United States Department of the Interior

OFFICE OF THE SOLICITOR
Pacific Southwest Region
2800 Cottage Way
Room E-1712
Sacramento, California 95825-1890

July 21, 2008

IN REPLY
REFER TO:

By overnight delivery

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Subject: Don Pedro Project, FERC No. 2299-057
Answer of the Department of the Interior

Dear Ms. Bose:

Enclosed for filing with the Federal Energy Regulatory Commission in the above-captioned proceeding, please find the original and nine copies of the Department of the Interior's Answer to Motion to Clarify Record of Modesto and Turlock Irrigation Districts.

Please date-stamp the ninth copy and return it to me in the stamped, self-addressed envelope.

Thank you for your attention.

Sincerely,

Daniel G. Shillito
Regional Solicitor

Kerry O'Hara

By: Kerry O'Hara
Assistant Regional Solicitor

Enclosures: (Answer and Supporting Materials)
cc: Service List, Project No. 2299

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Turlock Irrigation District	)	
Modesto Irrigation District	)	
	)	**Project No. 2299**
Don Pedro Project	)	
Tuolumne River, California	)	
	)	
	)	

Certificate of Service

I hereby certify that the Department of the Interior's Answer to Motion to Clarify Record of Modesto and Turlock Irrigation Districts has this day been sent via overnight delivery for filing with the Federal Energy Regulatory Commission and served, via deposit in U.S. mail, upon each person designated on the Service List compiled by the Commission Secretary for this Project.

Dated at Sacramento, California, this 21st day of July 2008.

Dorothy Hernandez

Dorothy Hernandez, Secretary

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Modesto Irrigation District Turlock Irrigation District Don Pedro Project	)))))	Project No. 2299-057

U.S. DEPARTMENT OF THE INTERIOR
ANSWER TO MOTION TO CLARIFY RECORD
OF MODESTO AND TURLOCK IRRIGATION DISTRICTS

For the reasons described herein, the United States Department of the Interior (Department) hereby objects to the filing by the Modesto and Turlock Irrigation Districts (Districts) of the Motion to Clarify Record (Motion), on the grounds that such Motion constitutes a prohibited Answer to the Requests for Rehearing filed by the Department, the National Marine Fisheries Service of the Department of Commerce, California Department of Fish and Game and other parties to the Federal Energy Regulatory Commission's (Commission) April 3, 2008, Order on Ten-Year Summary Report Under Article 58 (123 FERC ¶ 62,012) (Order). In the alternative, if the Commission determines to accept the Districts' filing, the Department submits the attached Answer, pursuant to 18 C.F.R. § 385.213.

OBJECTION

The Department objects to the Districts' filing of the subject Motion, on the grounds that such filing is a thinly veiled attempt to bypass the Commission's regulatory prohibition against the filing of answers to rehearing requests. 18 C.F.R. §§ 385.713(d)(1) and 385.213(a)(2). The Commission's regulations clearly provide that "[t]he Commission will not permit answers to

requests for rehearing" (18 C.F.R. 385.713(d)(1)) and that "[a]n answer may not be made to a ... request for rehearing." 18 C.F.R. 385.213(a)(2). To avoid that prohibition, the Districts have characterized their pleading as a Motion, but a review of its contents reveals that it is in fact simply an attempt to answer and to refute the various Requests for Rehearing. The Districts' pleading includes a new technical report, which offers no new information but rather serves only to review and comment upon the rehearing requests. This filing should be recognized as what it is: an Answer to the rehearing requests that is characterized as a Motion to Clarify. Such a filing is clearly not permitted by the Commission's regulations. The Department objects to the Districts' filing and respectfully requests that the Commission strike the filing from the record and not consider its contents when reviewing the Requests for Rehearing.

