

Table 4  
CATCH OF LARVAE DURING LARVAL SPLITTAIL SURVEY, APRIL 19-21, 1995

	Sacramento R near Isleton	Cache Slough at Yolo Bypass	American R above Hwy 5 Bridge	Sacramento R above American R Confluence	Feather R above Sacramento R Confluence	Sacramento R at Sutter Bypass Confluence	Sacramento R above Sutter Bypass	Total
Centrarchid spp.	5	11		1	1	12		30
Cyprinid spp.		6		3	1	6	1	17
Delta smelt			17		5			22
Log perch	3	5		2		8	1	19
Longfin smelt	2							2
Prickly sculpin	21	363	32	69	41	73	116	715
Sacramento sucker				1	1		2	4
Splittail	3	29		10		14		56
Wakasagi			1		6			7
White sturgeon	4							4
Total	38	414	50	86	55	114	120	877

catches from below the Sutter Bypass were higher than average. Sampling took place over a limited time span, however, and was not repeated. As a result, effort was insufficient to rule out the potential for spawning in the Sacramento River above the Sutter Bypass or in the Feather or American rivers.

Delta smelt and wakasagi were also collected from the American and Feather rivers (Table 4). Neither species was collected at any other location. In the American River, delta smelt were more numerous than wakasagi; the reverse was observed in the Feather River. Two longfin smelt were collected at the Isleton location.

### Conclusion

Results of these studies and those of Baxter (1994) — no adult splittail were caught in the Sacramento River during August 1994 — support the observation of Caywood (1974), that splittail migrate from the delta to the rivers after the first fall or winter rains to forage and spawn. In this scenario, the delta, Suisun Marsh, Suisun Bay, and other tidal fresh and brackish water areas constitute adult summer and fall habitat, whereas

riverine areas are used during winter and spring (some proportion of the splittail population may not migrate or may not go far, especially if the delta is fresh during the spawning season). The importance of the rivers for foraging can be inferred from a number of pieces of information:

- Splittail were being caught in the river for 2 months before the first ripe individuals were observed.
- Splittail were caught using red worms for bait, indicating feeding was taking place.
- Adults appear in the fishery (DFG unpub. data) and in fish salvage (DWR and USBR 1994) earlier in the year and in greater numbers in "wet" years, when terrestrial foraging opportunities are greater, than in "dry" years.
- The potentially long duration of riverine residence (up to 5 months in 1995) would necessitate some feeding. Flooding and associated foraging opportunities may not only instigate upstream migration, but may also prolong riverine residence.

In 1995, the persistence of adult splittail in the Sacramento River near Miller Park, Discovery Park, and the lower end of the Sutter Bypass sug-

gests that these are important foraging and spawning areas or are near such areas. Larval sampling confirmed that spawning did take place in both the Sutter and Yolo bypasses and, based on relatively high larval numbers, suggests that the bypasses were important spawning habitats. Each of these locations has areas of reduced water velocity and, at least at high flows, access to flooded terrestrial habitat. During high flows, the bypasses provide the most extensive areas of accessible terrestrial habitat in the lower Sacramento River. Adult access to flooded terrestrial habitats for foraging and spawning is believed to be necessary for the production of a strong year class (Caywood 1974). Since this floodplain access is related to streamflow, improved foraging and spawning success represent a couple mechanisms that may underlie the outflow abundance relationships observed by Caywood (1974), Moyle and Daniels (1983), DFG (1992), and the bypass inundation abundance relationship observed by Sommer *et al* (In prep.). Further studies at these locations can help identify what factors influence when and specifically where spawning takes place and whether it leads to a strong year class.

### References

- Baxter, R.D. 1994. Preliminary results of a summer gill-net survey for Sacramento splittail. *IEP Newsletter* Autumn 1994, pp. 14-15.
- Daniels, R.A., and P.B. Moyle. 1983. Life history of splittail (Cyprinidae: Pogonichthys macrolepidotus) in the Sacramento-San Joaquin Estuary. *Fishery Bulletin* 81(3): 647-654.
- Department of Water Resources and U. S. Bureau of Reclamation (DWR and USBR). 1994. *Biological Assessment: Effects of the Central Valley Project and the State Water Project on Delta smelt and Sacramento Splittail*. Prepared for U.S. Fish and Wildlife Service. 230 pp.
- Sommer, T., R.D. Baxter, and B. Herbold. (In prep). The resilience of splittail in the Sacramento-San Joaquin Estuary. To be submitted to *Trans. Am. Fish Soc.*

### IEP Surfboard

Doug Demko

Each edition of the IEP Surfboard will introduce about 15 useful, interesting, or entertaining Web sites. The focus will be on sites related to fish, water issues, or the environment, primarily in the Central Valley and bay/delta regions. This edition focuses on popular, easily located Web sites; subsequent articles will preview more obscure sites.

In addition to providing each Uniform Resource Locator in this article, a copy of this article with links to each Web site will be posted at <http://www.spcramer.com>. Instead of typing in URLs, read this article on-line and jump from site to site with your mouse. You can also add your favorite site to a list of links submitted by other IEP *Newsletter* subscribers. If you like, include a review of the site you contribute.

Experienced Web users are probably already familiar with most of the agency home pages. If you are new to the Internet, put these sites at the top of your surfing list:

- IEP (<http://www.iep.water.ca.gov/>)
- USFWS (<http://www.delta.dfg.ca.gov/usfws/index.html>)
- DWR (<http://www.dwr.water.ca.gov/>)

- NMFS (<http://kingfish.ssp.nmfs.gov/>)
- DFG (<http://www.dfg.ca.gov/>) OR (<http://www.delta.dfg.ca.gov/index.html>)
- USGS (<http://water.wr.usgs.gov/>) OR (<http://sfbay.wr.usgs.gov/>)

Another great place to begin surfing:

- American Fisheries Society (<http://www.esd.ornl.gov/societies/AFS/>)

All of these sites are easily navigated and provide information for the public as well as environmental professionals.

USGS and DWR maintain Web sites where current and historical streamflow data can be viewed and downloaded for many California streams. The California Data Exchange Center has flow data in hourly, daily, and monthly formats (<http://cyclone.water.ca.gov/>). Data such as snowpack and water temperature are also present. At the USGS page, locating the desired flow monitoring station is simple due to a "clickable" image map. The USGS also maintains a Web site specific to the bay/delta region (<http://sfbay.wr.usgs.gov/>). In addition to a "near real-time" wind pattern map, you'll find detailed information on water quality and

salinity in the bay/delta area and learn about current research.

The DFG Bay-Delta server includes pictures and information on northern pike and alligator gar captured in California waters (<http://www.delta.dfg.ca.gov/index.html>). The alligator gar photographs are worth the wait (I wouldn't touch it without gloves either). While there, don't miss pictures of Barney, the harbor seal pup captured at Skinner Fish Facility. The amount and diversity of information present and the useful links to other sites make the DFG Bay-Delta home page a good stop.

To find out what El Niño is or read about the latest El Niño research, visit the "El Niño Theme Page" at <http://www.pmel.noaa.gov/toga-tao/el-niño/home.html>. Although the graphics can be hard to read, complete descriptions and great links make the collection of pages superior, as indicated by the awards they have received.

If you think things are rough where you work, or if your fingers get cold while measuring fish, check out the Yukon Fish and Game Association home page (<http://www.yukonweb.wis.net/community/yfga/>). While there, visit the longest wooden fish ladder in the world (hint: it's 400 yards long and it's not in Red Bluff).