Supplemental Information for the Key Silverside

Biological Status Review Report

The following pages contain peer reviews received from selected peer reviewers, comments received during the public comment period, and the draft report that was reviewed before the final report was completed

March 31, 2011

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Peer review #1 from Dr. Chuck Getter

From: Chuck Getter
To: Imperiled
Subject: Re: Deadline reminder for peer reviews of BSR reports
Date: Friday, February 04, 2011 12:50:56 AM
Attachments: Getter,_Morkill,_&_Killam_Poster_Presentation_10-2010_vGettertoKillam[pdf1](2).pdf
Letter to Dr. Elsa Haubold.docx

Dear Elsa:

Sorry I am late with my review. Please find it attached.

Sincerely:

Chuck

February 3, 2011

Elsa M. Haubold, Ph.D.
Section Leader, Species Conservation Planning
Florida Fish & Wildlife Conservation Commission
620 South Meridian Street
Tallahassee, Florida 32399

Review of the Preliminary Biological Status Review of the Key Silverside

Dear Dr. Haubold:

Thank you for the opportunity to review the BSR for the key silverside. I used the same categories you did and addressed my review with regard to: (1) the completeness and accuracy of the biological information and data analyses in the BSR, and (2) the reasonableness and justifiability of the assumptions, interpretations of the data, and conclusions.

Taxonomic Classification – My conclusion based on BRS and this additional information- I agree that, "For the purposes of this biological status review, the key silverside is considered a distinct taxonomic unit." Anecdotally I would add that Yamahira and Conover (2002) attempted an experiment with this species to test a hypothesis that the warm temperatures of the keys created a phenotype with fewer vertebrae and a smaller, more compact shape. They were, however, unable to complete their experiment since when they attempted to lower specimens of the key silverside to 17°C, they showed poor hatching success. Conover shared with me in a personal communication that the fact that the specimens could not survive the lower temperatures and the preliminary genetic data for Menidia conchorum looked "pretty different" to him from Menidia peninsulae.

Population Size- Last year I revisited all of the 20 sites that I monitored for my dissertation work in the 1970's. Overall the ponds and lagoons of the lower Florida Keys are in two categories, first: those in developed areas, and second: those afforded some protection either in refuges, military lands, or in areas that are remote and undeveloped. I looked at all of the previous key silversides ponds noted by Getter (1981) and Conover (2000). There are developments in several of them including: one (Blue Hole on Big Pine) which is lost to an introduced species, another site (on southern Big Pine) has a housing development that has removed most (90%) of the habitat that was there in the 1960's, a third (Cudjoe Key) now has a landfill/transfer station on it, and a fourth (Cudjoe Key) has a large dredging operation in the pond.

Several other ponds (one on Boca Chica, another on Big Pine) have been breached by hurricanes since Conover's work (Hurricane Wilma) and/or flooded by increasing sea level and/or hurricanes and have other species of silversides, grouper and snapper invading them at the expense of the key silverside. Other ponds, such as ones on Cudjoe and Big Pine, have increased flushing, depth and water levels since the 1970's and the fish community assemblages appearing there today include more piscivorous fish species (snapper and grouper) that I didn't record in the 1970's.

In some areas where we performed catch and release quantitative sampling last year, we realized that the key silverside is patchy even where it exists and nowhere is it found uniformly in large numbers. Their numbers are not great even in areas where they are present. Literature reporting them as present throughout the lower Florida Keys ignores the rarity and rapid rate of development affecting appropriate ponds and lagoons, since in fact these ponds may occupy only a fraction (5% or less) of a key that they are recorded from. In earlier surveys Getter (1981) and Conover (2000) both reported the key silverside as not universally present in all ponds, but sporadic and ephemeral.

Sea Level Rise- Most notably, the BSR for the key silverside does not address issues regarding sea level rise and how that might imperil the species. In fact, the habitats of the key silverside include the "transitional" zone of the Nature Conservancy's projection of lost intertidal habitats and are in direct line to be inundated by as much as a meter of water in the next 89 years. In a recent paper (Getter *et al*. 2010 attached)) we predicted 89% loss of this transition zone, resulting in the loss of most of the habitat for residential pond/lagoon species, including the survival-threatened Key silverside, Menidia conchorum, Some scientists believe we are only decades away from the demise of the key silverside.