ANSWER

If the Commission permits the filing of the Motion, the Department, pursuant to 18 C.F.R. §§ 385.213(a)(3) and 385.213(d)(1), timely answers such Motion through this filing, which includes a Technical Memorandum from the Fish and Wildlife Service, attached hereto as Exhibit 1 and incorporated herein by this reference. The Exhibit responds to the Districts' Motion and accompanying report. The Districts' Motion contains a number of assertions about the scientific materials provided with the rehearing requests. The tight timelines provided by the Commission's procedural regulations are not conducive to the technical exchange that is necessary to fully respond to each point raised by the Districts and thus to ensure that the Commission is fully informed as it decides this rehearing. After review of the Districts' submittal, however, the Department remains of the view that its recommendations, as more fully

articulated in its May 1, 2008, Request for Rehearing, are supported by substantial evidence and should be adopted by the Commission.

CONCLUSION

The Department respectfully requests that the Commission deny the Districts' Motion to Clarify the Record and strike it from consideration in this rehearing process. Such Motion is in fact a prohibited Answer to the rehearing requests. If the Commission allows the filing of the Motion, however, the Department requests that the Commission consider the Answer filed herein, including the attached Technical Memorandum from the Service. The Commission's conclusions that the March 25, 2005, Summary Report and the underlying fisheries studies and monitoring comply with Article 58 are not supported by substantial evidence and fail to adequately consider recommendations of the Service and other Resource Agencies. The Districts through their Motion have not provided evidence to the contrary.

Respectfully Submitted this 21st day of July, 2008.

Daniel G. Shillito
Regional Solicitor

Kerry O'Hara

Kerry O'Hara
Assistant Regional Solicitor

EXHIBIT 1

United States Department of the Interior

FISH AND WILDLIFE SERVICE
California and Nevada Region
2800 Cottage Way W-2606
Sacramento, California 95825

In reply refer to:

JUL 21 2008

Memorandum

To: Regional Solicitor, Pacific Southwest Region, Sacramento, California (Attn: Kerry O'Hara)

From: Acting Regional Director, Region 8, Fish and Wildlife Service, Sacramento, California

Subject: Review of and Answer to July 1, 2008, Technical Memorandum provided by Stillwater Sciences to Turlock Irrigation District and July 7, 2008, Motion to Clarify Record of Modesto and Turlock Irrigation Districts

In their Motion to Clarify Record (Motion), the Modesto and Turlock Irrigation Districts (Districts) claim that Commission reliance upon the supporting documents provided by the Service and other parties in their rehearing requests would be inappropriate and contrary to the requirement that the Commission base its actions on substantial evidence, and that such uncritical reliance could lead to adverse impacts to the fishery resources in the Tuolumne River. (Motion at 5). However, the Stillwater Sciences' Technical Memo, which accompanies the Districts' Motion, does not refute the primary evidence provided by the Service and there is no merit to the claim that the agencies' recommendations to increase instream flow releases could lead to adverse impacts to the fishery resources in the Tuolumne River. We provide this information for inclusion in the Department's Answer to the Districts' Motion.

In the May 1, 2008, Request for Rehearing, the Service provided substantial evidence on the following three points that have not been refuted by the Districts:

1. There is new evidence based on otolith microchemistry analyses that Central Valley steelhead (*Oncorhynchus mykiss*) reproduce in the lower Tuolumne River (Zimmerman et al. 2008). The low abundance of Central Valley steelhead in the Tuolumne River is potentially a result of inadequate instream flow releases. While the Districts' claim that these fish are of uncertain origin, this factor does not preclude the need to address deleterious Project effects to this population of Central Valley steelhead in the Tuolumne River.

