

FIELD REPORT – CONTROL OF NUISANCE SEA LIONS IN THE ROGUE RIVER ESTUARY, GOLD BEACH, OREGON

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Project participants -- Mark Lottis¹, Vern Tarwater¹, Scott Nelson², Robin Brown², Bryan Wright², Susan Reimer², Todd Confer², Pat Gearin³, Brent Norberg³, and Garth Griffin³

INTRODUCTION

In the early summer of 2005, the Curry Sportfishing Association (CSA) requested the assistance of National Marine Fisheries Service (NMFS) and the Oregon Department of Fish and Wildlife (ODFW) to work with local business owners, sport fishermen, and the Port of Gold Beach (Port) to reduce the level of sea lion/fishery interaction in the lower Rogue River salmonid sport fisheries (Figure 1). The CSA representative described California and Steller sea lion presence (feeding and resting) at an all time high and that conflict with these animals was resulting in economic loss to businesses and angler frustration putting individual sea lions at risk.

Three species of seal and sea lions (pinnipeds) inhabit the lower Rogue River. Steller sea lions and harbor seals are present all year round and California sea lions are present most of the year. All pinnipeds are protected under the Marine Mammal Protection Act (MMPA). In addition, Steller sea lions in Oregon are listed as a threatened species under the Endangered Species Act (ESA). Steller sea lions have a breeding rookery on Rogue Reef, approximately three miles northwest of the city of Gold Beach. Harbor seals also breed in the estuary and on nearshore rocks. However, harbor seals were rarely involved in conflicts with the sport fishery and were not a focus of this project. California sea lions breed in the California Channel Islands, and after mating male animals disperse into coastal habitats from Mexico to Canada. Salmonids comprise part of these animals' diet. Depending on the time of year, fish and invertebrate food resources, and ocean conditions, pinnipeds focus on different prey species. During spring, late summer, and fall months in Oregon, pinnipeds are actively following and feeding on adult salmonids.

In its natural state, the Rogue River Estuary would have provided suitable habitat for pinnipeds, but human activities have also attracted increased attention from these adaptable animals and increased the likelihood of problem interactions. For example, a number of floats and docks are readily accessible as resting places (haul-outs) for California sea lions. Several fish cleaning stations discharge fish carcasses directly into the estuary, providing food for the animals and encouraging them to seek feeding opportunities near people and be tolerant of human activities. Many of the animals attracted to the estuary are opportunistic predators on the highly developed sport fishery in the lower river.

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The CSA, Port, NMFS, and ODFW discussed the situation and on several occasions met with the Gold Beach public. As a result of these discussions, a research and monitoring plan was developed to test and evaluate the efficacy of three complimentary and concurrent actions:

1. Modification of moorage and dock structures in the Rogue River Estuary to reduce the available haul-out and resting options for nuisance sea lions in close proximity to the fishery and limit damage to floating dock structures.
2. Curtailment or elimination of the practice of dumping fish carcasses into the Rogue River Estuary, in cooperation with private property owners, to reduce the attraction of nuisance animals.
3. Use of standard non-lethal pinniped deterrence measures such as above- and below-water noisemakers and pyrotechnics (e.g., cracker shells, seal bombs), and tactile devices (e.g., water hoses, rubber bullets/buckshot) in the Rogue River Estuary to dissuade nuisance sea lions from damaging private and public property and taking angler catch.

Under the MMPA, the Port (as a local government) has the authority to conduct non-lethal removal of nuisance sea lions. Additionally, the Port can non-lethally remove nuisance Steller sea lions that are listed under the ESA. However, part three of the plan – deterrence – required the Port to seek ESA authorization from NMFS for the potential incidental take of listed coho salmon and a Scientific Taking Permit for fish and marine invertebrates from the ODFW.

The Port applied for the required State and Federal authorizations in May 2006. The ODFW and NMFS granted the Port authority for the incidental take of fish and marine invertebrates in June 2006, and non-lethal sea lion hazing began in July 2006. The NMFS funded ODFW to monitor and evaluate the effectiveness of the Port's nuisance sea lion control plan.

MATERIALS AND METHODS

Personnel

Project personnel included state and federal biologists (salmon and marine mammal) and local government representatives. Activities were coordinated with state, federal, and local law enforcement agencies as well as Port commissioners, city and county government contacts, and Gold Beach business leaders. Community volunteers aided in all parts of the work.

Permitted activities were conducted by the following individuals: Mark Lottis (Port of Gold Beach), Vern Tarwater (Port of Gold Beach), Robin Brown (Oregon Department of Fish and Wildlife), Brent Norberg (National Marine Fisheries Service), Scott Nelson (Port of Gold Beach volunteer), and Toby Carlson (Port of Gold Beach volunteer).

Human and Animal Safety

Personnel involved with sea lion hazing activities were given instruction in the safe and effective use of the various deterrent tools. This included handling, lighting and deploying the seal bombs (underwater pyrotechnic) and the use of shotguns to project the above-water deterrents (cracker shells). Basic safety concerns for individuals using these devices were reviewed as well as for anglers fishing in the area of the hazing activities. Basic firearm safety and use were also reviewed. No above-water projectiles were used in the immediate vicinity of anglers in boats or near anyone along the shorelines. Use of rubber buckshot rounds was carefully applied to avoid injury to animals (e.g., no shots directly into the face of pinnipeds).

