Salton Sea Fisheries Long-term Monitoring

Draft Quarterly Report: Summer 2006

Salton Sea Program
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Introduction:

The California Department of Fish and Game (CDFG) is monitoring the status and trends of the Salton Sea fisheries. This will require a compilation of sampling results over several years. In the spring of 2003, Department personnel started quarterly sampling at fourteen stations around the sea, as the basis of a long term monitoring program. To allow comparison of current and future monitoring efforts by CDFG to past results, the following protocol was adapted from those previously used by researchers at the Salton Sea.

Each quarter, if conditions allow, this protocol will produce about 816 net-hours of sampling. After each quarter's sampling is completed this draft report will be prepared, summarizing the numbers and species of fish netted, and calculating the overall and species-based catch-per-unit-effort (CPUE). This report will also offer qualitative comments on the condition and breeding status of each species. After annual repetitions of seasonal sampling, enough data will be collected to allow statistical tests for significant differences in numbers, seasonality, and site use, by and among the four species of fish.

Methods:

The sampling sites comprise three broad habitat types: pelagic (3 sites), near-shore (8 sites), and estuarine (3 sites). The pelagic sites are in the approximate middles of the north basin, south basin and inter-basin areas of the Sea. The near-shore sites are spaced widely apart, four each, near the west and east shores, to capture as much breadth of habitat as possible. The estuarine sites are in the body of the Sea, close enough to the mouths of the New, Alamo, and Whitewater Rivers, to be under the influence of their outflows. See Table 1. for the exact locations of all sites.

Sampling takes place during each of the putative seasons, as follows: spring- April and May; summer- July and August; fall- October and November; winter- January and February. We will attempt to compress the total sampling period into as few days as possible, to the extent that the weather, equipment maintenance, and personnel scheduling constraints allow. Nets are typically set at one or two sites in the morning, and hauled in after approximately 24 hours. The exact number of hours set is recorded for each net, to the nearest quarter-hour.

Fish are sampled by deploying multi-panel monofilament gill nets with 6 X 30 foot panels of 0.5, 1, 2, 3, and 4 inch mesh. Two nets are set at all sites at the water's surface. The nets are set far enough apart to allow room for maneuvering a boat during setting and retrieval, usually 100-200 meters. The nets at near-shore and estuarine sites are set in 2.5 to 4.5 meters of water, typically 200-300 meters from the shore.

Two additional nets are set at the bottom of water column at the three pelagic sites. The conditions fish experience at the bottom in deep water is different enough from the surface water,

in dissolved oxygen, light, food availability and temperature, that this can be considered a discrete habitat, and thus we sample it as though it were a separate site.

At the time of each set and retrieval, water depth, water temperature, conductivity, salinity, and dissolved oxygen are measured and recorded.

When nets are pulled in the following day, all fish are removed and immediately stored on ice. Data are collected from these fish as soon as possible, almost always the same day they are hauled in.

All fish are identified to species level and counted. For the four sport fish in the Salton Sea, (tilapia, Gulf croaker, orangemouth corvina and sargo) weights, lengths (fork length), sex, physical condition, and reproductive status are recorded. Fish above five pounds are weighed to the nearest ounce. Fish below five pounds are weighed to the nearest half ounce. Lengths of fish under 50 centimeters are recorded to the nearest millimeter. Lengths of fish over 50 centimeters are recorded to the nearest centimeter. The sex of all adult fish is determined by dissection. A sample of at least ten fish of each species is also dissected to determine physical condition and breeding status.

Changes to Protocol after Year One:

Our protocol is designed to elucidate long-term trends in the fisheries. Until very recently, deep water habitats have provided some low level of productivity for the fisheries, and were important habitat components to sample. Since we began sampling, however, our three deep water sites have been completely unproductive, a costly element of our efforts, and the least probable site for fish use, given the severe reduction in population size which we have discovered.

We have therefore temporarily eliminated sampling at the three deep water sites, which reduces our efforts by 288 net-hours, to a quarterly total effort of 528 net-hours. We leave these sites in the protocol, since they will likely provide useful information about population trends and habitat use, should the fisheries rebound to levels which allow robust comparisons among these and the other sampling sites.

All future comparisons of CPUE that we make will be among quarterly data sets that exclude previously sampled deep-water sites from the calculations. The CPUE values for our first year will then be higher overall, but the comparison between years will be valid. Our data are not designed to determine absolute numbers, but to show trends.

Results:

Our summer 2006 sampling session was conducted from July 6 through July 25. Table 2. shows the numbers of fishes sampled at each site. Total number of fish sampled at 11 sites was 2,441 tilapia with 264 net-hours of effort, for a CPUE of 9.26. Fish were present at all sites, although sample sizes varied by an order of magnitude, from 46 to 537 fish. No clear pattern has emerged of differences in fish densities among the sampling sites.

