U.S. Fish & Wildlife Service

Arcata Fisheries Data Series Report DS-2011-21

Tidewater Goby Investigations - 2010 North Coast Populations

Charles D. Chamberlain

U.S. Fish and Wildlife Service
Arcata Fish and Wildlife Office
1655 Heindon Road, Arcata, CA 95521
(707) 882-7201

March 2011

Arcata Fish and Wildlife Office participation in this study was funded by the U. S. Fish and Wildlife Service.

Disclaimer: The mention of trade names or commercial products in this report does not constitute endorsement or recommendation for use by the Federal Government.

The Arcata Fish and Wildlife Office Fisheries Program reports its study findings through two publication series. The **Arcata Fisheries Data Series** was established to provide timely dissemination of data to local managers and for inclusion in agency databases. The **Arcata Fisheries Technical Reports** publishes scientific findings from single and multi-year studies that have undergone more extensive peer review and statistical testing. Additionally, some study results are published in a variety of professional fisheries journals.

key words: Tidewater Goby, northern California

The correct citation for this report is:

Chamberlain, C. D. 2011. Tidewater Goby investigations - 2010 north coast populations. U.S. Fish and Wildlife Service. Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report DS-2011-21, Arcata, California.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Arcata Fisheries Data Series Report DS-2011-21

Tidewater Goby Investigations - 2010 North Coast Populations

Charles D. Chamberlain

U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office
1655 Heindon Road; Arcata, California 95521
charles_chamberlain@fws.gov

Abstract.
The Arcata Fish and Wildlife Office conducted a quick survey of local waters to support recovery plan implementation efforts related to Tidewater Goby, and to collect and voucher tissue samples for future genetic investigation. Using a small mesh seine or long-handled dipnets, 120 locations within 18 local waters were sampled. Over 900 Tidewater Goby were captured among 38 of those locations within 14 of the waters sampled. No Tidewater Goby were detected within four of the 17 waters where they have been confirmed within the last decade. One previously undiscovered population was detected at Connick Ranch near the mouth of the Eel River Estuary. Utilizing non-lethal fin clips, tissue collections were made from 290 individuals for future gentic investigation.

INTRODUCTION

Listed as endangered in 1994, Tidewater Goby *Eucyclogobius newberryi* are found in lagoons and estuaries along the coast of California (USFWS 1994). To support recovery plan implementation efforts in the northern California region (Del Norte, Humboldt, and Mendocino Counties), Arcata Fish and Wildlife Office (AFWO) received funding to conduct surveys of local waters. The aims of this survey (proposal attached as Appendix A) were to: survey local waters to determine presence, and collect genetic tissue to explore temporal and spatial change within and between populations following a similar investigation conducted in 2006 (McCraney et al. 2010; genetic investigation proposal attached as Appendix B).

METHODS

Waters sampled

Arcata Fish and wildlife staff conducted 120 samples of 18 local waters (Figure 1; Table 1). All waters with the exception of Connick Ranch at the mouth of the Eel River were previously known locations for Tidewater Goby. Included were 11 of the populations reported by McCraney et al (2010) in their genetic analysis of populations sampled in 2006 (Table 1).

Capture methods

Wherever possible, a small-mesh beach seine was employed. Long-handled dip nets were utilized at locations where soft substrate and/or dense vegetation precluded seining. Captured fish were immediately transferred to a bucket or fish viewer for identification and/or genetic tissue collection. Crews attempted to capture 50 individuals per location for tissue sample collection purposes (discussed below).

Sample locations were recorded on aerial photo and later interpreted into a GIS shapefile. The shapefile includes date of sample and the number of Tidewater Goby captured per sample effort.

Tissue collection

Tidewater Goby genetic tissue samples were obtained nonlethally by dissection of a small (1 mm^2) piece of the pelvic disc. The tissue was transferred to a folded piece of water resistant paper and inserted into a scale envelope. Fish were returned live to the water of capture. Scale envelopes were dried at approximately 38 ºC overnight. The samples were vouchered at the Arcata Fish and Wildlife Office for future transfer to Humboldt State University for process.