Part 1.—Modification of haulout structures

Docks in the Gold Beach marina that had regularly been used by pinnipeds (primarily California sea lions) were prioritized and scheduled for placement of sea lion barriers or other deterrents. Project staff assisted Port authorities in identifying key areas where various barrier designs might be tested to determine their effectiveness in deterring sea lion haulout behavior and the effects of the installed devices on the intended use and function of the structures.

Initially, the main haul out area (breakwater in front of Jerry’s Jet Boats) was fitted with plywood panel fencing and motion-sensing sprinkler heads that sprayed water on sea lions using the docks (Fig. 2A). Meanwhile, a new breakwater with a permanent barrier to sea lions was constructed (Fig. 2B). This barrier was an A-frame of aluminum pipes that had three rows of treated lumber (2x4s) running horizontally the length of the dock and across the ends.

Other port docks in the commercial vessel area were barricaded with a 2” galvanized pipe (“bull rail”) running the length of the docks about 20” above the dock surface (Fig. 2C). These pipes were supported by vertical pipe stanchions at roughly 10’ intervals. In some cases, a stainless steel wire (1/8”) was strung between the dock and the horizontal pipe if sea lions learned to squeeze under the pipe to reach the dock. In addition, “wavy racks” (commercially available bicycle racks made from galvanized pipe), were also tried in some areas (Fig. 2D).

Part 2.—Fish carcass disposal

Some individual Pacific harbor seals, Steller sea lions, and California sea lions in the Rogue River estuary had learned to feed on a regular supply of salmon, rockfish, perch, and tuna carcasses and guts provided via five fish cleaning stations. The fish cleaning stations consist of cleaning tables with attached discharge pipes that funnel the fish waste directly into the estuary. One fish cleaning station is operated by the Port while the other four are used by small businesses. Fisherman’s Direct Seafood processing is located within the estuary but it is unknown whether they discharge fish waste into the water. Regardless of the source of input, these animals “make the rounds” between stations outflow pipes and are even observed exhibiting what appears to be begging behavior.

To reduce disposal of fish waste into the bay and thereby eliminate this source of attraction for nuisance sea lions, project staff developed several options including; 1) holding and dumping

fish waste outside of the estuary (i.e., ocean); 2) holding and disposing waste in land fills; 3) holding and paying an animal feed processor to haul the waste away for processing; and 4) purchasing a commercial grinder(s) to process the waste locally before disposal.

Part 3.—Non-lethal harassment

To provide relief for the fishery from predation by nuisance sea lions, on-water non-lethal harassment activities were implemented (harbor seals were rarely a problem in this regard and were not targeted by the hazing activities of this project). Harassment (hazing) activities, conducted during the hours of peak sport fishing effort, included deployment of pyrotechnics (seal bombs, cracker shells) and active pursuit of animals using the hazing boat. On-water hazing activities were not typically pursued in areas of the bay such as the marina where fishing was not occurring. In some instances, sea lions hauled out on unfenced docks were harassed if necessary to allow safe access by marina patrons to and from their vessels.

The hazing vessel was clearly marked with an identification placard and began each day with a survey of the lower river and bay. If sea lions were encountered, the hazing vessel would deploy seal control firecrackers nearby and then actively pursue the animals toward the bay entrance and beyond the entrance bar. Once the animals were outside of the entrance bar at the mouth of the bay, cracker shells (firecrackers deployed from a shot gun) and/or rubber buckshot were used to drive them beyond the harbor jetties. Hazing personnel were instructed to avoid excessive use of underwater firecrackers for the protection of fish and to maintain their novelty as a negative stimulus for sea lions as long as possible during the season. Once the bay was cleared of sea lions “working the fishery” the hazing vessel would patrol the area or station itself at a vantage point to intercept animals attempting to re-enter the area.

Fishery participants could contact the hazing vessel via radio to report encounters with sea lions in the bay. The hazing vessel would respond to calls, reposition and engage the animals to drive them from the bay. Hazing personnel logged encounters with sea lions and noted time, location (lower, middle, upper estuary), pinniped species and number, number and type of deterrents used, indications of effects on non-target species (fish), and outcome (Appendix 1A).

Monitoring

Monitoring and evaluation of the Port’s nuisance sea lion control consisted of three independent parts: shore-based observations recorded by ODFW Marine Mammal Program staff; boat-based observations recorded by Port staff; and dockside angler interviews conducted by ODFW Ocean Recreational Boat Survey staff. In addition, the ODFW District Biologist reviewed fish passage data from upstream research projects to assess passage effects and any indication of injuries to salmonids passing through the estuary during the active hazing period of the project.

Shore-based observations.