2. The magnitude and duration of flow releases to the lower Tuolumne River from La Grange Dam, when juvenile Chinook salmon (*O. tshawytscha*) are rearing and migrating, are the primary environmental factors that control the production of adult Chinook salmon in the Tuolumne River (Mesick and Marston 2007, Mesick et al. 2007). The analyses by Mesick and Marston (2007) indicate that environmental factors in the Delta and ocean also affect salmon production, although to a lesser degree in most years. The strong adverse effect of ocean conditions that occurred during spring 2005 resulted in low escapement in fall 2007. This was the first time since 1980 that ocean conditions had a greater effect on salmon production than instream flow releases (Mesick and Marston 2007). Although Mesick and Marston (2007) did not directly evaluate the influence of habitat restoration in the lower Tuolumne River, which primarily occurred between 1998 and 2005, the gradual decline in escapement to the Tuolumne River since 2000 indicates the implemented restoration did not substantially affect the salmon population. Furthermore, site specific monitoring suggests that there would have been little short-term benefit from the restoration actions because: (a) gravel augmentation projects have had only moderate use by spawners based on California Department of Fish and Game salmon carcass surveys; (b) filling of the gravel mine pit at SRP 9 did not reduce predator abundance (Districts' March 25, 2005, Ten-Year Summary Report); and (c) floodway restoration at the 7/11 project site focused on sediment transport rather than frequent floodway inundation (Id.), which is correlated with high levels of salmon production (Mesick 2008). In contrast to representations in the Districts' submittal, the cohort reconstruction analyses described in Mesick et al. (2007) are sound. Mesick et al. (2007) compute an index of salmon recruitment, rather than a standard estimate as asserted in the technical report accompanying the Districts' Motion. Their index is based on California Department of Fish and Game's escapement estimates (GrandTab Excel spreadsheet available online at http://www.delta.dfg.ca.gov/afrp/), ocean harvest estimates for California's Central Valley provided by the Pacific Fisheries Management Council (available online at http://www.pcouncil.org/salmon/salpre.html#2003), and scale based age analysis for a majority of the Tuolumne River escapement estimates (Table 7 in Mesick et al. 2007), but does not incorporate year-to-year variation in natural mortality in the ocean.[1] The Mesick and Marston (2007) analyses provide substantial evidence because they reflect the effect of Project operations on escapement and ocean harvest, which are primary concerns of the Resource Agencies.[2]

3. In the materials accompanying its Request for Rehearing, the Service indicated that the fall-run Chinook salmon production in the Tuolumne River dropped to very low levels from 1990 to 1994 and from 2005 to 2007 primarily due to the effects of low instream flow releases (Mesick 2008). The escapement estimates and estimates of the number of coded-wire-tagged hatchery fish in the escapement presented in Table 1 of Mesick 2008 are not in dispute. It is highly likely that at least some of the unmarked fish in the Tuolumne River escapements are

[1] Natural mortality rates in the ocean for adult Chinook salmon are not measured or estimated for the California Central Valley populations.

[2] The flow-salmon recruitment regression analyses described in Mesick and Marston (2007) and Mesick (2008) are being finalized for the State Water Resources Control Board's September 2008 workshop on San Joaquin River Flow Objectives (Draft Bay-Delta Strategic Workplan 2008). The documentation on the final model should be available for review at that time.

strays from hatchery releases in the Delta and Bay from the Feather, American, and Mokelumne River hatcheries. Therefore, there is substantial evidence that the Tuolumne River escapement of naturally produced salmon dropped to very low levels from 1990 to 1994 and from 2005 to 2007. Lindley et al. (2007), which was a peer-reviewed paper, suggests that these low levels of escapement would place the Tuolumne River population at a moderate to high risk of extinction due to a loss of genetic diversity. In particular, low escapements over three consecutive years probably reduce the genetic diversity of the population and thereby substantially increase the risk of extinction (Lindley et al. 2007). A loss of genetic diversity during the low escapements from 1990 to 1994 provides a possible explanation of why Chinook salmon productivity dropped by about 50% in the Tuolumne River from 1997 to 2003 (Figure 2 in Mesick 2008). The Districts suggest that the significance levels of the regressions used in Mesick (2008) are not valid because they violate assumptions that the recruitment response "observations" be independent and identically-distributed. However, Dr. Allan Hubbard, Assistant Professor of Biostatistics (Division of Biostatistics, School of Public Health, University of California, 101 Haviland Hall, MC 7358, Berkeley, CA 94720), has conducted additional statistical analyses, Newey-West Regressions and Permutation Tests, to address the issues of autocorrelation and distribution with the observations used by Mesick (2008). His analyses corroborates the results presented in Mesick (2008): (a) the mean flow near La Grange from February 1 to June 15 was strongly correlated ($P < 0.0001$) with Chinook salmon recruitment in the Tuolumne River; and (b) the intercept of the regression between flow and adult recruitment from 1997 to 2004 was about 50% lower than it was from 1980 to 1990 at a statistically significant level ($P = 0.01$).

