

# PROJECT CROOS

## Collaborative Research on Oregon Ocean Salmon

[www.PacificFishTrax.org](http://www.PacificFishTrax.org) & [www.projectCROOS.com](http://www.projectCROOS.com)

### Oceanography Project Summary *(as of January 6, 2010)*

Dr. Lorenzo Ciannelli and Bobby Ireland

#### Summary

Oceanographic analysis of Project CROOS catch data investigates the distribution of discrete population units of Chinook salmon along the Oregon continental shelf and the physical factors that affect this distribution. Because salmon return to their home stream to spawn they form reproductively isolated population units that can be distinguished with Genetic Stock Identification (GSI) techniques. Currently, the ocean distribution of salmon stocks is inferred through recovery of Coded Wire Tags implanted in hatchery-reared fish. Coded Wire Tag (CWT) data has helped describe large-scale patterns in the ocean distribution of salmon stocks; however, CWT returns are small in number, lack precise spatial and temporal accuracy, and are limited to hatchery-reared salmon. In contrast, GSI techniques can be used on both wild and hatchery-reared Chinook and the Project CROOS study design provides large data sets with precise point and time of capture. Ocean distribution of Chinook salmon can now be investigated on scales that discern daily changes in their location and migration. Also, patterns in their movement and distribution can be correlated with physical oceanographic changes such as sea surface temperature and primary productivity.

#### Progress

- ⇒ The coastal range of individual salmon stocks have been mapped by latitude.
- ⇒ The proximity to river cohorts to determine the degree of stock clustering has been plotted.
- ⇒ Distribution of Chinook salmon for key periods in 2006 and 2007 has been compared to satellite measurements of chlorophyll-a concentration and temperature in the surface water. High chlorophyll-a concentrations are typically associated with areas of high ocean productivity.

#### Results to Date

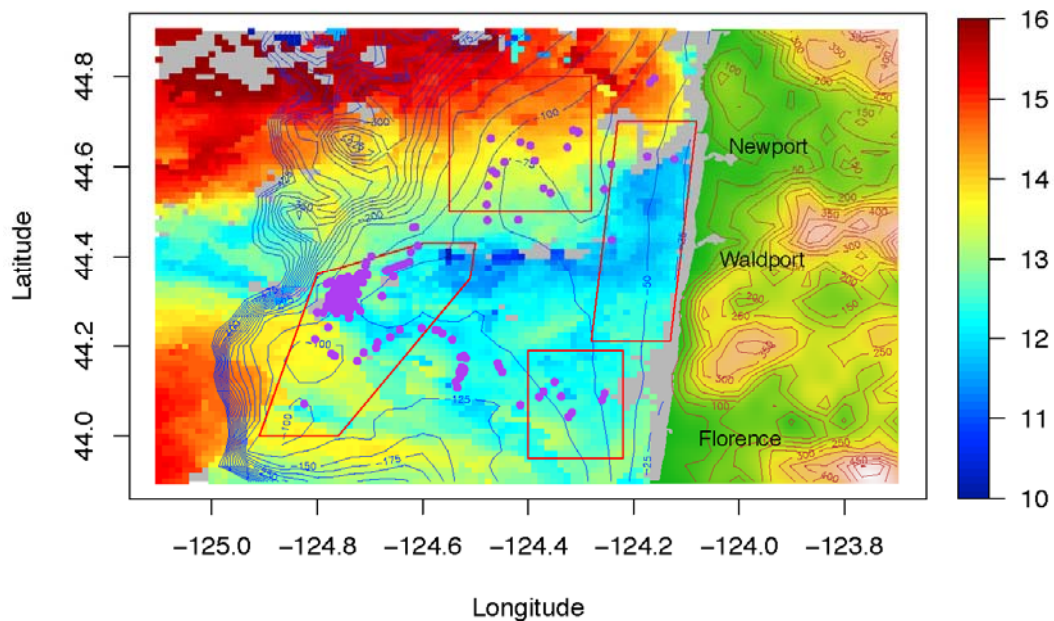
- ⇒ In 2007 Chinook stocks from the Sacramento River tended to range widely along the Oregon Coast. Stocks from the Rogue River and Klamath River were generally more abundant off the southern Oregon coast and their range tended to be much more closely associated with their river of origin than the Central Valley stocks. These differences in the coastal distribution Chinook population units provide an opportunity for tailored management at the stock level.
- ⇒ While Chinook caught in the Oregon fishery occur in mixed-stock shoals, there is some evidence that river cohorts may be more closely associated than expected if stocks mixed randomly.
- ⇒ Chinook are frequently, though not exclusively, associated around upwelling fronts of cold nutrient-rich water. Also, to a lesser degree, Chinook are associated with areas of high productivity. See attached figures.

#### Future Actions

- ⇒ Utilize additional tools (Ripley's K) to further investigate stock aggregations and the spatial scale at which aggregations are observed.
- ⇒ Investigate changes in depth of capture using generalized additive models, and if possible, correlate with surface conditions.

Figure 1 shows the distribution of the Chinook salmon catch during the three-day period from Sep. 17 to Sep. 19, 2006. Color patterns depicting the average sea surface temperature in °C for the same three-day period indicate a strong plume of cold, upwelled water moving offshore with Chinook catch occurring primarily along the upwelling front. One week later, Figure 2, the upwelling plume has weakened – the Chinook catch for the period from Sept 24 through 26 has moved inshore where the cold, upwelled water still hugs the coastline.

**Figure 1** CROOS 2006: Sept 17–19



**Figure 2** CROOS 2006: Sept 24–26