A single ODFW observer conducted shore-based observations for approximately 6 hours/day for 4 days/week from July 1 to September 30, 2006. Observations were conducted for two hours in each of three areas of the estuary (lower, middle, and upper estuary; Figure 1), the order of which

was randomly determined. Observations started one hour after sunrise. At the beginning of an observation period, and every ½ hour thereafter, the observer conducted a scan sample of the area and recorded: time, visibility, the number and species of pinnipeds, the number and type of anglers, and whether the Port hazer was present (Appendix 1B). This resulted in five scan samples per area per day. During the four 30-min periods between scan samples, the observer conducted a focal-area sample and tallied the frequency of three types of events: predation, angler catch, and hazing. Details of each of these events were entered on a separate “event” form (Appendix 1C). In addition to the scan and focal-area samples, observers conducted haul-out counts at the beginning and end of each day.

Angler interviews.

ODFW’s Oregon Recreational Boat Survey (ORBS) estimates marine recreational angler catch and effort at select ports throughout Oregon. ORBS methodology is available at <http://www.dfw.state.or.us/MRP/salmon/ORBSDesign.htm>. During the 2006 season at Gold Beach, the ORBS port sampler asked all sampled boats whether they had interactions with pinnipeds during their trip, and if so, if they had lost fish as a result.

RESULTS

Part 1.—Modification of haulout structures

Plywood panel barrier

The floating breakwater structure in the marina is intended as a wave dampening device that protects a commercial dock used by local tour boat operators. Initial attempts to fence the floating breakwater in the marina using plywood panel fencing proved ineffective. Sea lions were able to access the area behind the fence and weaken the structure resulting in premature structural failure.

Sprinklers

The use of the motion-sensor water sprinklers (installed June-July) was initially quite effective, but animals soon learned to haul out on areas of the breakwater that were not covered by the sprinklers. The motion sensors required careful adjustment to focus on the float and avoid being triggered by movement in the surrounding vicinity. Also, since the sprinklers were mounted on the dock pilings, at lower tides the docks were farther from the motion sensors and sometimes failed to respond to sea lion movement on the docks.

A-frame barrier

The A-frame structure built upon the new breakwater dock was durable, fairly easy to install, and highly effective (built August; installed September). No sea lions have used this breakwater as a haul-out area since installation.

Bull Rail

Dock floats used for mooring boats presented an added challenge in that sea lion exclusion strategies also needed to accommodate the intended human activities associated with mooring, such as loading and unloading boats. Bull rails had been successfully used in other ports along the west coast and the design was adopted for long sections and narrow ends of floats where boats were likely to be moored. Our use of bull rails (installed July-August) showed that most sea lions were reluctant to leap over these barriers to rest on the docks, and so were quite effective. Since vessel owners and operators could easily step over these barriers to board moored vessels, we received no significant complaints about their use in these areas. As stated previously, some of these barriers were modified by stringing wire between the dock and the horizontal pipe where sea lions occasionally slipped under the bar to access the docks. This modification proved very successful and no sea lions were known to go under or over these modified barriers.

Wavy racks

Wavy racks were installed on wide ends and outside corners of docks used by boats. The spacing of the vertical bars is sufficiently narrow to prevent passage by sea lions but wide enough apart for a person to step through when boarding or leaving vessels. The low point of the wave is low enough to step over and the high point can serve as a handhold. Sea lions avoided dock sections protected by wavy racks, however the cost per foot of coverage was considerably higher than the cost of bull rails.

Part 2.—Fish carcass disposal

Fish carcass disposal proved most effective at the public fish cleaning station inside the Gold Beach Marina. This site was more easily monitored for cooperation and the collected fish carcasses were readily moved to the refrigerated storage van nearby. Five-Star Charters retained the fish carcasses from their daily fishing trips and disposed of them at sea or transported them to the refrigerated van for removal by the animal feed processor. Other fish cleaning stations around the Rogue estuary were not as consistent about avoiding disposal of carcasses into the river, but collection of carcasses increased later in the season. Overall, the amount of potential sea lion food disposed of in the estuary was largely reduced. The frequency of observations of sea lions looking for carcasses at the outfall of the public cleaning station was obviously lower than before this action was taken.

Purchase of commercial grinder(s) to grind fish waste prior to disposal was determined to be infeasible for implementation in 2006. Initial cost of purchasing equipment was a factor as was the cost of staffing and operation of the machine to grind hundreds of pounds of fish waste per day. Installation of the grinders at the fish cleaning stations for use by the public was considered but rejected for liability concerns.

Part 3.—Non-lethal harassment

Hazing activities began 7/19/06 and ended 9/30/06. Data from 59 of the 74 days were available for summary. Based on the available data, Steller sea lions and California sea lions were hazed 120 and 239 times, respectively. The frequency with which California sea lions were hazed increased over time (coinciding with their local population increase) whereas Steller sea lion hazing frequency decreased (Figure 3). Note that the same animal could be hazed multiple times.

Number, type, and location of deterrents used (seal bombs, cracker shells, rubber bullets, vessel chase) was based on experience of effectiveness and applicability of other methods of deterrence. During the course of hazing activities (using seal bombs) we observed approximately 25 occasions during July and August where temporarily stunned baitfish (small anchovy) rose to the surface of the water. We occasionally observed a few of these fish being eaten by gulls but the vast majority swam away as quickly as they appeared.