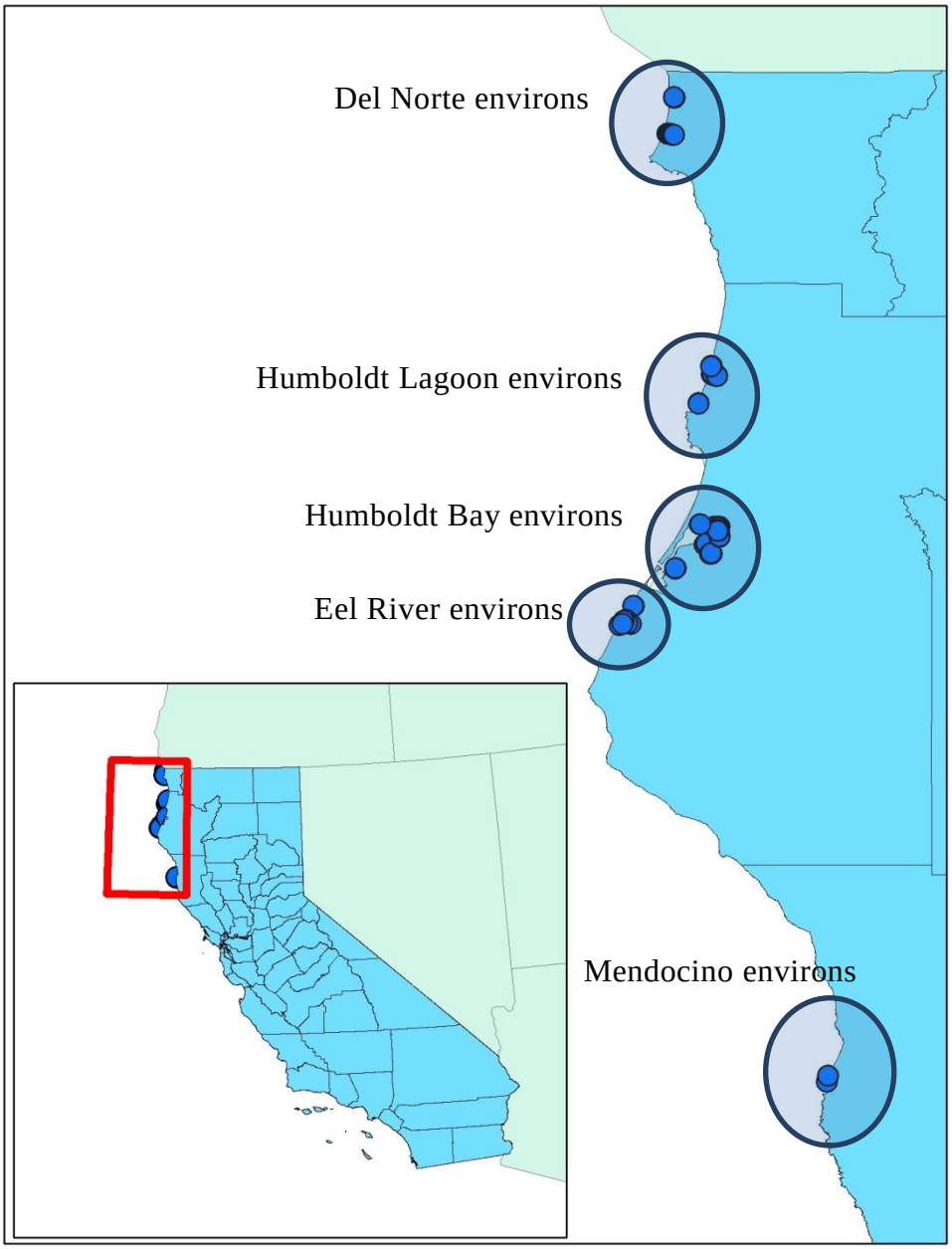

Figure 1. Sample locations.

Table 1. Waters sampled.

Water	Tributary to:	Sample dates	Replicate for genetic comparison to McCraney et al?
Tillas Slough	Smith River	9/30/2010	No
Lake Earl	Pacific	8/30/10	Yes
Big Lagoon	Pacific	8/26/2010	Yes
Stone Lagoon	Pacific	9/15 and 10/15/2010	Yes
McDaniel Slough	Humboldt Bay	9/14/2010	No
Arcata Aquaculture Pond	Humboldt Bay	10/6/2010	No
Gannon Slough	Humboldt Bay	9/1/2010	Yes
Gannon Pond	Humboldt Bay	8/17/2010	Yes
Jacoby Creek	Humboldt Bay	9/27/2010	Yes
Rocky Gulch	Humboldt Bay	9/28/2010	No
101 ditch	Humboldt Bay	8/24/2010	No
Wood Creek	Humboldt Bay	8/31/2010	Yes
Elk River	Humboldt Bay	9/23/2010	Yes
Ocean Ranch	Eel River	10/26/2010	Yes
Riverside Ranch	Eel River	10/14/2010	No
Connick Ranch	Eel River	10/13/2010	No
Virgin Creek	Pacific	10/4/2010	Yes
Pudding Creek	Pacific	10/4/2010	Yes

RESULTS

Of the 11 waters re-sampled from McCraney et al. (2010), Tidewater Goby were captured at 8, though the capture numbers were only adequate to collect the target number of tissue samples (50) at Big Lagoon, Ocean Ranch on the Eel River Estuary, Virgin Creek, and Pudding Creek. Captures were also adequate to collect tissues samples for genetic characterization of the previously unknown population at Connick Ranch on the Eel River Estuary.

Del Norte environs

Tillas Slough, Smith River

A total of 32 Tidewater Goby were captured 9/30 at Tillas Slough (Figure 2). Due to their small size (total length range 16 to 25 mm), no tissue samples were collected from this population (Table 2).

Lake Earl

Only one goby was captured 8/30 from the eleven sites sampled on the north side of Lake Earl (Figure 2). A tissue sample from the single Goby was vouchered (Table 2).