For all fish, no sex, stomach contents, or condition data were collected.

Discussion:

We are in the middle of a fourth year of monitoring the Salton Sea fisheries. Chart 1. shows a comparison of all results for tilapia, by season. Note that the scale is logarithmic, for ease of viewing. The putative winter seasons' sampling actually took place in January and February of the following calendar years.

We anticipated very high rates of catch this summer, based on a steady increase in sample sizes for the last three years, recent improvement in angler success, and visible signs of robust reproduction this spring. We reduced our sampling efforts to one net at each site, to avoid unnecessary waste of fish, and create a more manageable challenge for field personnel. The reduction in reliable launch sites around the Salton Sea has also impacted the logistics of sampling the most distant sites.

The CPUE from this season's sampling (9.26 fish/net hour) is an increase of 34% over last summer's sampling period (6.91 fish/net hour), and the highest catch rate of any sampling period. These results support our belief that the tilapia population has undergone a three year period of expansion which continues today.

Tilapia were in two obvious size classes (Table 3). The sizes of young-of-the-year (YOY) fish were consistent with those from previous summers (about 60-70mm), although the much larger sample size detected more outliers.

The sizes of larger fish were sufficiently divergent in past samples that we could confidently identify putative size classes. However, there are now multiple years' cohorts present, and variability in growth rates is magnified by several years growth. Thus the sizes of fish we sampled present a continuum, with no clear breaks to divide the classes. To properly differentiate among size/age classes at this time would require otolith examination. In the future, we will only distinguish among adult fish and YOY fish, as we did in this report.

The sizes of individual tilapia were consistent with our observations of repeated reproduction and recruitment, and the development of age structure in the population. The high percentage of YOY fish is notable, and different from previous years' results. It points to a very successful breeding season, and may portend a large increase in the population next year, if the recruitment of this year's young is as successful. On the other hand, comparing this season's CPUE for just adult fish to last summer's (1.53 vs. 4.65) the breeding population seems to be much reduced.

No Gulf croaker, orangemouth corvina, or sargo were sampled this period. These three marine sport fish species have been undetectable by gill netting since mid-May, 2003. This represents 6,756 nets hours of effort. In addition, none have been detected in fish kills, or presented by anglers during the last 24 months.

Table 1. Locations of Sampling Sites

SITE NAME	HABITAT TYPE	UTM COORDINATES
Whitewater River	Estuarine	11S 0587948
		3707343
New River	Estuarine	11S 0621567
		3666958
Alamo River	Estuarine	11S 0628480
		3675635
North Shore	Near-shore	11S 0598465
		3709237
North Wister	Near-shore	11S 0628368
		3685497
Bat Caves	Near-shore	11S 0607427
		3699864
South Salton City	Near-shore	11S 0604971
		3682198
North Desert Shores	Near-shore	11S 0589366
		3699424
The Dome	Near-shore	11S 0596997
		3690022
The Cliffs	Near-shore	11S 0615062
		3691509
Test Base	Near-shore	11S 0608813
		3672196
North Basin	Pelagic	11S 0596156
		3701218
Inter-basin	Pelagic	11S 0606837
		3689452
South Basin	Pelagic	11S 0618275
		3678697