In order to end and hopefully reverse the loss of genetic diversity of the Tuolumne River fall-run Chinook salmon, the Service is of the view that it will be necessary to change the Article 37 flow requirements. The Service provided a recommendation in the May 1, 2008, Request for Rehearing for a new flow schedule that should be adequate to prevent the Tuolumne River fall-run Chinook salmon from declining to low levels in the future. Although it is based on statistical correlations between flow releases and adult salmon recruitment to the Tuolumne River, the amount of uncertainty associated with this analysis is relatively low. Moreover, the Service's recommendations do not attempt to provide floodplain inundation or otherwise preclude the Districts' obligations for flood control. Therefore, this flow recommendation should be implemented along with a fisheries monitoring plan to determine its effectiveness.

Attachment

REFERENCE CITED

1. Lindley S.T., R.S. Schick, E. Mora, P.B. Adams, J.J. Anderson, S. Greene, C. Hanson, B.P. May, D.R. McEwan, R.B. MacFarlane, C. Swanson, and J.G. Williams. 2007. Framework for assessing viability of threatened and endangered salmon and steelhead in the Sacramento- San Joaquin Basin. San Francisco Estuary and Watershed Science Volume 5, Issue 1 [February 2007], article 4. (Provided with DOI Request for Rehearing).

2. Mesick, C.F. Marston, D. and T. Heyne. 2007. Provisional Draft: San Joaquin River East-side Tributary Fall-run Chinook Salmon Age Cohort Reconstruction. (Provided with DOI Request for Rehearing). Referred to Mesick and Marston (2007b) in the Licensees' Motion to Clarify submitted July 7, 2008.

3. Mesick, C.F. and D. Marston. 2007. Provisional Draft: Relationships between fall-run Chinook salmon recruitment to the major San Joaquin River tributaries and streamflow, Delta exports, the Head of the Old River Barrier, and tributary restoration projects from the early 1980s to 2003. (Provided with DOI Request for Rehearing).

4. Mesick, C.F. 2008. The High Risk of Extinction for the Natural Fall-Run Chinook Salmon Population in the Lower Tuolumne River due to Insufficient Instream Flow Releases. (Provided with DOI Request for Rehearing).

5. Modesto and Turlock Irrigation Districts, Ten-Year Summary Report, March 2005. (Provided with DOI Request for Rehearing).

6. Zimmerman, C.E., et al. 2008. Maternal Origin and Migratory History of *Oncorhynchus mykiss* captured in rivers of the Central Valley, California. California Department of Fish and Game (Provided with DOI Request for Rehearing).

7. State Water Resources Control Board, Strategic Workplan for Activities in the San Francisco Bay/Sacramento-San Joaquin delta Estuary, June 2008 (Attached herein).

8. Hubbard, A., Assistant Professor of Biostatistics, Division of Biostatistics, School of Public Health, University of California, 101 Haviland Hall, MC 7358, Berkeley, CA 94720. Personal communication with Mesick regarding the results of a typical regression, Newey-West Regression, and Permutation Test of the Tuolumne River Recruitment Estimates and mean La Grange flow estimates from 1980 to 2004 used in the Mesick (2008) analyses. Personal communication with Carl Mesick via email on July 16, 2008 and July 17, 2008.