Only one incident occurred in which hazing activities created a potentially dangerous situation with anglers. An angler on a private boat was fighting a fish and a California sea lion grabbed the fish. The Port hazer responded and was successful in getting the sea lion to release the fish. However, during the encounter a lit seal bomb landed in the private's boat and detonated. No one was hurt but a boat cushion was damaged (which CSA replaced for the angler). It should be noted that the angler took the incident in stride. The only other incident of note involved contact between the Port hazing boat and a guide boat.

At no time did we observe any signs of injury to marine mammals caused by hazing activities. To the best of our knowledge, neither local, state, nor federal officials received complaints of noise, injury to fish (including salmonids), marine mammals, other wildlife, or people.

Monitoring

Shore-based observations.

ODFW monitored pinniped haul-outs, boat activity, and pinniped foraging behavior over 54 days from 7/1/06 – 9/30/06. Haul-out counts of harbor seals declined from a high of approximately 150 in July to around 25 by the end of September (Figure 4). Conversely, only a single California sea lion was observed in the marina until mid-August, at which point migrating animals returned and the local population eventually reached a maximum of at least 20 animals (Figure 4). The actual number of individuals was likely greater than 20 since not all animals haul-out at the same time and there is likely turnover over time as well. Steller sea lions do not haul out inside the estuary. The daily maximum number of boats and pinnipeds (by species) observed in the estuary during scan samples are summarized in Figures 5.

During focal samples, ODFW documented 291 instances of fish being caught by anglers; of these, just three were lost to pinnipeds (Table 1). Seventy-two hazing events were observed, most of which resulted in the animal being moved downriver. Lastly, a total of 28 natural predation events were documented, of which at least 15 were free-swimming salmon.

Angler interviews

ODFW's Ocean Recreational Boat Survey (ORBS) interviewed anglers from 1,047 boat-trips returning to Gold Beach (Table 2). Of these, just two reported losing fish to pinnipeds (for a total of 3 fish) and these occurred in the ocean, not in the estuary salmon fishery.

Fish passage and injury assessment

The preliminary run size estimates for the Rogue in 2006, based on research seining at Huntley Park (river mile 8) were: 18,142 fall Chinook; 13,118 adult late-run summer steelhead; and 30,072 half-pounder steelhead. An escapement estimate was not yet available for coho at the time of this writing. Research seining at Huntley Park covers nearly the entire run of fall Chinook, but only a portion of the summer steelhead run is sampled because early-run summer steelhead migrate through the system before seining begins.

The seine crew handled a total of 437 fall Chinook (355 adults and 82 jacks), 315 adult summer steelhead, 703 half-pounder steelhead, and 515 coho (457 adults and 58 jacks) at Huntley Park in 2006. No injuries or unusual health conditions were observed (other than the usual hook and predation scars). Furthermore, no migration delay or unusual pre-spawning mortality was observed in the lower Rogue. The ODFW Gold Beach Field Office did not receive any comments or complaints regarding injured/dead salmon or steelhead from anglers or tour boat operators operating in the river.

DISCUSSION

To the best of our knowledge, this project, involving federal, state and local government authorities, coordinated with the local sport fishing organization, was the first such effort carried out to reduce the loss of hooked fish to predation by pinnipeds. As mentioned above, the loss of hooked salmon to sea lions in this fishery had been increasing in recent years and in 2005 was considered to be a significant problem with the potential to have real negative economic impacts on the local community if some resolution to the problem was not found. Fortunately, the actions taken during 2006 proved highly effective at deterring California and Steller sea lions from taking hooked salmon from sport anglers in the Gold Beach estuary.

Early in the season (July), Steller sea lions were the most common pinniped interacting with the sport fishery (Figure 3). Only one California sea lion was regularly observed in the study area at this time (Figure 4). Hazing individual Steller sea lions and deterring them from the area of the sport fishery proved quite easy. These sea lions seemed to respond to direct hazing by quickly leaving the estuary and heading back toward the ocean. Individual animals would attempt to re-enter the estuary every few hours, but were again effectively deterred by the use of hazing tools.

By August, as California sea lions were moving north into Oregon following the breeding season, their numbers in the Rogue River estuary began to increase. As has been observed in other areas (e.g. below Bonneville Dam), California sea lions are more difficult to deter by non-lethal hazing techniques. However, while California sea lion numbers in the area were relatively

low, the hazing techniques still proved to be quite effective. In general, more effort and an increase in the use of hazing tools were required to move California sea lions from the estuary. Sea lions hauled out in the marina were generally left alone since hazing them would likely displace them into the area of the active sport fishery. By late August and September, as the numbers of California sea lions continued to increase, the hazing boat was required to work at a greater pace and was involved in an increasing number of pinniped interactions. However, as documented by the shore-side observer (Table 1), the majority of hazing interactions continued to result in pinnipeds moving in a direction out of the estuary and loss of hooked salmon was significantly reduced from previous years.

During the entire project there was only one incident involving unsafe use of the deterrent tools and only one incident of a boat collision. Boat collisions, thought minor at trolling speeds, can occur in a busy troll fishery but the risks of seals bombs are real and extreme caution must always be used. The small area where fishing and hazing occurs, coupled with the frenetic nature of catching fish in powerboats and the desire of the angling public to assist in sea lion management puts a premium on safe operating procedures which ensure the safety of the public.