Table 3. Size Classes of Tilapia

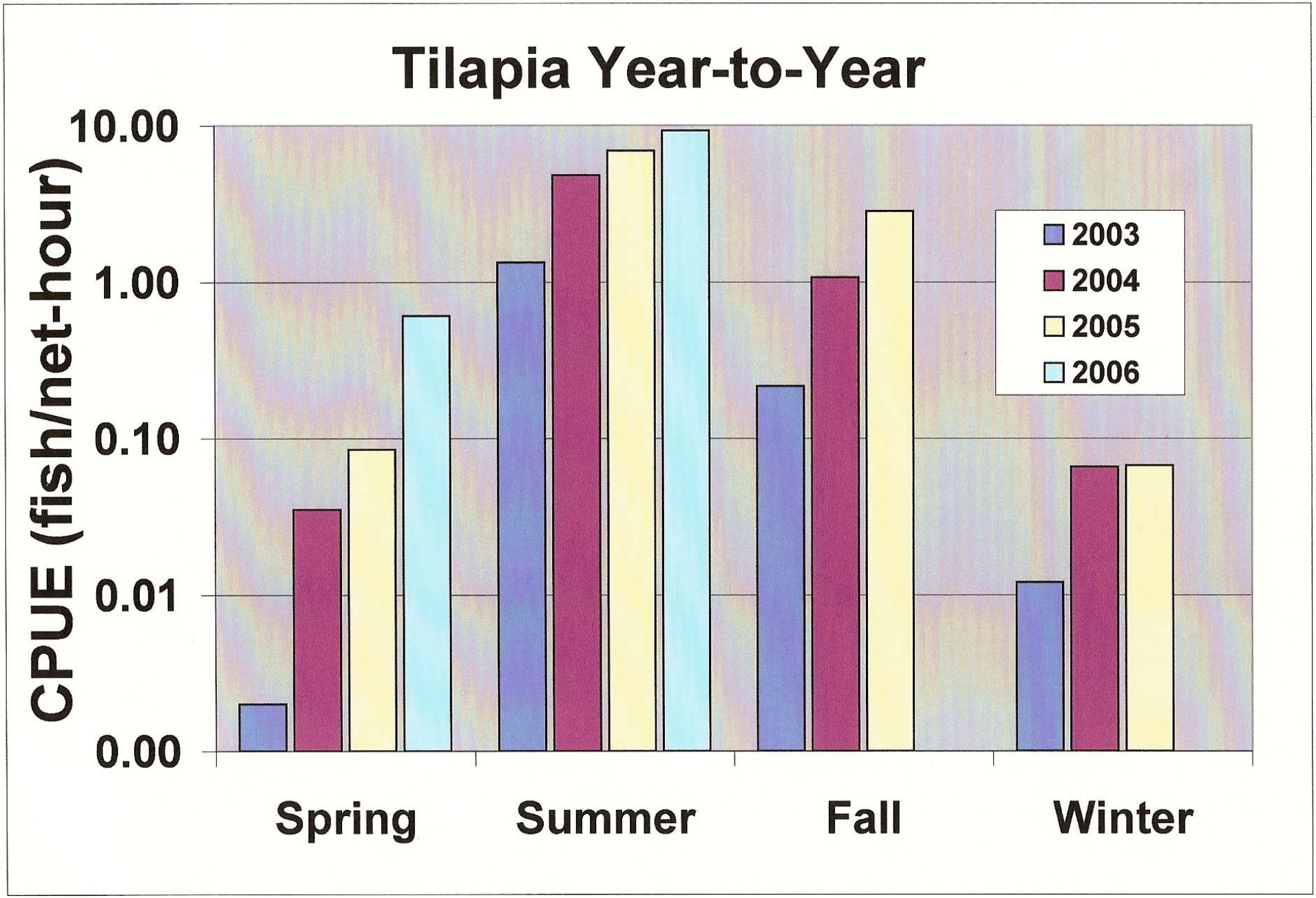
Sample Period	Size Class 1.			Size Class 2.			Size Class 3.		
	Range (mm)	n	%	Range (mm)	n	%	Range (mm)	n	%
Spring '04	67-70	4	22	134-173	14	78	----	0	---
Summer '04	60-70	785	31	120-160	1,751	69	180-200	8	<1
Fall '04	64-79	11	2	120-197	615	98	265-290	4	<1
Winter '05	----	0	---	125-197	34	100	----	0	---
Spring '05	----	0	---	132-194	45	100	----	0	---
Summer '05	60-73	1,152	32	123-175	2,443	68	228-308	10	<1
Fall '05	63-74	13	<1	122-202	1,494	99	240-282	2	<<1
Winter '06	----	0	---	129-157	35	100	----	0	---
Spring '06	63-68	2	<1	125-190	311	99	264	1	<1

Sample Period	Size Class 1.			Size Class 2.		
	Range (mm)	n	%	Range (mm)	n	%
Summer '06	56-78	2,037	83	104-278	403	17

Table 2.

Date	Site	Net-hours	Tilapia	Croaker	Corvina	Sargo	Other	Total Fish	CPUE
7/7/2006	Whitewater River	24	288	0	0	0	0	288	12.00
7/7/2006	North Shore	24	537	0	0	0	0	537	22.61
7/11/2006	North Desert Shores	24	135	0	0	0	0	135	5.68
7/11/2006	The Dome	24	120	0	0	0	0	120	5.05
7/13/2006	The Cliffs	25	244	0	0	0	0	244	9.86
7/13/2006	Bat Caves	24	237	0	0	0	0	237	10.09
7/18/2006	North Wister	24	451	0	0	0	0	451	19.19
7/18/2006	Alamo River	24	46	0	0	0	0	46	1.94
7/20/2006	South Salton City	24	48	0	0	0	0	48	1.98
7/20/2006	Test Base	24	127	0	0	0	0	127	5.29
7/25/2006	New River	25	208	0	0	0	0	208	8.40
Totals		**264**	**2441**	**0**	**0**	**0**	**0**	**2441**	**9.255**

Chart 1.


Tilapia Year-to-Year
CPUE (fish/net-hour)
10.00
1.00
0.10
0.01
0.00
2003
2004
2005
2006
Spring
Summer
Fall
Winter