Alan Hubbard
<hubbard@stat.Berkeley.EDU
>
07/16/2008 09:54 AM

To "Dean Marston" <dmarston@dfg.ca.gov>
cc <AVRY@aol.com>, "Tim Heyne" <THEYNE@dfg.ca.gov>, <carl_mesick@fws.gov>
bcc
Subject Re: Fwd: Statistical Issue on Linear Regression analyses of recruitment

OK - here are the results - look different if all the years are included, however, I can get auto-correlation adjusted standard errors (see the difference of the regress vs. the newey comands below). Substantively, not much difference.

Note - x=1 <=1995, 0 otherwise.
inter is x*lgfebjun

For both typical regression and newey regression, no sig. difference between slopes (inter term non-significant) and no sig. difference between intercepts (x term non-significant).

I can talk, but only briefly unfortunately, at 5:30 pm my time (2:30 yours), Best, Alan

```
. regress tuolrecruit lgfebjun x inter

      Source |       SS       df       MS              Number of obs =
25
-------------+------------------------------           F(  3,    21) =   21.62
       Model |  9.4674e+09     3  3.1558e+09           Prob > F      =
0.0000
    Residual |  3.0648e+09    21   145941524           R-squared     =
0.7554
-------------+------------------------------           Adj R-squared =  0.7205
       Total |  1.2532e+10    24   522172016           Root MSE      =
12081

------------------------------------------------------------------------------
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
     lgfebjun |   6.774162   2.591614     2.61   0.016     1.384605
12.16372
            x |   4536.789   7652.745     0.59   0.560    -11377.97
20451.54
        inter |   2.693342   2.887959     0.93   0.362    -3.312498
8.699181
        _cons |  -4193.593   6617.111    -0.63   0.533    -17954.63
9567.441
------------------------------------------------------------------------------

.
.
end of do-file

. do "/tmp/SD00257.000000"

. ** Intercept > 1995
```

```
. lincom _cons

  ( 1)  _cons = 0

------------------------------------------------------------------------------
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
         (1) |  -4193.593   6617.111    -0.63   0.533    -17954.63
9567.441
------------------------------------------------------------------------------

. ** slope > 1995
. lincom lgfebjun

  ( 1)  lgfebjun = 0

------------------------------------------------------------------------------
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
         (1) |   6.774162   2.591614     2.61   0.016     1.384605
12.16372
------------------------------------------------------------------------------

. ** Intercept <= 1995
. lincom _cons+x

  ( 1)  x + _cons = 0

------------------------------------------------------------------------------
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
         (1) |   343.1953   3844.263     0.09   0.930    -7651.387
8337.778
------------------------------------------------------------------------------

. ** slope <= 1995
. lincom lgfebjun+inter

  ( 1)  lgfebjun + inter = 0

------------------------------------------------------------------------------
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
         (1) |   9.467504     1.2743     7.43   0.000     6.817451
12.11756
------------------------------------------------------------------------------

.
.
end of do-file

. do "/tmp/SD00257.000000"

. tsset year
        time variable:  year, 1980 to 2004
```

```
. newey tuolrecruit lgfebjun x inter, lag(3)

Regression with Newey-West standard errors                Number of obs    =        25
maximum lag: 3                                            F(  3,    21)    =     11.36
                                                          Prob > F         =

0.0001

------------------------------------------------------------------------------
             |             Newey-West
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
     lgfebjun |   6.774162   1.505952     4.50   0.000     3.642362
9.905962
            x |   4536.789   3496.836     1.30   0.209    -2735.279
11808.86
        inter |   2.693342   2.809929     0.96   0.349    -3.150226
8.53691
        _cons |  -4193.593   3045.027    -1.38   0.183    -10526.07
2138.887
------------------------------------------------------------------------------

.
end of do-file

. do "/tmp/SD00257.000000"

. ** Intercept > 1995
. lincom _cons

  ( 1)  _cons = 0

------------------------------------------------------------------------------
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
         (1) |  -4193.593   3045.027    -1.38   0.183    -10526.07
2138.887
------------------------------------------------------------------------------

. ** slope > 1995
. lincom lgfebjun

  ( 1)  lgfebjun = 0

------------------------------------------------------------------------------
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
         (1) |   6.774162   1.505952     4.50   0.000     3.642362
9.905962
------------------------------------------------------------------------------

. ** Intercept <- 1995
. lincom _cons+x

  ( 1)  x + _cons = 0

------------------------------------------------------------------------------
```

```
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
--------------+----------------------------------------------------------------
          (1) |   343.1953   1625.404     0.21   0.835    -3037.018
3723.408
------------------------------------------------------------------------------

. ** slope <= 1995
. lincom lgfebjun+inter

  ( 1)  lgfebjun + inter = 0

------------------------------------------------------------------------------
  tuolrecruit |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
--------------+----------------------------------------------------------------
          (1) |   9.467504   2.502754     3.78   0.001     4.262743
14.67226
------------------------------------------------------------------------------
```