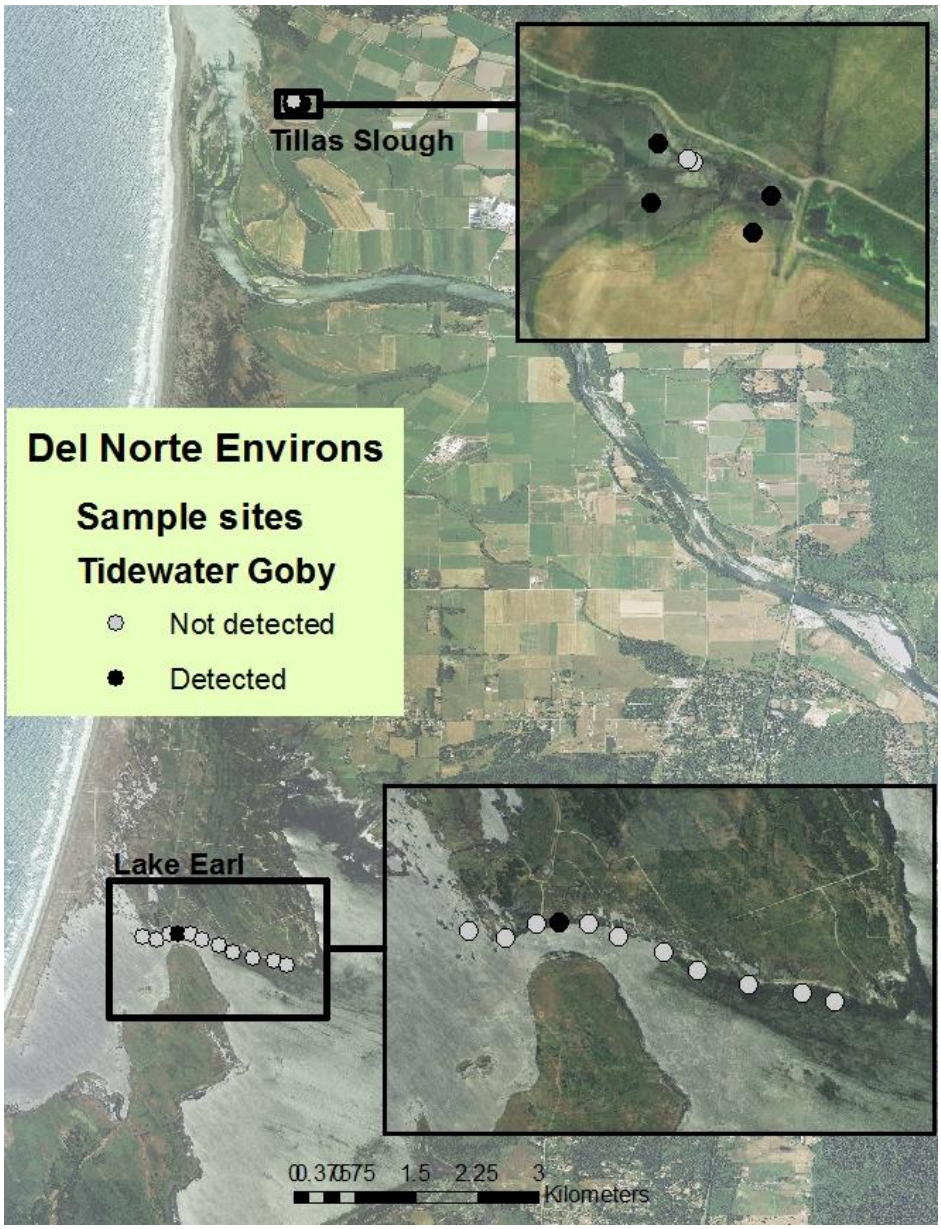

Figure 2. Del Norte environs.

Table 2. Capture results and number of tissue samples vouchered at each location.

Water	Tributary to:	Tidewater Goby captured	Tissue samples vouchered
Tillas Slough	Smith River	32	0
Lake Earl	Pacific	1	1
Big Lagoon	Pacific	81	52
Stone Lagoon	Pacific	1	1
McDaniel Slough	Humboldt Bay	13	13
Arcata Aquaculture Pond	Humboldt Bay	2	2
Gannon Slough	Humboldt Bay	0	0
Gannon Pond	Humboldt Bay	2	1
Jacoby Creek	Humboldt Bay	>100	2
Rocky Gulch	Humboldt Bay	16	13
101 ditch	Humboldt Bay	0	0
Wood Creek	Humboldt Bay	0	0
Elk River	Humboldt Bay	1	0
Ocean Ranch	Eel River	110	50
Riverside Ranch	Eel River	0	0
Connick Ranch	Eel River	88	54
Virgin Creek	Pacific	79	51
Pudding Creek	Pacific	391	50

Humboldt Lagoon environs

Big Lagoon

At Big Lagoon, 81 Tidewater Goby were captured 8/26 among the three sites sampled (Figure 3). Tissue samples were collected from 52 individuals (Table 2).

Stone Lagoon

Twelve sites were sampled at Stone Lagoon on 9/15 (Figure 3) with only one dead adult Tidewater Goby encountered. Thirteen sites were sampled 10/15 and one live Tidewater Goby was captured (tissue sample collected; Table 2).

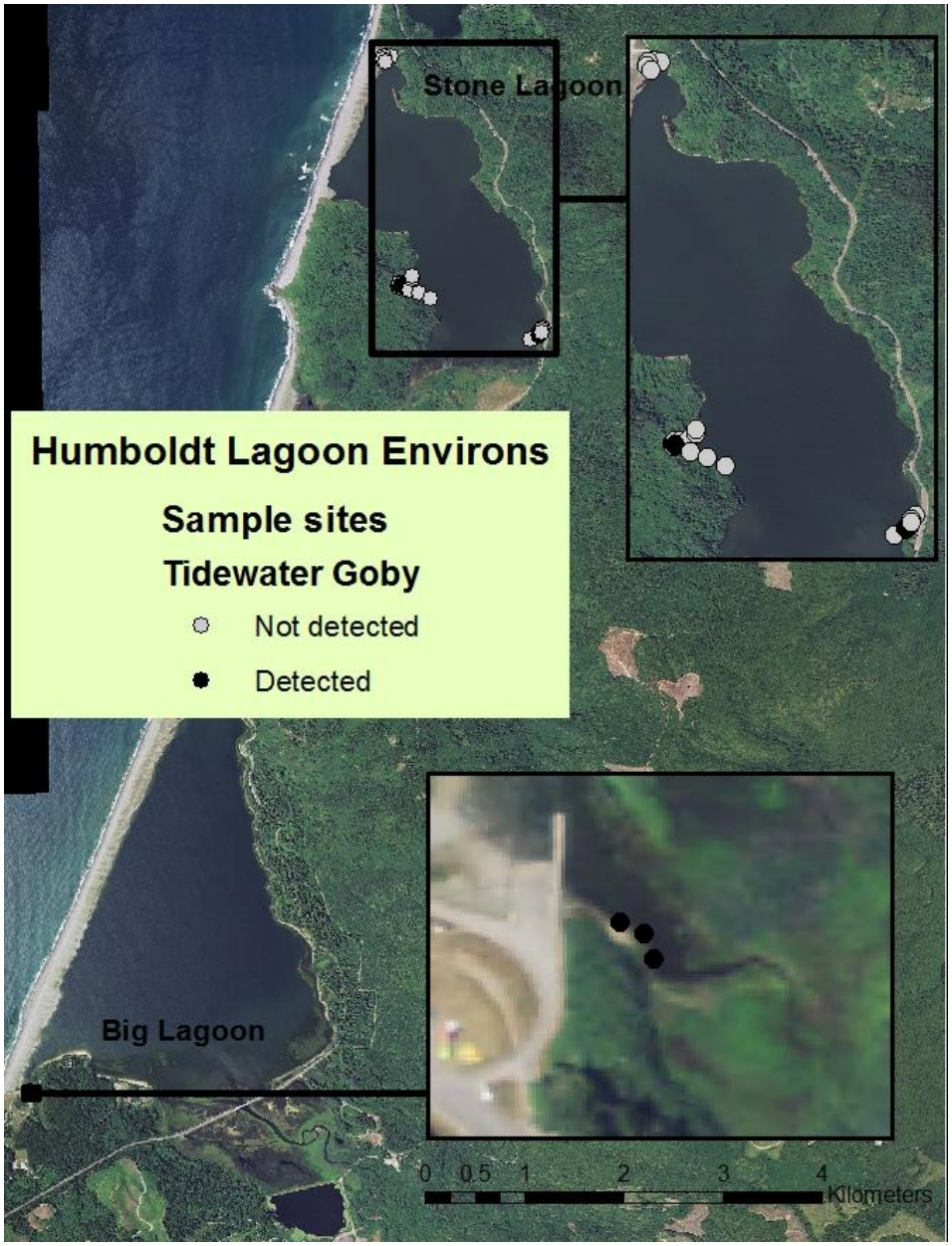

Figure 3. Humboldt Lagoons environs.

