomass of the individual panels and traps batch weighed. Relative fisheries efforts will be measured per meter of net set or per area of trap set. Fish from each gill net panel and trap will be identified to species, counted, measured for total length to the nearest millimeter and weighed individually to the nearest 0.1 gram in order to calculate fish condition indices, length-weight relationships, and construct size-frequency histograms. In order to analyze age-frequencies of fish populations, otoliths will be collected using standard methods from all fish in the large panels (1-5") and a sample of 5 to 10 fish taken from smaller panels (0.25-0.5") after morphometric measurements are taken.

At all 9 sampling stations a suite of routine water quality parameters (temperature, salinity, conductivity, oxygen, pH) will be measured using a refractometer, YSI oxygen meter, and field pH meter at the surface, 1.0 m, and at a depth interval 10 cm above the bottom.

Procedures for Locating and Selecting Environmental Samples

Nine Salton Sea stations will be established: (1) Two freshwater Alamo River and New River stations, both with salinities from 0-5 ppt; (2) delta Alamo River and delta New River stations with brackishwater salinities (10-20 ppt) in an "estuarine mixing zone" that extends from the river mouths approximately 300 m offshore (unpublished field data, 1997-98); (3) two Salton Sea littoral zone stations of about 3 m water depth outside of the influence of any inlet rivers or agricultural drains along the shorelines of the northern and southern part of the Sea; (4) three Salton Sea pelagic zone stations greater than 5 m total depth in the middle, southern, and northern parts of the Salton Sea; all stations comprising representative portions of the pelagic zone.

Stations were chosen to encompass the entire range of available fishery habitats and salinites in the Salton Sea.

Fishery stations will be resampled every other month starting in February 1999 by recording and returning to Global Positioning System (GPS) coordinates established by the limnological reconnaissance group.

Schedule for Project Sampling Activities

Sampling Date	Action

10-17 January 1999	Project Initiated
Feb. 7-14, 1999	First Routine Sampling
April 4-11, 1999	Second Sampling
June 13-20, 1999	Third Sampling
August 8-15, 1999	Fourth Sampling
October 12-19, 1999	Fifth Sampling
December 5-12, 1999	Sixth Sampling

Validation of Any Nonstandard Methods

All nets and traps will be set at dusk/sunset and pulled at sunrise the following day. In January 1999, an initial experiment will be done to examine different set times and biomass accumulation rates at pelagic and littoral zone stations in order examine the effects of set times on catch rates in order to avoid overloading of gill nets and increase catch bias.

B2 Sampling Method Requirements

Sampling Methods and Types of Samples to be Collected

Discussed in previous sections.

Decontamination Procedures and Materials

Standard Methods (1997) will be used for the suite of routine water quality parameters.

Sampling System Failure Response and Corrective Action Process

Adequate numbers of back up multi-panel, multi-mesh gill nets and fish traps are available.

B3 Sample Handling and Custody Requirements

B4 Analytical Methods Requirements

All captured fish will be taken from each net panel and trap and put into separate marked buckets and bins, and the total biomass of the individual panels and traps batch weighed. Relative fisheries efforts will be measured per meter of net set or per area of trap set. Fish from each gill net panel and trap will be identified to species, counted, measured for total length to the nearest millimeter and weighed individually to the nearest 0.1 gram in order to calculate fish condition indices, length-weight relationships, and construct size-frequency histograms. In order to analyze age-frequencies of fish populations, otoliths will be collected using standard methods from all fish in the large panels (1-5”) and a sample of 5 to 10 fish taken from smaller panels (0.25-0.5”) after morphometric measurements are taken. Standard methods of stock assessment are to be used (Gayanilo et al. 1997).

At all 9 sampling stations a suite of routine water quality parameters (temperature, salinity, conductivity, oxygen, pH) will be measured using a refractometer, YSI oxygen meter, and field pH meter at the surface, 1.0 m, and at a depth interval 10 cm above the bottom.

A custody notebook of fish samples and otoliths will be maintained. Field staff that sample otoliths and fish will be the same personnel that process samples in the laboratory.