Despite the two aforementioned incidents, there were no known injuries to project staff, sport anglers, salmonids or pinnipeds. As mentioned, we occasionally observed temporarily stunned baitfish rise to the surface of the water (caused by use of the underwater pyrotechnics) but only a small proportion of these resulted in mortality (through bird predation). It is important to note that use of the underwater firecrackers had no known negative effect on salmonids or on the ability of anglers to catch salmonids. Often these tools were used in relatively shallow water (1-2 m) with no negative results. No complaints were received from anglers about any real or perceived negative effects on fishing success. From this we conclude that these underwater firecrackers can be safely used in areas where salmonids occur without fear of negative effects on individual fish, fish passage or sport angling success.

CONCLUSIONS & RECOMMENDATIONS

- The success of this project was due largely to the positive interactions and effective coordination of the various agencies, anglers (CSA in particular), and the local community that were determined to see this test of non-lethal harassment of pinnipeds in a sport fishery take place. This same type of cooperation and support would be essential to repeating this project in the Rogue River or for implementing something similar in other areas.
- Conducting this project was not inexpensive and required a large contribution of CSA funds. Contributions by NMFS and ODFW were important, but the majority of the costs of this type of effort in the Rogue River or elsewhere will likely need to be provided by the sport fishing community itself.
- The approach of simultaneously tackling the multiple problems of man-made resting areas for sea lions, fish carcasses provided as pinniped food, and interactions with anglers was key to this project and must be addressed in all similar efforts in the future. If a

project such as this is anticipated in other areas, it would be wise to resolve the problems of man-made haul-out structures and fish carcass disposal well before any efforts to deter pinnipeds in a fishery begins.

- A-frame barriers and bull rails placed on docks in the Gold Beach marina ultimately proved effective at reducing the number of sea lions hauling out and resting in the project area. However, sea lions are resourceful and will continue to attempt to use docks as resting areas. Placement of additional barriers in areas previously unused by sea lions may be necessary in the future, and regular adjustments or modification of all barriers may be needed.
- Disposal of carcasses in the Gold Beach marina was largely reduced but this was not the case at other fish cleaning stations in the project area. However, reductions in the overall dumping of fish remains in the estuary did occur and therefore some opportunistic feeding at these locations by sea lions was eliminated. Increased cooperation and coordination will be necessary to stop all carcass dumping in the estuary.
- Use of hazing tools for pinniped deterrents should always be preceded by appropriate training in their safe and effective use to avoid injuries to humans or animals. Local ordinances related to use of firearms or fireworks should always be considered and addressed with the appropriate authorities. Involving federal, state and local law enforcement agencies was a key to our success and should be repeated in at any location where pinniped hazing is anticipated. In light of the two incidents documented during the first season's effort we recommend that operating procedures be revisited to ensure the safety of the public to the greatest extent possible.
- Monitoring of this project proved successful with a relatively limited effort. We conclude that in subsequent years the monitoring of this type of project in the Rogue River estuary might be adequately conducted by the boat hazing staff only. However, an additional year of shore-based monitoring may be warranted to fully document the efficacy of continued improvements to haul-out modifications, fish carcass disposal, and hazing activities. If a similar project is planned for a new area, we recommend a comprehensive monitoring effort during the initial (and ideally the preceding) year of the project similar to that described here.

ACKNOWLEDGEMENTS

We wish to acknowledge and thank all those who cooperated and supported the conduct of this work, especially the staff of the Port of Gold Beach, the Port of Gold Beach Commissioners, and all of the Rogue River sport anglers that cooperated with us. Funds and logistical support were provided by CSA, NMFS, ODFW and the Port of Gold Beach. We'd also like to thank Molly Walker for her reporting on the project for the Curry County Reporter.



Figure 1. Overview of Rogue River Estuary Project Area (2005 orthoimagery) showing lower, middle, and upper estuary observation areas.



A. Plywood panel barrier.



B. A-frame barrier.



C. Galvanized pipe “bull rails”.



D. Wavy racks.

Figure 2. Haul-out structure modifications to deter use by sea lions.