Humboldt Bay environs

McDaniel Slough, Humboldt Bay

Two sites at McDaniel Slough were sampled 9/14 (Figure 4), and 13 Tidewater Goby were captured. Genetic tissue was vouchered from all (Table 2).

Arcata Aquaculture Ponds

Two Tidewater Goby were captured from one of the four sites sampled at the Arcata Aquaculture Ponds 10/6 (Figure 4). Genetic tissue was vouchered from both (Table 2).

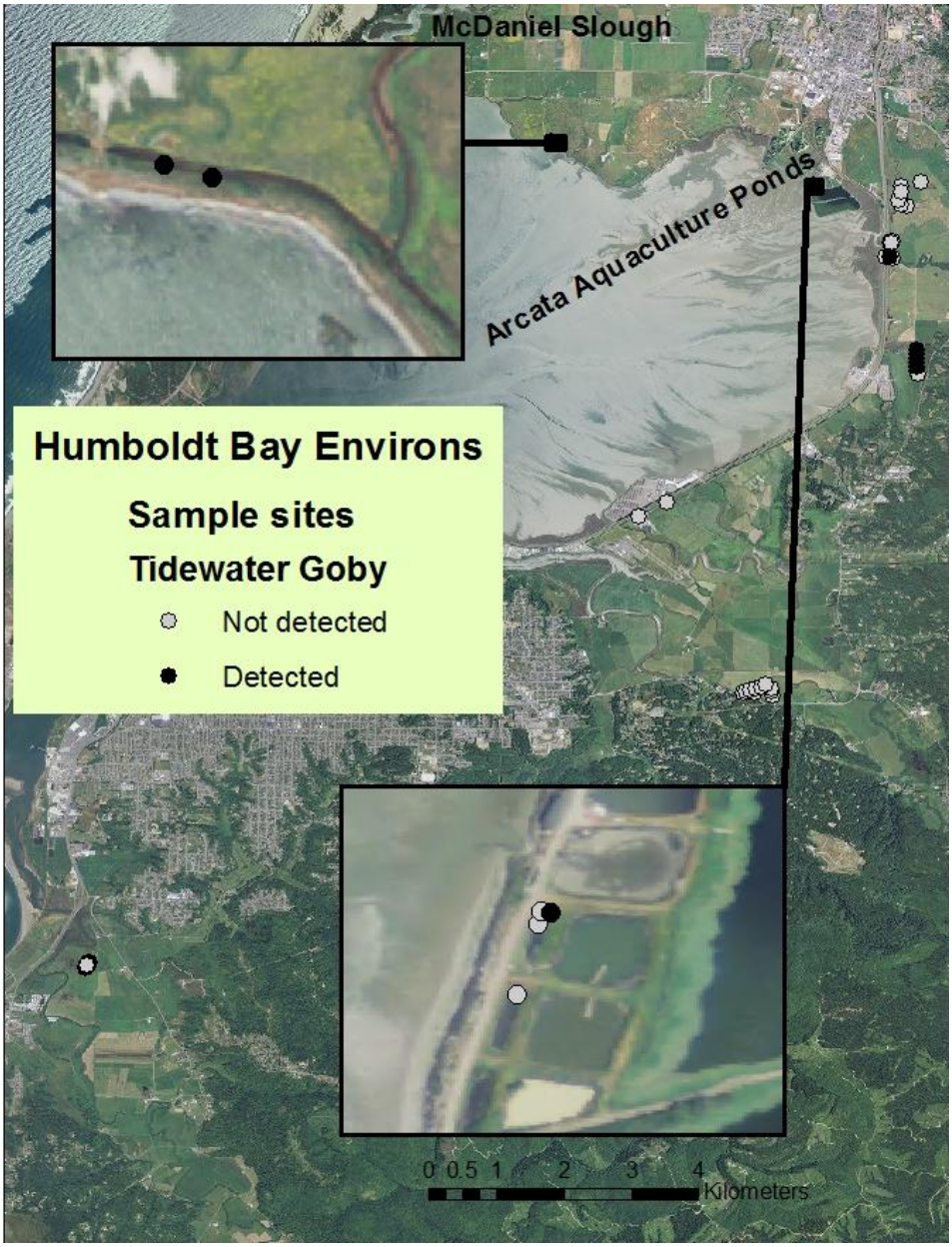

Figure 4. Humboldt Bay environs (1 of 3).

Gannon Slough, Humboldt Bay

No Tidewater Goby were captured 9/1/10 from the six sample sites at Gannon Slough (Figure 5; Table 2).

Gannon Pond

Only two Tidewater Goby were captured at Gannon Pond 8/17 (Figure 5). Tissue was collected from one (Table 2).

Jacoby Creek, Humboldt Bay

One of the three sites sampled at Jacoby Creek 9/27 were positive for Tidewater Goby (Figure 5). Over 100 larval Tidewater Goby and 5 ranging in size from 21 to

41 mm total length were captured. Tissue samples were only collected from two fish here due to the small size of most of the capture (<25 mm; Table 2).

Rocky Gulch, Humboldt Bay

Five of seven sites at Rocky Gulch sampled positive for Tidewater Goby on 9/28 (Figure 5). Sixteen total individuals were captured. Tissue samples were collected from 13 (Table 2).