Doing both length-based and age-based fisheries population dynamics assessments will allow a second means of checking determinations of population recruitment intensities, growth, and fish mortalities for the mixed species composition of tropical and temperate species in the Salton Sea.

B5 Quality Control Requirements

All captured fish will be taken from each net panel and trap and put into separate marked buckets and bins, and the total biomass of the individual panels and traps batch weighed. Relative fisheries efforts will be measured per meter of net set or per area of trap set. Fish from each gill net panel and trap will be identified to species, counted, measured for total length to the nearest millimeter and weighed individually to the nearest 0.1 gram in order to calculate fish condition indices, length-weight relationships, and construct size-frequency histograms. In order to analyze age-frequencies of fish populations, otoliths will be collected using standard methods from all fish in the large panels (1-5") and a sample of 5 to 10 fish taken from smaller panels (0.25-0.5") after morphometric measurements are taken.

At all 9 sampling stations a suite of routine water quality parameters (temperature, salinity, conductivity, oxygen, pH) will be measured using a refractometer, YSI oxygen meter, and field pH meter at the surface, 1.0 m, and at a depth interval 10 cm above the bottom.

B6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Dr. Reidel will be responsible for daily maintenace of all nets and gears.

B7 Instrument Calibration and Frequency

B8 Data Management

A daily field log will be maintained of all activities by Dr. Riedel. All time series (bimonthly) fisheries data will be entered directly after field sampling into Excel^{R} spreadsheets by each sampling station. Each spreadsheet will be divided into sections for each species, and subdivided by gill net panel (mesh size). Each spreadsheet will contain data on fish total length, weight, and Fulton's condition factor (L/W^3).

B9 Data Acquisition Requirements

Data collected during this project will be compared to the only existing data on the Sea from Walker et al. (1961). These data are so old and the Sea ecosystems so changed that this study will be used as background historical information only.

Section C: ASSESSMENT/OVERSIGHT

C1 Reports to Management

Dr. Costa-Pierce will be responsible for all reports to management. Dr. Costa-Pierce will make needed adjustments in reporting as the study progresses and note any changes in a section of each monthly report. Dr. Thiery is responsible for approving any adjustments.

Milestones	Action Date
Jan. 1, 1999	Synopsis Report
March 1999	First Sampling Report
May 1999	Second Sampling Report
July 1999	Third Sampling Report; Six Month Progress Report
September 1999	Fourth Sampling Report
November 1999	Fifth Sampling Report
January 2000	Sixth Sampling Report; One Year Progress Report
May 1, 2000	Final Report Submitted

Section D: DATA VALIDATION AND USABILITY

D1 Data Review, Validation, and Verification Requirements

Data will be reviewed after each field sampling journey and monthly at the time of reporting.

All nets, traps and meters will be evaluated and restandardized, and minor repairs made after each sampling.

Doing both length-based and age-based fisheries population dynamics assessments will allow a second means of checking determinations of population recruitment intensities, growth, and fish mortalities for the mixed species composition of tropical and temperate species in the Salton Sea.

Fisheries data will be stored in a comma delimited ASCII format for compatibility with the majority of software applications. Three files will store the data:

- SALSTA.TXT stores information pertaining to a replicate net within a station;
- SALFIS.TXT stores information on individual fish;
- SALSUB.TXT stores data from subsamples of catches.

Reporting will be done in Microsoft Word text summaries with tables and figures in Excel and Powerpoint. FiSat (Gayanilo et al. 1996), Excel, SAS, and Statgraphics will be used for data analyses.

References

Gayanilo, F.C. et al. 1996. *FAO-ICLARM Stock Assessment Tools*. ICLARM and FAO, Rome, Italy.

Miller, and R.N. Lea. 1972. *Guide to the Coastal Marine Fishes of California.* Bulletin #157. California Dept. of Fish and Game, Sacramento, CA.

Standard Methods. 1997. *Standard Methods for Water and Wastewater Analysis*. American Water Works Assoc.