Much work is needed to manage this species, and although we have begun to do a lot of it, much work remains. I look forward to your future listing of the species as imperiled with extinction, in my opinion in the near future related to loss of its habitat due to sea level rise.

Sincerely:

Chuck Getter

Charles D. (Chuck) Getter, Ph.D.
Encl. Getter *et al.* 2010

Fishes of Transitional MarineHabitats of The Lower Florida Keys:

Projected Impact of Accelerated Sea Level Rise

Chuck Getter[2], Anne Morkill[1], and Kristie Killam[1]

1-Florida Keys National Wildlife Refuges, Big Pine Key, FL33043, 2-ImpactOfSeaLevelRise.org

Introduction

In 2007, high-resolution elevationdata was acquired to allow mapping of present dayand future shoreline locations based upon future sea rise scenarios in certain zones. One of the categories was called the “transition zone”. This habitat is the transitional area between marine and terrestrial conditions, at 50-80 cm elevation, and comprises 28% of Big Pine Key. (Bergh, 2007) The specific purpose of this study was to determine habitat preferences of fishes of the transition zone of the lower Florida Keys; to test for and then describe these preferences and then examine the predicted changes to these habitats due to sea level rise projections. .

Methods

From March 1977 toAugust 1978, twenty sites were visited bi-weekly which represent five transitional habitat types includingnear shore (5), tidal creeks (3), lagoons (6),ponds (3) and intermittent ponds (3). At each site ten one-hour surveys were made, either by diving (in greater than 1 m averagewater depth) or walking (in less than 1m averagewater depth). Sixty eight (68) taxa of fishes were identified and placed into a statistical data base foranalysis of parsimony (cladistics) to produce cladograms and phylograms that mathematicallydescribe community assemblages (Getter, 1981).

In January 2010 we revisited all 20 stations where we took photos, and surveyed by truck and kayak to ground truth the location of the stations against the locations of the “transition zone” of Bergh (2007). We tabulated data from this zone to project future loss of these ponds and lagoons using both a continuation of historical sea level rise and the most probable accelerated scenario.

Results

Figure 1 presents a cladogram for all fish species associated with the “transition zone” of the lower Florida Keys. Two distinct fish communities were identified in different habitats.