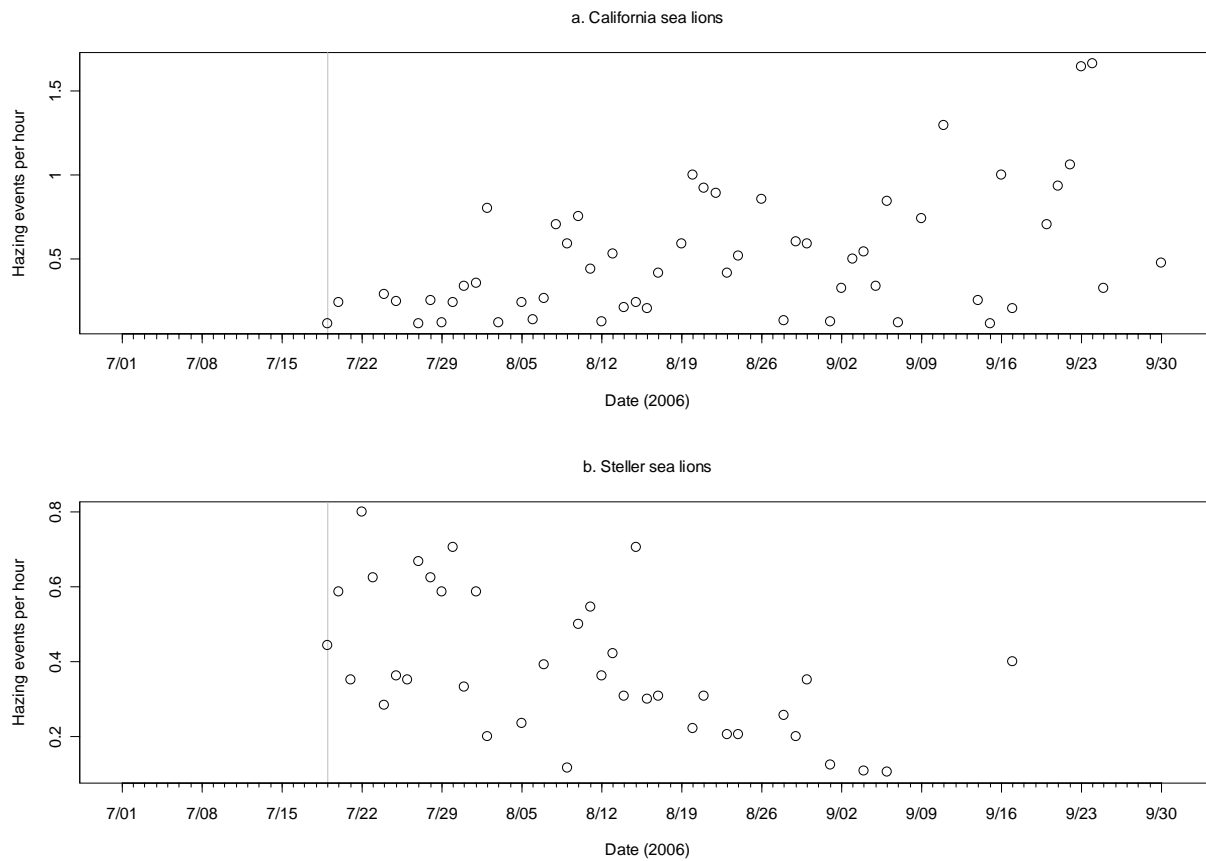


Figure 3. Frequency (events per hour effort) of hazing events targeting (a) California sea lions and (b) Steller sea lions at the Rogue River estuary, July 19-September 30, 2006. Vertical line on 7/19/06 indicates start of hazing activities.