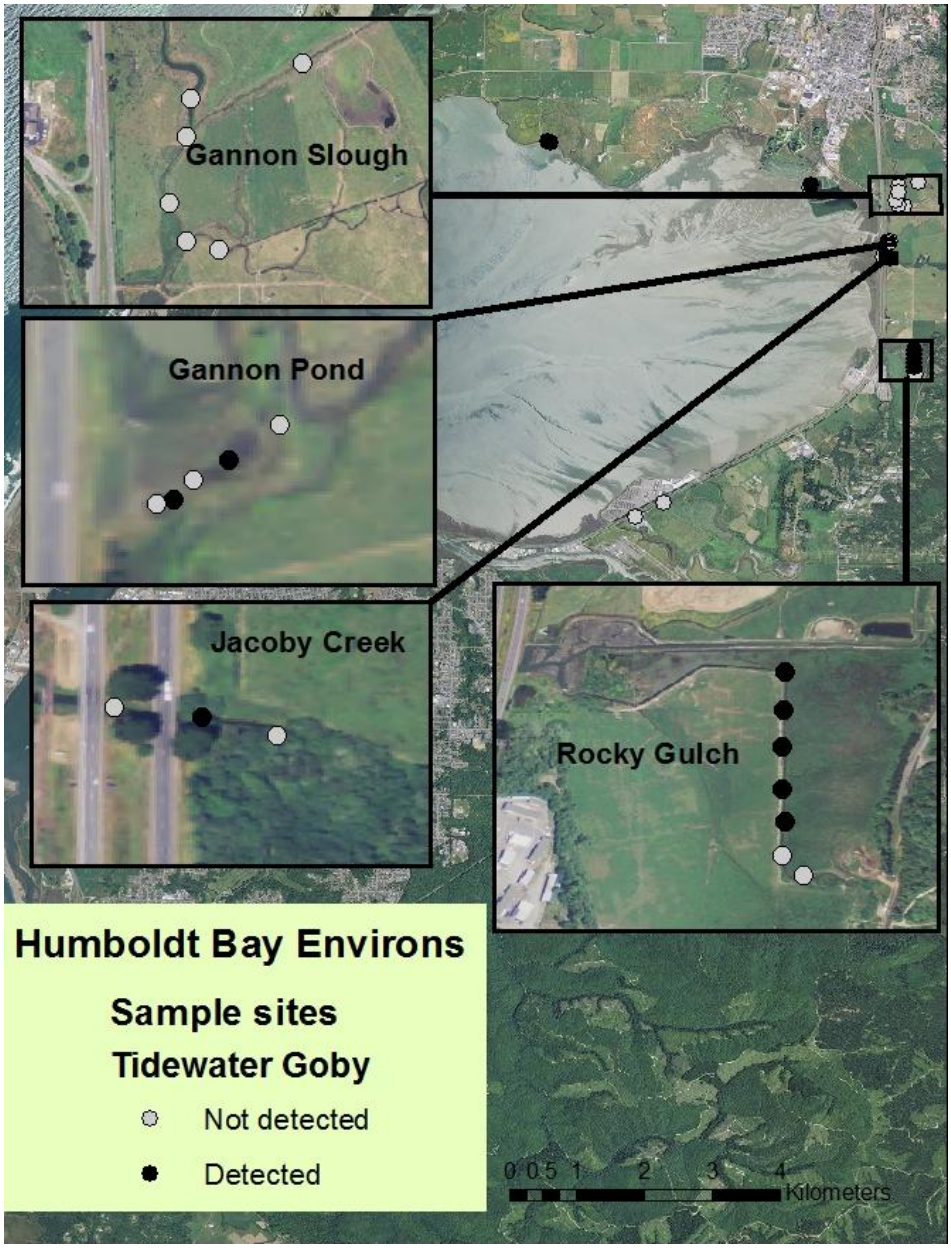

Figure 5. Humboldt Bay environs (2 of 3).

101 ditch, Humboldt Bay

No Tidewater Goby were captured 8/24 from either of two sample sites at the 101 ditch (Figure 6; Table 2).

Wood Creek

No Tidewater Goby were captured from ten sample sites at Wood Creek 8/31 (Figure 6; Table 2).

Elk River, Humboldt Bay

Ten sites at Elk River were sampled 9/23, but only one Tidewater Goby was captured and no genetic tissue was vouchered (Figure 6; Table 2).