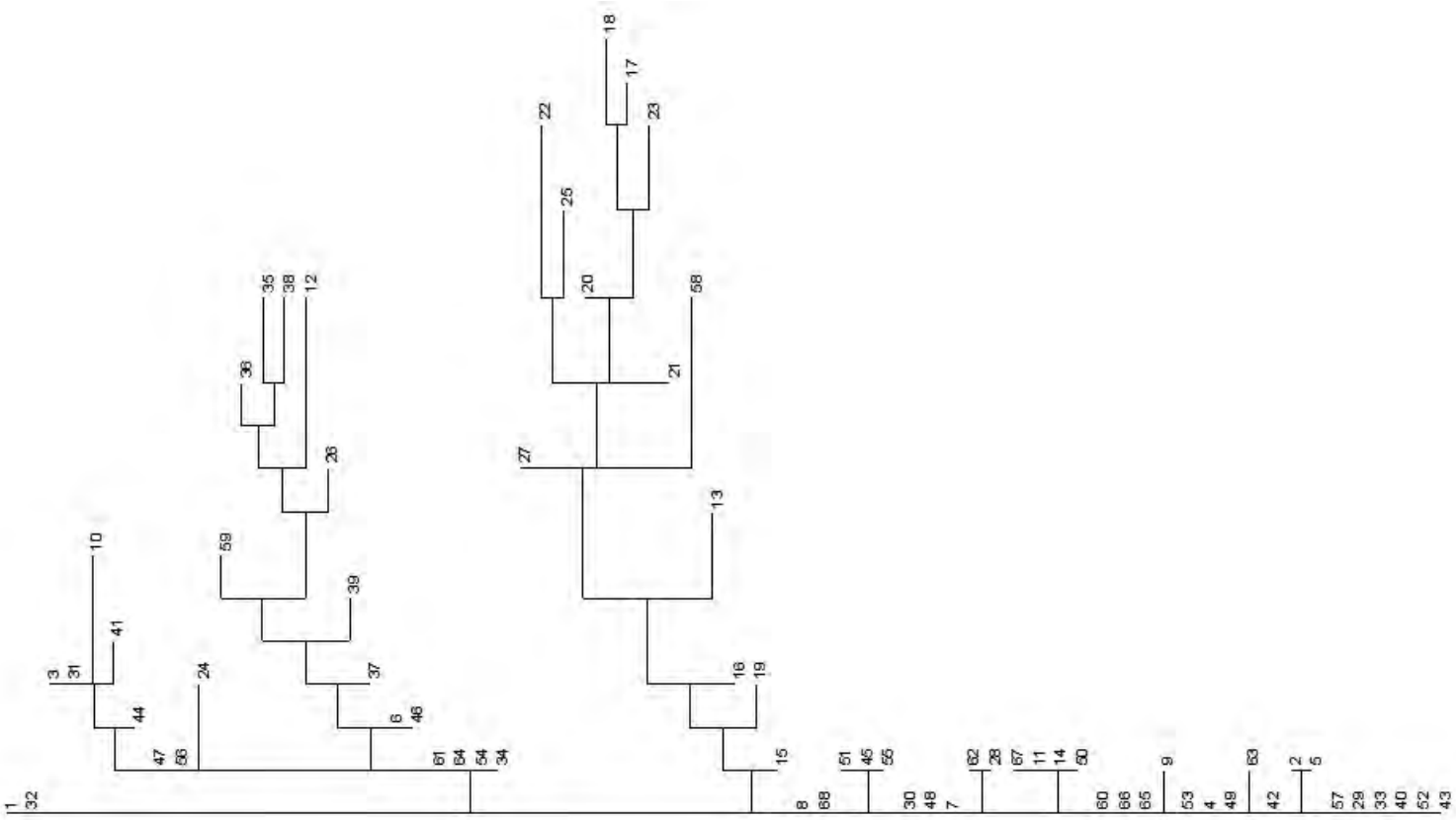
Figure 1. Cladistic phylogram of fishes associated with transitional habitats of the lower Florida Keys (using Heuristic SPR Fitch). Note the tall cluster which contains the following killifishes and silversides, characteristic ichthyofauna of more landlocked tidal lagoons and salt ponds in this location. Cyprinodontidae (killifishes): 17: Cyprinodon variegatus; 18: Floridichthys carpio; 20: Fundulus grandis; 21:Fundulus similis; 22: Lucania parva; 23: Gambusia affiinis; 25: Poecilia latipinna; Atherinidae (silversides): 27:Menidia conchorum.

The second cluster to the left are fishes of more well flushed and open tidallagoons, including Belonidae (needlefishes): 12: Strongylura sp. and Lutjanidae (snappers): 35: Lutjanus apodus; 36: Lutjanus griseus; and Gerreidae (mojarras): 37: Eucinostomus argenteus; 38:Eucinostomus gula; and 39: Gerres cinereus

These clusters are fishes of more well-flushed and open tidal lagoons and are found elsewhere, and appear to be invading more landlocked waters.

↓

This cluster contains 13 fish taxa that complete their life cycles in more landlocked tidal lagoons and salt ponds.↓



The Key silverside, *Menidia conchorum*, is an obligate of transitional ponds and lagoons of the lower Florida Keys. It is found nowhere else. Projections indicate 89% loss of this habitat by 2100.

Conclusions

There is a unique assemblage of residential (obligate) pond/lagoon fishes including the vulnerable keysilverside and six killifish species (tall cluster, figure 1) residing in the transition zone. Observations since the late 1970's indicate opportunists (left clusters)in morewell flushed lagoons, these include competitors and predators. Decreasing salinity increases invasion byadditional species, including predators (Figure 2).

Figure 2. Salinity (in log variance)plotted against number of species.

Table 1. This model of rising sea level predicts the loss of this transition zone, resulting in the loss of most of the habitat for residential pond/lagoon species, including the survival-threatenedKeysilverside, Menidia conchorum, by 2100 to 2163.

Table 1. Data from Bergh (2007). Actual historical data for mean sea level in Key West has been 2.24 millimeters/year with a 95% confidence interval of +/- 0.16 mm/yr based on monthly mean sea level data from 1913 to 2006 which is equivalent to a change of 0.73 feet in 100 years.