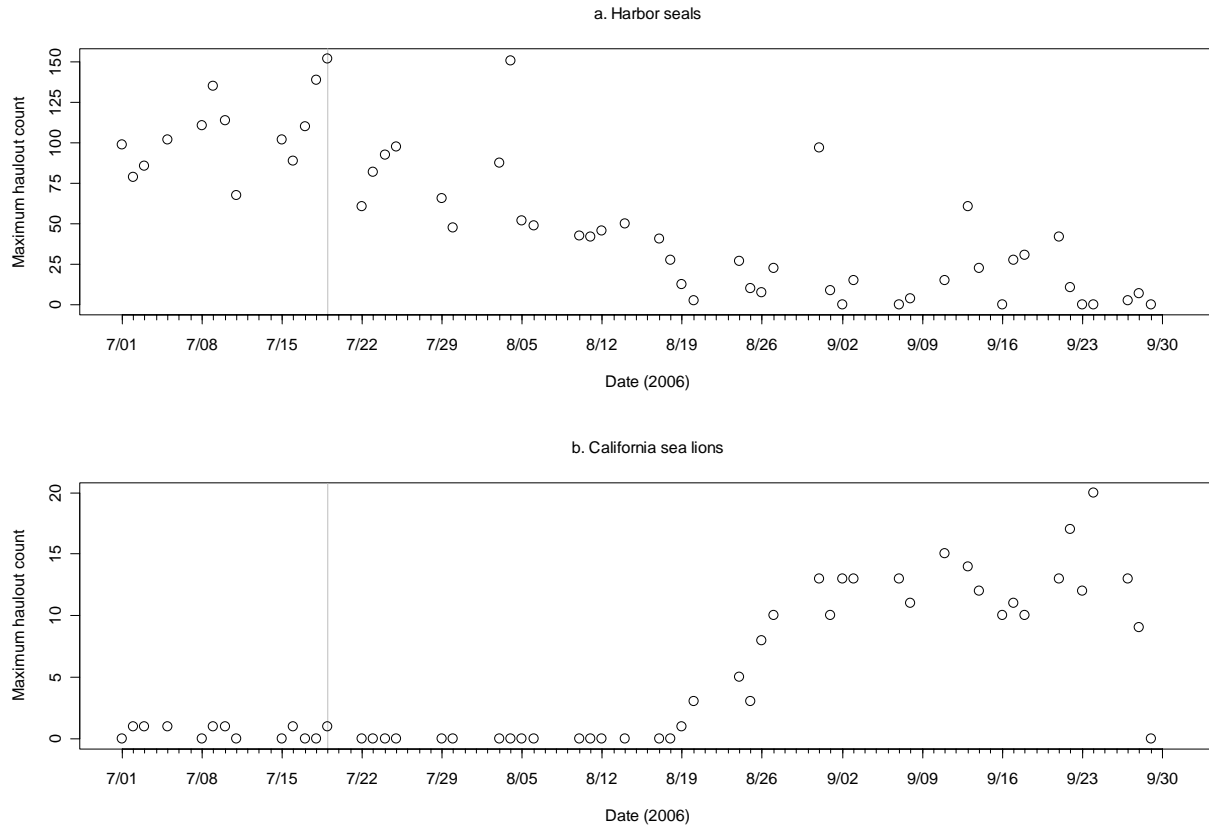


Figure 4. Maximum number of (a) harbor seals and (b) California sea lions hauled-out per day at the Rogue River estuary, July 1-September 30, 2006 (based on early morning and late afternoon counts of the breakwater, commercial dock, marina, and spit). Vertical line on 7/19/06 indicates start of hazing activities.

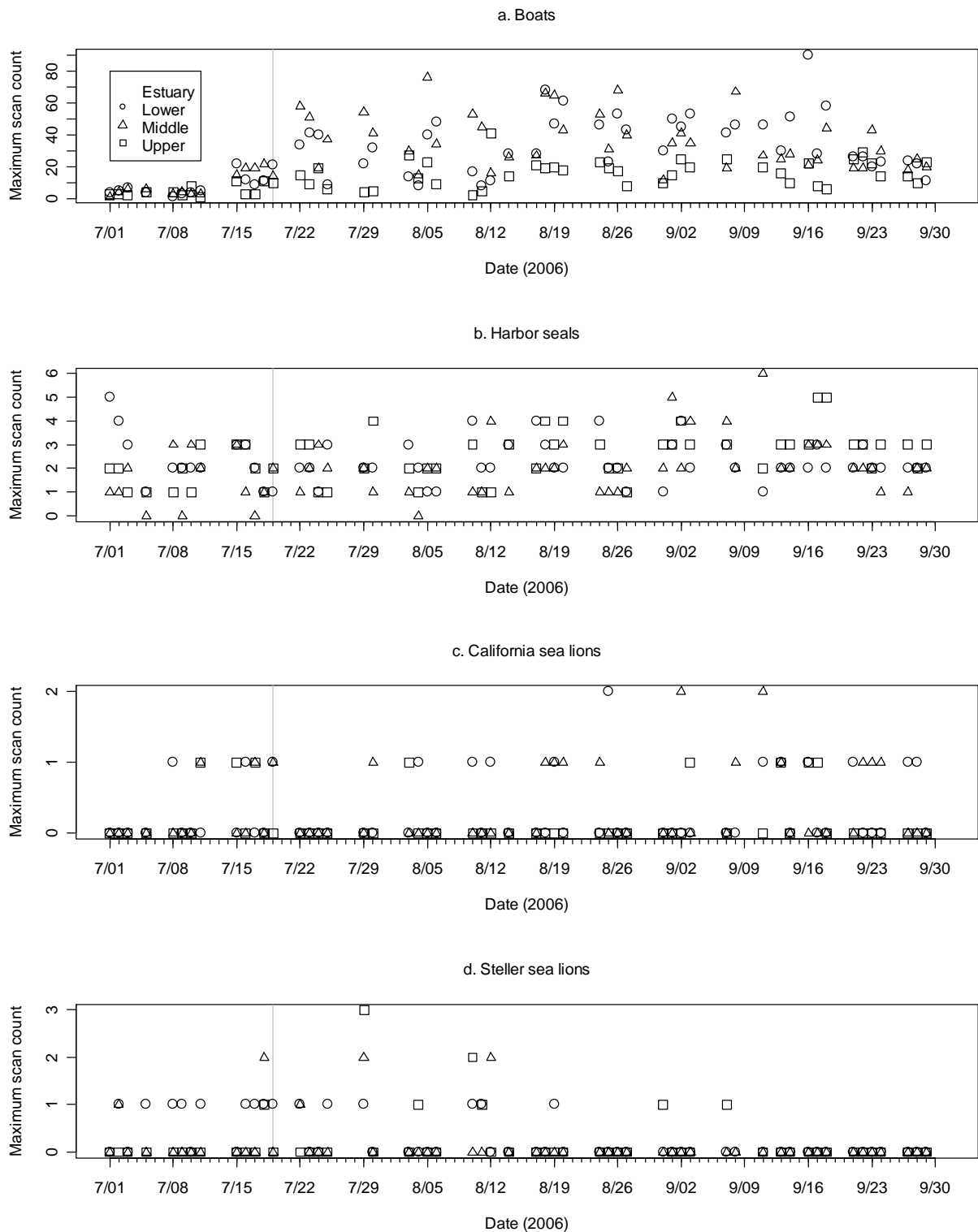


Figure 5. Maximum number of (a) boats, (b) harbor seals, (c) California sea lions, and (d) Steller sea lions by estuary area at the Rogue River, July 1-September 30, 2006 (based on five scan samples per area; time of day not indicated). Vertical line on 7/19/06 indicates start of hazing activities.