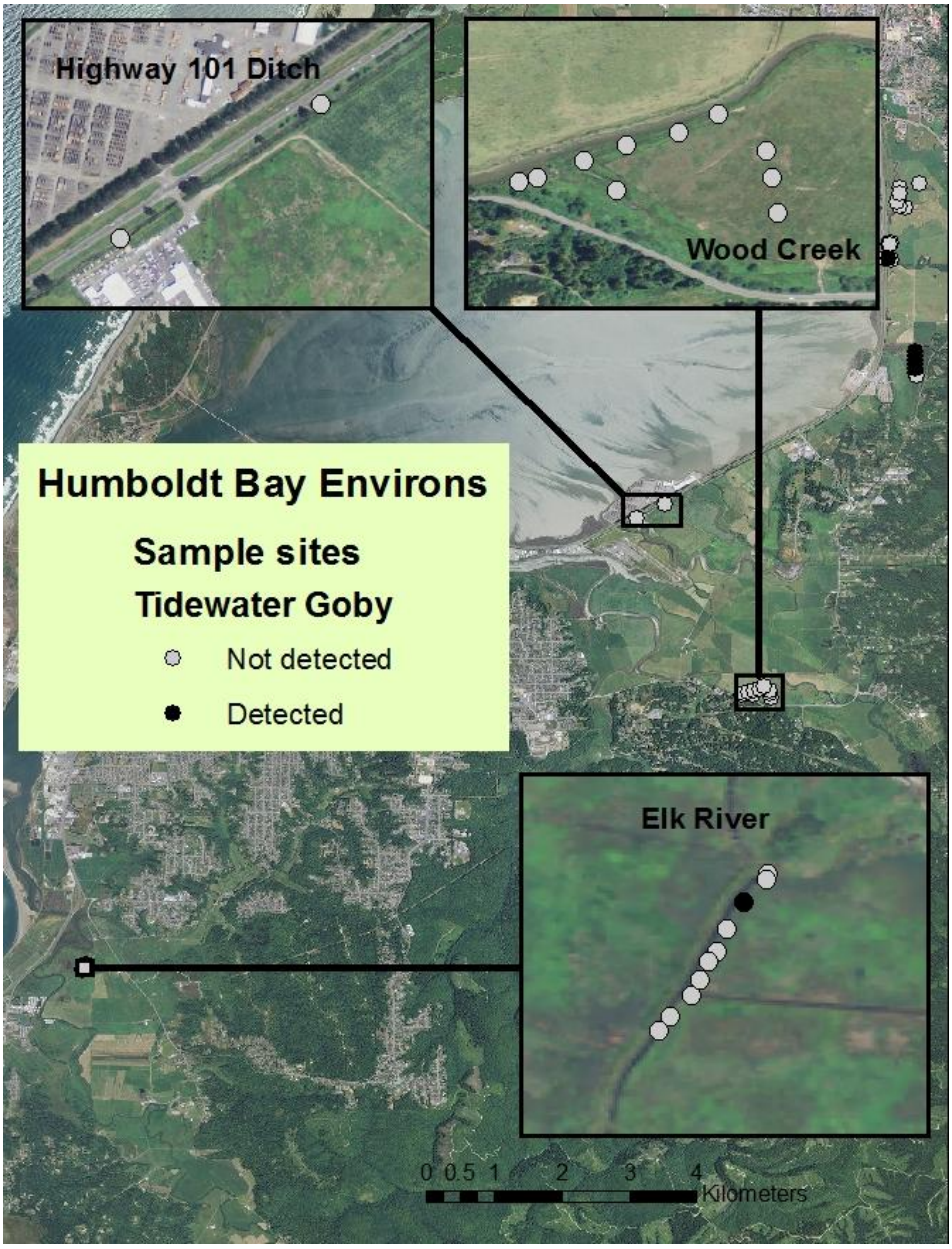

Figure 6. Humboldt Bay environs (3 of 3)

Eel River environs

Ocean Ranch, Eel River

Seven sites were sampled at Ocean Ranch on the Eel River Estuary 10/26 (Figure 7). Tidewater Goby were captured at three of the seven, and tissue from 50 of the 110 captured specimens was vouchered (Table 2).

Riverside Ranch, Eel River

No Tidewater Goby were captured 10/14 at Riverside Ranch at seven sample sites (Figure 7; Table 2).

Connick Ranch, Eel River

Four sites were sampled at Connick Ranch on the Eel River estuary 10/13 (Figure 7) and Tidewater Goby were captured at all. Tissues samples were collected and vouchered from 54 of the 88 Tidewater Goby captured (Table 2).

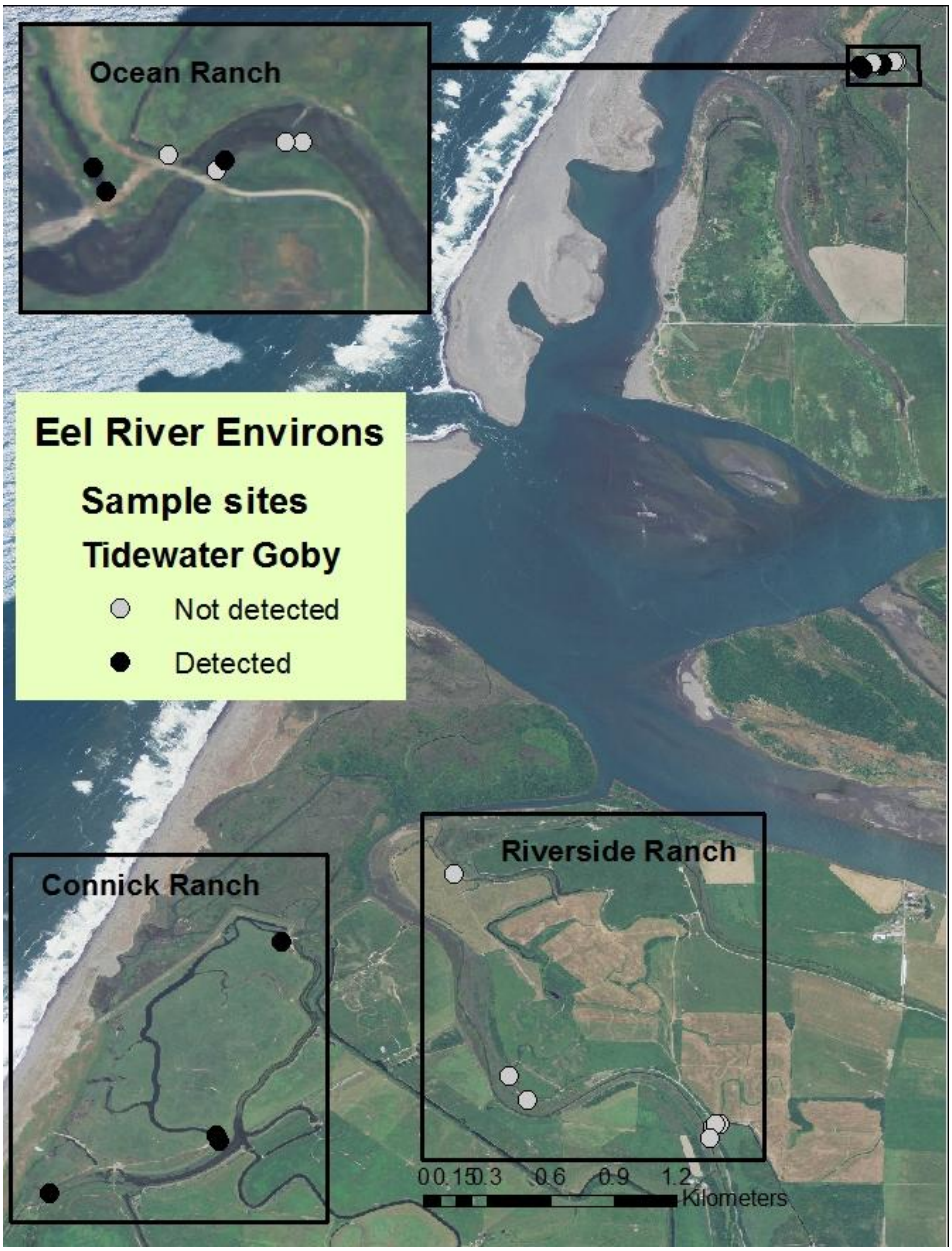

Figure 7. Eel River Estuary environs.

Mendocino environs

Virgin Creek

At Virgin Creek, 6 sites were sampled 10/4 (Figure 8). A total of 79 Tidewater Goby were captured and 51 tissue samples were vouchered (Table 2).

Pudding Creek, Humboldt Bay

Two sites were sampled 10/4 at Pudding Creek (Figure 8). A total of 391 Tidewater Goby were captured, and 50 tissue samples were vouchered (Table 2).