Historical levels only

Sea Level Rise (cm)	Loss Transitional Zone (%)	Year Projected
0	0	2007
18	18	2087
35	46	2163

Most probable sea level accelerated rise according to Ramsdorf (2007) is a meter in less than 90 years from now.

Sea Level Rise (cm)	Loss Transitional Zone (%)	Year Projected
0	0	2007
18	18	2024
35	46	2040
59	71	2062
100	89	2100

Literature Cited

Bergh, 2007. Initial estimates of the ecological and economic impacts of sea level rise on the Florida Keys through the year 2010. The Nature Conservancy. http://www.frrp.org/SLR%20documents/FINAL%20%20Aug%2021%20-WITH%20COVER.pdf

Getter, C.D. 1981. Ecologyand survival of the key silverside, Menidia conchorum, an atherinid fish endemic to the Florida keys. PhD Dissertation, Universityof Miami. 128p.

Rahmstorf, S. 2007. A semi-empirical approach to projecting futuresea-level rise. Science 19: Vol. 315. no. 5810, pp. 368 – 370

Peer review #2 from Dr. William Loftus

From: William Loftus
To: Imperiled
Cc: Bademan, Martha; Gruver, Brad; Grant Gilmore
Subject: Re: Key silverside Draft BSR Report
Date: Monday, January 31, 2011 11:29:12 AM

Dear Dr. Haubold:

As per your request, I have reviewed the BSR report prepared for *Menidia conchorum*. While working for the USGS office in Gainesville, FL, I obtained funding for the Conover survey of that species following Hurricane Georges in the Florida Keys. I served as contract representative for the project and joined the contractors in doing the field work. Thus, I am familiar with their findings which form, to my knowledge, the most recent field data on the status of this fish.

It is my assessment that the team that prepared the BSR for the Keys Silverside have accessed the available information for this species and reached a sound conclusion regarding the status of its systematics and its abundance. While additional research is needed to clarify its relation to *Menidia peninsulae*, it is reasonable to conclude that the Keys Silverside has been isolated in the Florida Keys for a period sufficient for the development of a morphologically distinct form, and is therefore worthy of designation as an Evolutionarily Significant Unit (ESU). Our work in the late 90's showed that the fish had disappeared from a few locations where it had previously occurred because of development. Because development continues in the Keys, and because the small number of localities at which the fish exists are vulnerable to natural and anthropogenic disturbances, I strongly support the classification of this fish as "threatened."

Thank you for the opportunity to review the information.

William F. Loftus, Ph.D.
Aquatic Research & Communication, LLC
5600 Dominica St.
Vero Beach, FL 32967

Peer review #3 from Calusa Horn

From: Calusa horn
To: Imperiled
Subject: Peer Review of Saltmarsh topminnow Draft BSR Report
Date: Thursday, January 27, 2011 1:00:03 PM
Attachments: calusa_horn.vcf

Comments of the Biological Status Review of the Key Silverside (Menidia conchorum).

The best available scientific information on Menidia conchorum was reviewed an accurately interpreted by the BSR. The BSRs conclusion and interpretation of best available scientific information, as well as, the application of that information using the IUCN Red List criteria appears to be accurate.

It may benefit the public to note the discrepancy between the category assigned to the Key silverside in the BSR (i.e., threatened) and the category assigned by the IUCN Red List (lower risk/near threatened). The difference in the listing categories (i.e., threatened vs. lower risk/near threatened) could be due to the fact that new information has become available on the species, which was not considered during the IUCN initial review and assignment of the lower risk category. However, because the BSR used the same criteria for categorizing this species as used by the IUCN the discrepancy in the listing categories may need to be discussed.