Table 1. Summary of events and outcomes documented by ODFW shore-based observer at the Rogue River estuary, July 1-September 30, 2006.

Event type / outcome	Frequency
Boat catch	291
Landed / released (no interaction)	11
Landed / retained (no interaction)	277
Lost to pinniped(s) [all to CA sea lions]	3
Hazing	72
Pinniped(s) moved downriver	58
Pinniped(s) moved upriver	7
Pinniped(s) movements unknown	7
Natural predation (i.e., free-swimming fish caught)	28
Salmon	15
Lamprey	9
Unknown	4
Total	391

Table 2. Summary of interviews conducted by ODFW's Ocean Recreational Boat Survey at Gold Beach, 2006.

Trip type	Trips sampled	Anglers	Trips w/ lost fish to pinniped(s)	No. fish lost
Estuary Private Salmon	935 ¹	2157		
Ocean Private Salmon and Combo	3	7	1 ²	1
Ocean Private Bottomfish	84	198		
Ocean Private Tuna	2	4		
Ocean Charter Salmon and Combo	1	6		
Ocean Charter Bottomfishing	22	133	1 ³	2
Total	1047	2505	2	3

¹ Estuary private salmon trip with one angler on 7/20/06; the angler reported that a "seal" interfered with the netting of his salmon.

² Ocean private combo trip (salmon and bottomfish) on 9/2/06 with 3 anglers; lost one fish.

³ Ocean charter bottomfish trip with 6 anglers on 8/6/06; lost 2 fish. Also reported losing 2 lings and 5 rockfish the week before on a trip that was not sampled.

Appendix 1. Monitoring dataforms

2006 ROGUE RIVER PINNIPED DETERRENCE STUDY – HAZER FORM

Date (yyyymmdd)	Initials	Time start	Time end
2006			

Hazing actions (enter one record for each animal or group of animals hazed):

Time	Area (1,2,3)	Pinniped spp. & no.*	No. seal bombs	Result**

(continue on back)

* S = Steller sea lion; C = California sea lion; H = harbor seal.
 ** U = animal moved upriver; D = downriver; ? = unknown/disappeared; O = other (describe) □

Entered by / date: _____ Verified by / date: _____
 Robie Brown, ODFW, 7118 NE Vaidesberg Ave., Corvallis, OR 97330, 541-757-4186 x242

1A. Boat event form.

2006 ROGUE RIVER PINNIPED DETERRENCE STUDY – SHORE FORM (4 d/wk)

Date (yyyymmdd)	Initials	Low tide time / height	High tide time / height	Hazing day (Y, N, ?)
2006				

Haul-out count (time, #)			Scat pick (time, # scat, # HS disturbed)		
	CSL - breakwater	HS - marina	HS - spit	Marina	Spit
AM					
PM					

Bout	Area (1,2,3)	Time* (24hr)	Visibility (G, F, P)	# pinniped in water			# anglers		Hazer present (Y/N)	"Event" tally**					
				SSL	CSL	HS	Boats	Shore		Natural predation	Angler catch		Hazing		
										Boat	Shore				
1															
2															
3															

* Begin observations 60 minutes after sunrise. Conduct 2 hrs of observations per bout, with pinniped/angler counts every 30 min (first 5 min of each ½ hr; 5 per bout); tally number of events during each of four 30 min observation periods. Allow 30 minutes between bouts.
 ** Fill out EVENT FORM for every event observed; staple all event forms to this sheet at end of day.

Entered by / date: _____ Verified by / date: _____ Robin Brown, ODFW, 7118 NE Vandenberg Ave., Conzallis, OR 97330, 541-757-4188 x242

1B. Shore survey form.

2006 ROGUE RIVER PINNIPED DETERRENCE STUDY – EVENT FORM

Date (yyyymmdd)	Initials	Bout	Area	Time first observed	Time last observed
2006					

Type of event:	___ Natural predation	Angler catch: ___ boat ___ shore	___ Hazing
Prey type:	___ Salmonid	___ Lamprey	Carcass: ___ salmonid ___ unknown
	___ Unknown	___ Not applicable	___ Other:
Pinniped species:	___ SSL	___ CSL	___ HS ___ Not applicable
Distance to event:	___ m		
Visibility:	___ Good	___ Fair	___ Poor

Natural predation:	Prey consumed by: ___ one pinniped ___ multiple pinnipeds (#: ___)		
Angler catch:	___ Lost fish to pinniped		
	___ Landed / retained fish without interaction	___ Landed / retained fish with interaction	
	___ Landed / released fish without interaction	___ Landed / released fish with interaction	
Hazing:	Hazer: ___ Port ___ Angler ___ Other:		
Method(s):	___ Bombs (#: ___)	___ Cracker shells	___ Other:
Result	Pinniped moved: ___ upriver ___ downriver ___ stationary ___ unknown/disappeared		

(Describe event on back)

Entered by / date: _____ Verified by / date: _____ Robin Brown, DDFW, 7118 NE Vandenberg Ave., Corvallis, OR 97330, 541-757-4186 x242

1C. Shore event form.