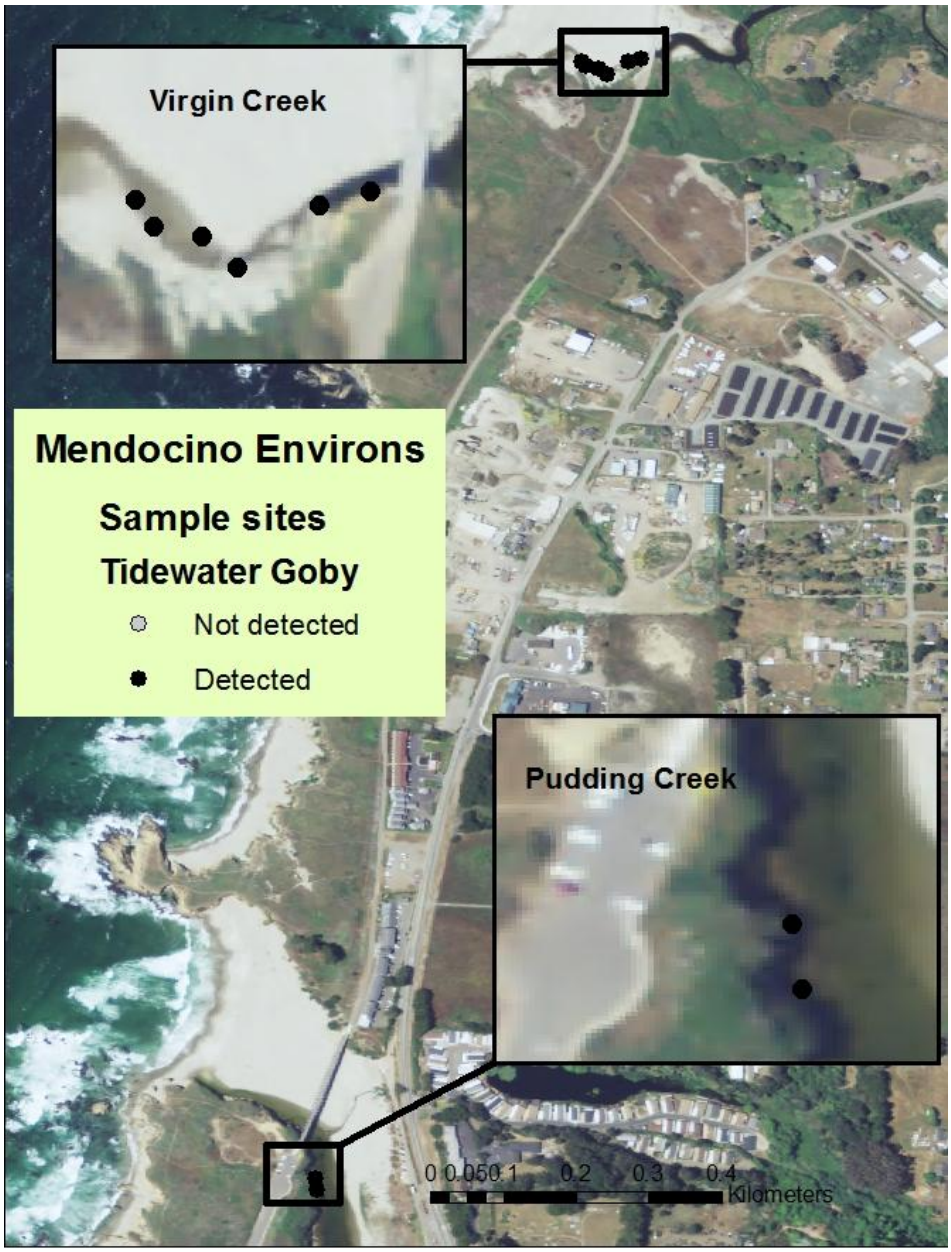

Figure 8. Mendocino County environs

DISCUSSION

Qualitatively, Tidewater Goby were encountered at lower densities than in 2006 when AFWO made the collections reported by McCraney et al (2010). Our crews were only able to voucher the target 50 individual tissue samples from five populations, one of which was a previously undiscovered population not included in the 2006 sample efforts.

Soft muck substrates difficult to walk, dense aquatic vegetation, depth greater than can be easily waded (~ 4ft), etc. can all make Tidewater Goby extremely difficult to detect, especially if they occupy a habitat at low densities. Chance encounter with

even a single individual obviously confirms occupancy, but negative detections often make a poor indicator of absence. No Tidewater Goby were encountered at Gannon Slough, the Highway 101 Ditch, Wood Creek, or the Riverside Ranch on the Eel River Estuary. With the exception of the Highway 101 ditch, Tidewater Goby have been recently detected at all of these locations and they all probably warrant revisit in 2011. A single Tidewater Goby was incidentally captured by California Department of Fish and Game at Wood Creek during the summer of 2010 (Mike Wallace, personal communication). Nine Tidewater Goby were captured by AFWO on and adjacent to Riverside Ranch during a pre-restoration site visit in May 2010. Tidewater Goby presence at Gannon Slough has been confirmed as recently as October 2009, though we captured none in September 2010.

Continued Tidewater Goby occupancy was confirmed at 13 of the 18 historically known locations sampled. A previously un-sampled and unknown population was discovered at Connick Ranch on the Eel River Estuary.

With only one Goby captured at Lake Earl among 11 sites sampled, the Lake Earl population density (at least along the north shore) was the lowest this office has observed at Lake Earl. This population has historically been qualitatively estimated to number into the millions or characterized as among the state's largest (Swift et al. 1989; USFWS 2005, Chamberlain 2006). The sampling conducted here in 2010 was highly localized and higher densities might have been encountered elsewhere in the water body if other areas were sampled. The low catch is reason for concern however, and we recommend revisit of Lake Earl in 2011.

ACKNOWLEDGEMENTS

CDFG, Land Conservancy, Anthony Scheiff, Vina Frye.

LITERATURE CITED

Chamberlain, C.D. 2006. Environmental variables of northern California lagoons and estuaries and the distribution of tidewater goby (*Eucyclogobius newberryi*). U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Technical Report Number TR 2006-04, Arcata, California.

McCraney, W. T., G. Goldsmith, D. K. Jacobs, and A. P. Kinziger. 2010. Rampant drift in artificially fragmented populations of the endangered tidewater goby (*Eucyclogobius newberryi*). Molecular Ecology, 19, 3315–3327

Swift, C. C., J. L. Nelson, C. Maslow, and T. Stein. 1989. Biology and distribution of the tidewater goby, *Eucyclogobius newberryi* (Pisces: Gobiidae). Of California. Los Angeles Co. Museum of Natural History. Contributions in Science 404:1-19.