IUCN Red list assessment of Menidia conchorum is available at
http://www.iucnredlist.org/apps/redlist/details/13145/0

Thank you for the opportunity to review and provide comments

Copy of the Key silverside BSR draft report that was sent out for peer review

DRAFT Biological Status Review for the
Key Silverside
(*Menidia conchorum*)

EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) directed staff to evaluate all species listed as Threatened or Species of Special Concern as of September 1, 2010. Public information on the status of the Key silverside, *Menidia conchorum*, was sought from September 17 to November 1, 2010. The members of a biological review group (BRG) met on November 18-19. Group members were Martha Bademan (FWC lead), George Burgess (Florida Museum of Natural History), and Grant Gilmore (Estuarine, Coastal, and Ocean Science, Inc.). In accordance with rule 68A-27.0012, Florida Administrative Code (F.A.C.), the BRG was charged with evaluating the biological status of the Key silverside using criteria included in definitions in 68A-27.001(3) and following the protocols in the *Guidelines for Application of the IUCN Red List Criteria at Regional Levels (Version 3.0)* and *Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1)*. Please visit http://myfwc.com/docs/WildlifeHabitats/Imperiled_EndangeredThreatened_FinalRules.pdf to view the listing process rule and the criteria found in the definitions. The Key silverside BRGd found the Key silverside, *Menidia conchorum*, met the criteria for listing based upon the best scientific information available. FWC staff, therefore, recommends the Key silverside be listed as Threatened.

This work was supported by a Conserve Wildlife Tag grant from the Wildlife Foundation of Florida.

BIOLOGICAL INFORMATION

Life History References – Bloom et al. 2009, Conover et al. 2000, Duggins et al. 1986, Getter 1981, Gilbert 1978

Taxonomic Classification – The taxonomic status of the Key silverside (*Menidia conchorum*) is unclear. The Key silverside may be distinguished from other *Menidia* silversides by morphometric characteristics; however, these measures are not always reliable because of intra- and inter-specific morphological variations (Duggins et al. 1986, Conover et al. 2000). Allozyme and mitochondrial DNA analyses suggest that the Key silverside is not a distinct species, but an ecotype or subspecies of *M. peninsulae*, the tidewater silverside (Duggins et al. 1986, Bloom et al. 2009). For the purposes of this biological status review, Key silverside is considered a distinct taxonomic unit.

Population Status and Trend – The total number of Key silversides in Florida is unknown. Conover et al. (2000) found little evidence of a Key silverside population decline during a 1999 survey in which 2,680 specimens were collected. The Key silverside seems to be

abundant in the limited area where it occurs; however, local population numbers fluctuate (Gilbert 1978, Getter 1981, Conover 2000). Key silversides are believed to live up to one year (Getter 1981).

Geographic Range and Distribution – The Key silverside is endemic to the lower and middle Florida Keys. Key silversides have been documented in lagoons on Long Key, Grassy Key, Big Pine Key, No Name Key, Little Torch Key, Cudjoe Key, Sugarloaf Key, Saddle Bunch Key, Rockland Key, Boca Chica, and Key West. Conover et al. (2000) collected silversides on Key Largo and mainland Florida north of Key Largo that were identified as either Key silverside or tidewater silverside. Duggins et al. (1986) and Conover et al. (2000) hypothesized that the Key silverside also occurs at other sites in the Keys that are not accessible by road or easily sampled.

The Key silverside is generally found in protected, saline lagoons and ponds with restricted tidal exchange (Getter 1981, Conover 2000). However, the Key silverside is known to be tolerant of a wide range of salinities (Getter 1981).

Quantitative Analyses – We are not aware of a population viability analysis for the Key silverside.

BIOLOGICAL STATUS ASSESSMENT

Threats – Habitat loss and alteration is a major threat to the Key silverside. Several documented Key silverside habitat sites have been filled, destroyed, or altered by development (Gilbert 1978, Getter 1981, Duggins et al. 1986, Conover 2000). Because the lagoons and ponds occupied by Key silversides are limited, development or alteration of remaining habitat could be detrimental to Key silverside subpopulations. Conover et al (2000) predicted that as the protected lagoons inhabited by Key silversides are inundated and joined to open water, the Key silverside would be replaced by the hardhead silverside, *Atherinomorus stipes*. Getter (1981) also noted that a population of Key silversides disappeared from a pond on Big Pine Key following introduction of the blue gill, *Lepomis macrochirus*, and the appearance of external trematode parasites on the Key silversides.

Statewide Population Assessment – Findings from the BRG are included in the Biological Status Review Information table beginning on page four of this document.

