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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[Docket No. 130312237-5115-01]

RIN 0648-XC567

Endangered and Threatened Wildlife; 90-Day Finding on a Petition to List Yellowtail Damselfish as Threatened or Endangered Under the Endangered Species Act

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce.

ACTION: Notice of 90-day petition finding.

SUMMARY: We (NMFS) announce a 90-day finding on a petition to list yellowtail damselfish (Microspathodon chrysurus) as threatened or endangered under the Endangered Species Act (ESA). We find that the petition does not present substantial scientific or commercial information indicating that the petitioned action may be warranted.

ADDRESSES: Copies of the petitions and related materials are available upon request from the Assistant Regional Administrator, Protected Resources Division, Southeast Regional Office, NMFS, 263 13th Avenue South, St. Petersburg, FL 33701, or online at: http://sero.nmfs.noaa.gov/pr/ListingPetitions.htm.

FOR FURTHER INFORMATION CONTACT: Jason Rueter, NMFS Southeast Region, 727-824-5312.

SUPPLEMENTARY INFORMATION:

Background

On September 14, 2012, we received a petition from the Center for Biological Diversity (CBD) to list eight reef fishes of the family Pomacentridae as threatened or endangered under the ESA. The eight species are orange clownfish (Amphiprion percula), black-axil chromis (Chromis atripectoralis), blue-green damselfish (Chromis viridis), Hawaiin dascyllus (Dascyllus albisella), reticulated damselfish (Dascyllus reticulatus), yellowtail damselfish or jewelfish (Microspathodon chrysurus), blackbar devil or Dick's damselfish (Plectroglyphidodon dickii), and blue-eyed damselfish (Plectroglyphidodon johnstonianus). The petition is available on our website (http://www.nmfs.noaa.gov/pr/species/petitions/pomacentrid_reef_fish_petition_2012.pdf). Given the geographic range of these species, we divided the lead for the response to the petition between our Southeast Regional Office (SERO) and our Pacific Islands Regional Office (PIRO). SERO led the response to the petition to list the yellowtail damselfish (Microspathodon chrysurus) in this finding; PIRO led the response for the remaining species separately and published a 90-day finding on those species on September 3, 2014 (79 FR 52276).

ESA Statutory and Regulatory Provisions and Evaluation Framework

Section 4(b)(3)(A) of the ESA of 1973, as amended (U.S.C. 1531 et seq.), requires, to the maximum extent practicable, that within 90 days of receipt of a petition to list a species as threatened or endangered, the Secretary of Commerce make a finding on whether that petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted, and to promptly publish such finding in the Federal Register (16 U.S.C. 1533(b)(3)(A)). When we find that substantial scientific or commercial information in a petition indicates the petitioned action may be warranted (a "positive 90-day finding"), we are required to promptly commence a review of the status of the species concerned, during which we will conduct a comprehensive review of the best available scientific and commercial information. In such cases, we are to conclude the review with a finding as to whether, in fact, the petitioned action is warranted within 12 months of receipt of the petition. Because the finding at the 12-month stage is based on a more thorough review of the available information, as compared to the narrow scope of review at the 90-day stage, a "may be warranted" finding at the 90-day stage does not prejudge the outcome of the status review.

Under the ESA, a listing determination may address a "species," which is defined to also include subspecies and, for any vertebrate species, any distinct population segment (DPS) that interbreeds when mature (16 U.S.C. 1532(16)). A species, subspecies, or DPS is "endangered" if it is in danger of extinction throughout all or a significant portion of its range, and "threatened" if it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (ESA sections 3(6) and 3(20), respectively; 16 U.S.C. 1532(6) and (20)). Pursuant to the ESA and our implementing regulations, we determine whether species are threatened or endangered because of any one or a combination of the following five section 4(a)(1) factors: the present or threatened destruction, modification, or curtailment of habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation; inadequacy of existing regulatory mechanisms; and any other natural or manmade factors affecting the species' existence (16 U.S.C. 1533(a)(1), 50 CFR 424.11(c)).

ESA-implementing regulations issued jointly by NMFS and USFWS (50 CFR 424.14(b)) define "substantial information" in the context of reviewing a petition to list, delist, or reclassify a species as the amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted. In evaluating whether substantial information is contained in a petition, the Secretary must consider whether the petition: (1)

Clearly indicates the administrative measure recommended and gives the scientific and any common name of the species involved; (2) contains a detailed narrative justification for the recommended measure, describing, based on available information, past and present numbers and distribution of the species involved and any threats faced by the species; (3) provides information regarding the status of the species over all or a significant portion of its range; and (4) is accompanied by the appropriate supporting documentation in the form of bibliographic references, reprints of pertinent publications, copies of reports or letters from authorities, and maps (50 CFR 424.14(b)(2)).