U.S. Fish and Wildlife Service (USFWS). 1994. Endangered and threatened wildlife and plants; determination of endangered status for the tidewater goby. Federal Register 59 (24): 5,494-5,498.

U.S. Fish and Wildlife Service (USFWS). 2005. Recovery Plan for the Tidewater Goby (*Eucyclogobius newberryi*). U.S. Fish and Wildlife Service, Portland, Oregon. vi + 199 pp.

PERSONAL COMMUNICATION

Mike Wallace – California Department of Fish and Game, Arcata, CA.

APPENDIX

Appendix A. Field sample proposal

2010 Tidewater Goby Investigations – North Coast Populations

In 2010, surveys for the tidewater goby are needed in several locations to determine the presence of these populations.

The Arcata Fish and Wildlife Office proposes to conduct field surveys for tidewater goby within the north coast recovery unit in selected areas. The field surveys will be conducted using the approved protocol for presence/absence survey for tidewater goby as published as Appendix F in the recovery plan. A combination of seining and dip-netting will be used to capture gobies. In a few cases, a beam trawl may also be used in deeper water. Any captures of tidewater goby will be recorded on field data forms, and captures at new sites will be photo-documented for species verification. Survey results will be stored in a digital database, and a report will be generated by the Arcata Fish and Wildlife Office.

Surveys are proposed to be conducted in the following water bodies for reasons identified with each location:

Water Body	Reason for Survey Needs
Eel River Estuary North	Surveys have only been conducted once (2004) – need to confirm status, survey other areas. Also relevant to restoration planning.
Eel River Estuary South (Salt River)	Short survey was conducted in 6 locations on May 4, 2010. Relevant to Salt River/River Ranch restoration project. Survey additional sites, if any exist, within project area. Survey ditch in northeast, above tidegate, to confirm if gobies are present and extent of their distribution. (Surveys will be conducted by the applicants or their consultants.)
Eel River Estuary Preserve	The Wildlands Conservancy is upgrading culverts, bridges, and tidegates on the property bought from Russ family. (Surveys will be conducted by the applicants or their consultants.)
Wood Creek	Surveys have only been conducted on two occasions, none since restoration took place.
Highway 101 Ditch	Surveys first detected gobies in 2004 – repeat surveys in 2006 showed absence. Current status unknown. Relevant to 101 corridor project.
Gannon Slough	Continued monitoring needed, especially in Campbell Creek above previously surveyed area. Trend is reduced numbers.
Jacoby Creek	Continued monitoring needed, due to sporadic presence during past surveys. One fish in May 2010 detected.
McDaniel Slough	Very little survey and documentation has occurred. Verification and extent of population needed, including in newly created restoration areas
Arcata Aquaculture Facility	Site has been documented recently. Future plans uncertain for the site.
Elk River	Only sampled on one occasion in 2006.
Mad River Slough - West shore	Survey of areas associated with restoration projects.

Palco Marsh	Surveyed in 2004 – no gobies found.

Relationships to Other Research

This sampling may include collection of up to 30 (depending on how many gobies appear to be present) nonlethal tissue samples per site for potential future genetic work. Tissue samples will be collected by fin clip of the posterior edge of the pelvic disc. Tissue will be placed in pre-labeled micro-centrifuge tubes with 90% ethanol or dried in filter paper and placed in labeled envelopes. Length of fish sampled will be recorded. Genetic research will help answer questions about tidewater goby movement and genetics between populations. The results should enable us to compare new samples to previous genetic analysis to see if there has been temporal and/or spatial change in genetics between and within populations. This data will assist the Service in restoration planning and recovery strategies, for Humboldt Bay and elsewhere, based on population and habitat connectivity.

Timeframe

Surveys would be conducted between July 2010 and September 30, 2010. A summary report of findings would be prepared by December 31, 2010.

Budget

	PP	Salary/PP	Subtotal/PP	
GS-11	1	2500	2500	(Oversight/publication)
GS-7	3	1601	4803	(Field sampling/oversight)
GS-5	3	1292	3876	(Field sampling/collect, preserve, genetic tissue)
GS-5	3	1292	3876	(Field sampling/Data entry)
			15055	total labor

Deliverables

A survey report identifying where gobies were located during the 2010 protocol surveys will be generated and will include accurate maps and figures as needed.

Appendix B. Proposal to explore genetics with vouchered tissue samples

CONSERVATION GENETICS OF THE FEDERALLY ENDANGERED TIDEWATER GOBY (EUCYCLOBIUS NEWBERRYI): TEMPORAL SAMPLING INSIGHTS INTO DRIFT AND MIGRATION

PRINCIPLE INVESTIGATOR: Dr. Andrew P. Kinziger
Department of Fisheries Biology
Humboldt State University
One Harpst Street
Arcata, CA 95521

AMOUNT REQUESTED: $76,519

ESTIMATED TIMELINE: Two Years

PROJECT SKETCH:

Our previous investigations of the federally endangered tidewater goby (*Eucyclogobius newberryi*) indicated artificially fragmented populations within Humboldt Bay exhibited higher genetic differentiation and lower genetic diversity relative to naturally fragmented populations and may suffer reduced fitness and adaptive potential (McCraney *et al.* 2010). It was unclear whether these patterns were the result of multidecadal isolation and lack of migration among geographically separated populations or if periodic recolonization of fragmented habitats combined with founder effects (e.g., metapopulation dynamics) were responsible. Determining which process is operating is key for conservation of tidewater goby because it will help guide management decisions. For example, translocations may be deemed unnecessary if metapopulation dynamics are evident at many locations.

We propose to evaluate the relative importance of isolation and metapopulation dynamics in Northcoast tidewater goby by analyzing a time series. The genetic structure described for tidewater goby in 2006 will be compared to collections from the identical sites from 2010, a time span equivalent to 5-6 generations. Stability in genetic structure would provide evidence for the importance of multidecadal isolation. In contrast, changes in genetic structure t would suggest a role for metapopulation dynamics. We suspect that both processes are likely ongoing and supporting a source and sink metapopulation dynamic.

REFERENCES:

McCraney, WT, Goldsmith G, Jacobs DK, Kinziger AP. 2010. Rampant drift in artificially fragmented populations of the endangered tidewater goby (*Eucyclogobius newberryi*). Molecular Ecology, 19, 3315-3327.