LISTING RECOMMENDATION

Based on the finding of the Key silverside BRG and subsequent consultation with other FWC fish experts, staff recommends that the Key silverside (*Menidia conchorum*) be listed as a Threatened species because it met criteria for listing in accordance with rule 68A-27.0012, F.A.C.

SUMMARY OF THE INDEPENDENT REVIEW

LITERATURE CITED

Bloom D.D., K.R. Piller, J. Lyons, N. Mercado-Silva, M. Medina-Nava. 2009. Systematics and biogeography of the silverside tribe Menidiini (Teleostomi: Antherinopsidae) based on the mitochondrial ND2 gene. Copeia 2009:408-417.

Conover, D.O., S. Munch, T.E. Lankford Jr. 2000. Current status of the Key silverside, *Menidia conchorum*, in southern Florida. U.S. Geological Survey. http://sero.nmfs.noaa.gov/pr/SOC/Revised%20SOC%20webpage%202010/Key%20Silverside/Menidia%20conchorum%20FINAL-1.pdf Cited 19 Oct 2010.

Duggins, C.F., A.A. Karlin, K. Relyea, R.W. Yerger. 1986. Systematics of the Key silverside, *Menidia conchorum*, with comments on other *Menidia* species (Pisces: Antheridnidae). Tulane Studies in Zoology and Botany 25:133-150.

Getter, C.D. 1981. Ecology and survival of the key silverside, Menidia conchorum, an atherinid fish endemic to the Florida Keys. PhD dissertation, University of Miami, Miami, FL.

Gilbert, C.R. 1978. *Menidia conchorum*. In: Rare and Endangered Biota of Florida. P.C.H. Prichard, Series Editor. 4: Fishes. University Presses of Florida.

Biological Status Review Information
Findings

Species/taxon: Key silverside
Date: 11/18/10
Assessors: Martha Bademan, Grant Gilmore, George Burgess
Generation length: <1 year (Getter 1981)

Criterion/Listing Measure	Data/Information	Data Type*	Criterion Met?	References
*Data Types - observed (O), estimated (E), inferred (I), suspected (S), or projected (P). Criterion met - yes (Y) or no (N).				
(A) Population Size Reduction, ANY of				
(a)1. An observed, estimated, inferred or suspected population size reduction of at least 50% over the last 10 years or 3 generations, whichever is longer, where the causes of the reduction are clearly reversible and understood and ceased[1]	do not have sufficient information		N	
(a)2. An observed, estimated, inferred or suspected population size reduction of at least 30% over the last 10 years or 3 generations, whichever is longer, where the reduction or its causes may not have ceased or may not be understood or may not be reversible[1]	do not have sufficient information		N	
(a)3. A population size reduction of at least 30% projected or suspected to be met within the next 10 years or 3 generations, whichever is longer (up to a maximum of 100 years) [1]	do not have sufficient information		N	
(a)4. An observed, estimated, inferred, projected or suspected population size reduction of at least 30% over any 10 year or 3 generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased or may not be understood or may not be reversible.[1]	do not have sufficient information		N	
[1] based on (and specifying) any of the following: (a) direct observation; (b) an index of abundance appropriate to the taxon; (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat; (d) actual or potential levels of exploitation; (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.				
(B) Geographic Range, EITHER				
(b)1. Extent of occurrence < 20,000 km^2 (7,722 mi^2) OR	endemic semi-enclosed lagoons and ponds in lower and middle Keys - Approximate EOO is 400 square miles	inferred	Y	Getter 1981, Duggins 1986, Conover 2000
(b)2. Area of occupancy < 2,000 km^2 (772 mi^2)	endemic semi-enclosed lagoons and ponds in lower and middle Keys	inferred	Y	Getter 1981, Duggins 1986, Conover 2000
AND at least 2 of the following:				
a. Severely fragmented or exist in ≤ 10 locations	severely fragmented	estimated	Y	Getter 1981, Duggins 1986, Conover 2000