Court decisions clarify the appropriate scope and limitations of the Services' review of petitions at the 90-day finding stage to make a determination whether a petitioned action "may be" warranted. As a general matter, these decisions hold that a petition need not establish a "strong likelihood" or a "high probability" that a species is either threatened or endangered to support a positive 90-day finding.

We evaluate the petitioner's request based upon the information in the petition, including its references, and the information readily available in our files. We do not conduct additional research, and we do not solicit information from parties outside the agency to help us in evaluating the petition. We will accept the petitioner's sources and characterizations of the information presented, if they appear to be based on accepted scientific principles, unless we have specific information in our files that indicates the petition's information is incorrect, unreliable, obsolete, or otherwise irrelevant to the requested action. Information that is susceptible to more than one interpretation or that is contradicted by other available information will not be dismissed at the 90-day finding stage, so long as it is reliable and a reasonable person would conclude it supports the petitioner's assertions. In other words, conclusive information indicating the species may meet the ESA's requirements for listing is not required to make a positive 90-day finding. We will not conclude that a lack of specific information alone negates a positive 90-day finding, if a reasonable person would conclude that the unknown information itself suggests an extinction risk of concern for the species at issue.

To make a 90-day finding on a petition to list a species, we evaluate whether the petition presents substantial scientific or commercial information indicating the subject species may be either threatened or endangered, as defined by the ESA. First, we evaluate whether the information presented in the petition, along with the information readily available in our files, indicates that the petitioned entity constitutes a "species" eligible for listing under the ESA. Next, we evaluate whether the information indicates that the species at issue faces extinction risk that is cause for concern; this may be indicated in information expressly discussing the species' status and trends, or in information describing impacts and threats to the species. We evaluate any information on specific demographic factors pertinent to evaluating extinction risk for the species at issue (e.g., population abundance and trends, productivity, spatial structure, age structure, sex ratio, diversity, current and historical range, or habitat integrity), and the potential contribution of identified demographic risks to extinction risk for the species. We then evaluate the potential links between these demographic risks and the causative impacts and threats identified in section 4(a)(1).

Information presented on impacts or threats should be such that it reasonably suggests that one or more of these factors may be operative threats that act, or have acted, on the petitioned species to the point that it may warrant protection under the ESA. Broad statements about generalized threats to the species, or identification of factors that could negatively impact a species, do not constitute substantial information that listing may be warranted. We look for information indicating that not only is the particular species exposed to a factor, but that the species may be responding in a negative fashion; then we assess the potential significance of that negative response.

Many petitions identify risk classifications made by other organizations or agencies, such as the International Union on the Conservation of Nature (IUCN), the American Fisheries Society (AFS), or NatureServe, as evidence of extinction risk for a species. Risk classifications by other organizations or made under other federal or state statutes may be informative, but the classification alone may not provide the rationale for a positive 90-day finding under the ESA. For example, as explained by NatureServe, their assessments of a species' conservation status do "not constitute a recommendation by NatureServe for listing under the U.S. Endangered Species Act" because NatureServe assessments "have different criteria, evidence requirements, purposes and taxonomic coverage than government lists of endangered and threatened species, and therefore these two types of lists should not be expected to coincide" (http://www.natureserve.org/prodServices/statusAssessment.jsp). Thus, when a petition cites such classifications, we will evaluate the source information that the classification is based upon, in light of the standards on extinction risk and impacts or threats discussed above.

Species Description

The yellowtail damselfish is a reef fish (Family Pomacentridae) that inhabits shallow coral reefs usually at depths between 1-10 m (depth range can be up to 120 m; Loris and Rucabado, 1990) in the western Atlantic Ocean including Bermuda, southern Florida, and the Caribbean Sea (Allen, 1991), south to Brazil (Moura et al., 1999), and also including the Gulf of Mexico (Bohlke and Chaplin, 1993). Yellowtail damselfish occupy non-overlapping, often contiguous territories on solid substrata averaging 44 m^2 in size (range 14–109 m^2, n= 22; P.

Sikkel, unpublished data) in which they feed on epilithic microalgae (algae growing on rock) and associated microfauna (Bohlke and Chaplin, 1968; Sikkel and Kramer, 2006). Adults are primarily algae-eaters (Robins et al., 1986), feeding on microalgae, epiphytic (growing on a plant) diatoms, and to a lesser extent live coral, and are therefore known as facultative corallivores (Cole et al., 2008). Adults of both sexes are solitary and they aggressively defend their territories against conspecifics and other species to a lesser extent (Sikkel and Kramer, 2006). The territories of females tend to be shallower and closer to shore than those of males (Sikkel and Kramer, 2006).