--
Alan Hubbard
Assistant Professor of Biostatistics
113B Haviland Hall
Office Phone: (510)643-6160
http://ehs.sph.berkeley.edu/hubbard/

Mailing address:
Div. of Biostatistics, School of Public Health
University of California
101 Haviland Hall, MC 7358
Berkeley, CA 94720

Alan Hubbard
<hubbard@stat.Berkeley.EDU
>

07/17/2008 07:23 AM

To "Dean Marston" <dmarston@dfg.ca.gov>
cc <AVRY@aol.com>, "Tim Heyne" <THEYNE@dfg.ca.gov>, <carl_mesick@fws.gov>
bcc
Subject Re: Fwd: Statistical Issue on Linear Regression analyses of recruitment

History: This message has been replied to.

Here's the sequence of permutation tests done. 1) test of difference of slopes, 2) test of difference of interecepts assuming no difference in slopes, 3) test of effect of flow assuming no difference in slopes nor intercepts.

Test	p-value
1	.21
2	.01
3	<0.0001

Thus, no strong evidence of difference in slopes between the two eras, however, evidence for difference in intercepts and strong evidence that flow matters. Also attached plot showing data and two lines.

--
Alan Hubbard
Assistant Professor of Biostatistics
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Office Phone: (510)643-6160
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Mailing address:
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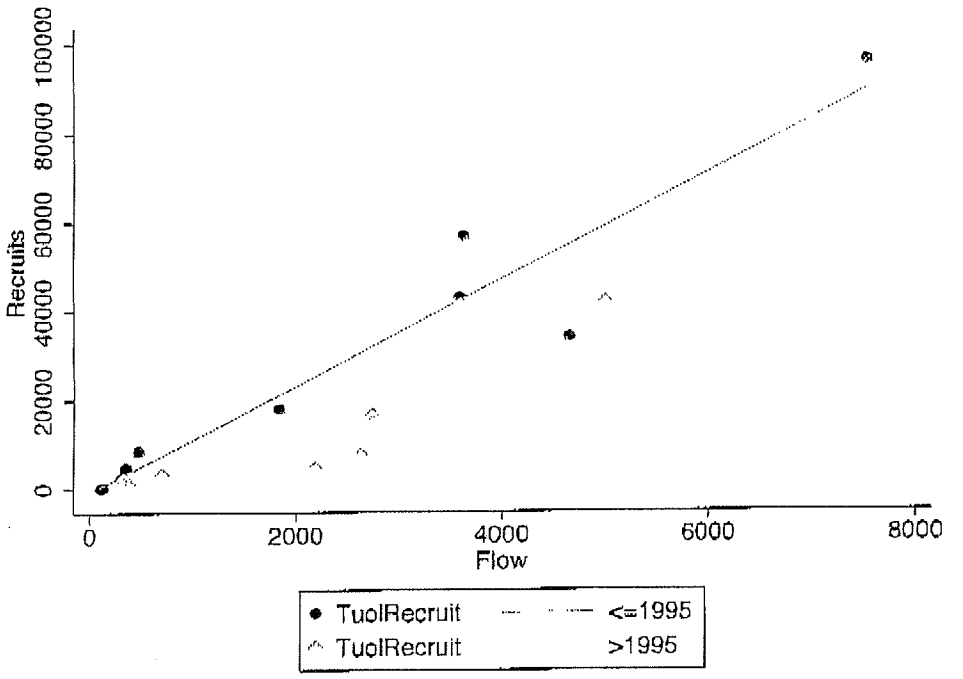
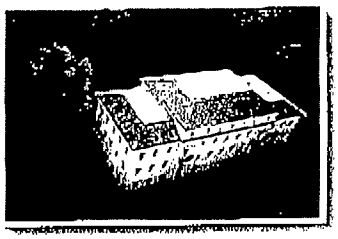
PlotsofBoth.pdf