b. Continuing decline, observed, inferred or projected in any of the following: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent, and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals	loss of habitat, introduced species, decline in water quality	estimated	Y for iii	Getter 1981, Conover 2000
c. Extreme fluctuations in any of the following: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals	No - fluctuations, but not "extreme" by IUCN standards	estimated	N	Getter 1981
(C) Population Size and Trend				
Population size estimate to number fewer than 10,000 mature individuals AND EITHER	Abundant where it is found; >2600 sampled over six day period by Conover (2000)	estimated	N	Getter 1981, Duggins 1986, Conover 2000
(c)1. An estimated continuing decline of at least 10% in 10 years or 3 generations, whichever is longer (up to a maximum of 100 years in the future) OR			N/A	
(c)2. A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:			N/A	
a. Population structure in the form of EITHER			N/A	
(i) No subpopulation estimated to contain more than 1000 mature individuals; OR				
(ii) All mature individuals are in one subpopulation			N/A	
b. Extreme fluctuations in number of mature individuals			N/A	
(D) Population Very Small or Restricted, EITHER				
(d)1. Population estimated to number fewer than 1,000 mature individuals; OR	Abundant where it is found; Conover (2000) captured >2600 over 6 days	estimated	N	Getter 1981, Conover 2000
(d)2. Population with a very restricted area of occupancy (typically less than 20 km^2 [8 mi^2]) or number of locations (typically 5 or fewer) such that it is prone to the effects of human activities or stochastic events within a short time period in an uncertain future	AOO is greater than 8 sq mi; more than 10 locations	estimated	N	Getter 1981, Duggins 1986, Conover 2000
(E) Quantitative Analyses				
e1. Showing the probability of extinction in the wild is at least 10% within 100 years	no quantitative analysis		N/A	

Initial Finding (Meets at least one of the criteria OR Does not meet any of the criteria)	Reason (which criteria are met)
meets criteria for listing	B: b(1), b(2) + a, b(iii)
Is species/taxon endemic to Florida? (Y/N)	Yes
If Yes, your initial finding is your final finding. Copy the initial finding and reason to the final finding space below. If No, complete the regional assessment sheet and copy the final finding from that sheet to the space below.	
Final Finding (Meets at least one of the criteria OR Does not meet any of the criteria)	Reason (which criteria are met)
meets criteria for listing	B: b(1), b(2) + a, b(iii)

Additional BRP comments: The available genetic studies are inadequate for determining the taxonomic status of the Key silverside. Detailed study of the Florida populations of *Menidia peninsulae* and *M. conchorum* are needed to determine if they are separate species and to understand the continuity of variation throughout their range. If the Key silverside is actually a subspecies or population of *M. peninsulae*, is the Key silverside variation extreme or are there other distinct populations of *M. peninsulae* throughout their range? Clinal variation is common for *Menidia* silversides. Distribution and evolutionary processes are similarly shown in other related forms (*Fundulus*, Killifishes, sheepshead minnow); there may be populations of other species that will be worthy of listing review in the future.

Appendix 1: Biological Review Group Members' Biographies

Martha Bademan has a B.S. in biology from Wake Forest University and a M.S. in marine biology from Florida Institute of Technology. She has worked in the FWC's Division of Marine Fisheries Management, Analysis and Rulemaking Subsection since 2008. As an Environmental Specialist, she has analyzed fishery information for the management of several of Florida's recreational, commercial, and ornamental fish and invertebrate species.

George Burgess is Director of the Florida Program for Shark Research at the Florida Museum of Natural History, Gainesville. He is a specialist in fisheries conservation, ecology, and biogeography, with a particular focus on icthyofauna of South Florida. Mr. Burgess earned his MS at the University of Florida, and has numerous peer-reviewed publications to his credit. George also manages the National Sawfish Encounter database.

R. Grant Gilmore received his Ph.D., from the Florida Institute of Technology in 1988. Dr. Gilmore is a Senior Scientist with Estuarine, Coastal and Ocean Science, Inc., (ECOS). Dr. Gilmore founded ECOS in 2004 after spending 32 years with the Harbor Branch Oceanographic Institution, Fort Pierce, Florida and Dynamac Corp. at the Kennedy Space Center. Dr. Gilmore has been studying the fish community and ecology of Florida and Caribbean Sea for the past 35 years and has published over 70 technical and popular papers on fish ecology and life history including reproductive habits of spotted seatrout, snook, groupers, and sharks.

Appendix 2: Summary of Public Comment

No information about this species was received during the public information request period.

APPENDIX 3. **Information and comments received from independent reviewers.**