Recruits
0
20000
40000
60000
80000
100000
0
2000
4000
6000
8000
Flow
TuolRecruit
<=1995
TuolRecruit
>1995

Alan Hubbard's homepage



Alan Hubbard

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Teaching

PH 242C: Longitudinal Data Analysis

This course covers the statistical issues surrounding estimation of effects using data on subjects followed through time. The course emphasizes a regression model approach and discusses disease incidence modeling and both continuous outcome data/linear models and longitudinal extentions to nonlinear models (e.g., logistic and Poisson). The primary focus is from the analysis side, but we will also discuss the mathematical intuition behind the procedures. The statistical/mathematical material include some survival analysis, normal linear models, logistic and Poisson regression and matrix algebra for statistics. Next taught in Spring, 2005.

Causal Inference

The course covers both the basic issues regarding the estimation of causal effects using observational data and also

specific, recently developed models designed to estimate such effects. Topics to be discussed include confounding, counterfactuals, graphical models, direct and indirect effects, the G-computation algorithm, propensity scores and marginal structural models for both point treatment and longitudinal studies. Time permitting, additional topics include instrumental variables, dynamic treatment regimes, structural nested models and structural equation models.

Research

Clustering Functions

This research has revolved around the apparently simple question: How many different kinds of patients does many data set contain? It was motivated by a data set from San Francisco General Hospital (SFGH) on several hundred HIV subjects followed after initialization of HAART. Subjects were followed irregularly over time and both CD4 counts and viral loads were recorded. The basic method involves an ad hoc part (smoothing and prediction at grid points, clustering) and a rigorous part (choosing the parameters at each step by cross-validation). The result is a set of clusters defined by the longitudinal profiles of patients.

Dynamic Models of Infectious Disease

More of my work has been focused on infectious diseases and the unique statistical issues that arise when outcome data among subjects is inherently related (correlated). Part of the work involves using mathematical infectious disease models to investigate the potential bias of ignoring the feedback inherent in infectious diseases. (Eisenberg, et al., 2003)

In addition, a recently submitted paper on analyzing the different contributions (person-to-person, person-to-environment-to-person) to the *Cryptosporidium* outbreak in Milwaukee, we used a novel technique to find the posterior distribution (the estimation distribution) of the relevant parameters in the model. This involved a combination of profile likelihood methods and a modified MCMC algorithm. (similar to Hubbard, et al., 2002)

Risk Assessment

With Prof. Mark Nicas on assessing risk from respiratory infections, also incorporating previous work on dose-response. This work is inspired by characterizing risk of infection (and the efficacy of preventive measures) from bioterrorism or infection of hospital workers in an outbreak. (Nicas and Hubbard, 2002 and Nicas and Hubbard, 2003)

Computational Biology

I have recently completed an initial analysis on Affymetrix data and workers exposed to benzene. The data (from Prof. Martyn Smith's lab) consists of 40,000+ gene expressions measured on 12 workers (6 exposed and 6 unexposed matched pairs) in China. In addition, we are examining a very similar data set on dioxin exposure.

Locally Efficient Estimation

Work on (treatment specific) locally efficient estimation in the presence of potentially informative censoring and confounding. (van der Laan, Hubbard and Robins, 2002, Hubbard, et al., 2000, and van der Laan and Hubbard, 1998)

Other Activities

Links

Curiculum vitae

Group in Biostatistics