Yellowtail damselfish spawning peaks for four to five weeks in February to March and again in July to August (Deloach, 1999). Spawning occurs during the first 1-3 hours of daylight (Sikkel and Kramer, 2006) at regular 3-day intervals from 3 days before to 3 weeks after the full moon (Pressley, 1980; Robertson et al., 1990). Females can travel up to 120 m from their territory to find mates (Sikkel and Kramer, 2006). Females lay their entire clutch within the male territory during a spawning event and will often mate with the same male over successive spawning trips (Sikkel and Kramer, 2006). Male damselfish prepare nests within their territories, frequently in coral rubble, and protect the eggs (Pressley, 1980). Embryos hatch approximately five days after fertilization (Pressley, 1980), and larvae enter a 21 to 27 day pelagic phase. They then tend to settle on shallow patch reefs, often inhabited by Millepora (fire coral), which Deloach (1999) states makes up much of the early diet, and Acropora species rubble habitats (Wilkes et al., 2008).

Analysis of the Petition

We evaluated whether the petition presented the information required in 50 CFR 424.14(b)(2) and found that the petition contains the species' taxonomic description, current geographic distribution, habitat characteristics, and threats that could be affecting it. The petition does not present any information on past or present population numbers, instead it acknowledges that abundance and population trends are unknown for the petitioned species, but suggests that the decrease in average live coral cover across the Caribbean from 50 to 60 percent coverage in the 1970s to 8 percent coverage today suggests reasons for concern. The petition does not provide information regarding the status of yellowtail damselfish over all or a significant portion of its range, other than a discussion of threats. The petition includes supporting references.

The petition states that yellowtail damselfish are vulnerable to coral habitat loss and degradation due to temperature-induced coral bleaching and ocean acidification, and that this vulnerability is heightened given their reliance on live branching corals such as species of Millepora and Acropora. The petition states yellowtail damselfish are threatened by ocean warming and ocean acidification that directly impairs its sensory capabilities, behavior, aerobic capacity, swimming ability, and reproduction. The petition also states that the global marine aquarium trade and lack of regulatory mechanisms further threaten yellowtail damselfish by decreasing their populations in the wild.

Information on Population Status, Trends and Demographics Relevant to Extinction Risk

As stated above, the petition does not include any information on past or present population numbers, and it acknowledges that abundance and population trends are unknown. The petition does not provide information regarding the status of yellowtail damselfish over all or a significant portion of its range, although one of the references cited describes the species as "common on shallow reefs in the tropical Western Atlantic," occurring at densities of up to four individuals per 100 m^2 in the Barbados (Sikkel and Kramer, 2006). The petition does not identify any risk classifications by other organizations for this species.

There is some information in our files on population status and trends for this species in the Florida Keys. We have data on the abundance of yellowtail damselfish from our Southeast Fisheries Science Center's (SEFSC) Reef fish Visual Census (RVC). The RVC is a long-term, spatially-extensive survey that has assessed trends in abundance of reef fishes in the Florida Keys, by collection of standardized data on trends in frequency of occurrence and density. The RVC survey includes data from 1980 through 2012 for the forereef, high relief spur and groove habitats, the preferred habitat zone for yellowtail damselfish (NMFS SEFSC, 2014). These data show yellowtail damselfish abundance declined during the 1980's but stabilized in the 1990's with no apparent trends through 2012. The RVC data recorded yellowtail damselfish in 93 percent of samples (annual average) in the 1980's. Since 1991, the frequency of occurrence has averaged around 79 percent, with no apparent trend. Similarly, the density of fish, when present, averaged 5 fish per standardized sample in the 1980's, and since 1991, the average annual density when present has been 2.7 fish per standardized sample, with no apparent trend (NMFS SEFSC, 2014). The observed decline in yellowtail damselfish frequency and density between the 1980's and the subsequent period of 1991 - 2012 in these data are correlated with the documented widespread loss of coral habitat that occurred during the 1980's, as noted in the petition. These data also indicate that since the initial decline, the long term trend in yellowtail damselfish frequency and density over 22 years of data collection has remained stable. We interpret these data as indicating a population that has demonstrated long term stability, despite significant habitat changes and a one-time population decline. Thus, we do not believe the available information on population status and trends suggest an extinction risk of concern for the species.

Information on Impacts and Threats to the Species

We also evaluated whether the information in the petition and information in our files concerning the extent and severity of one or more of the ESA section 4(a)(1) factors suggest these impacts and threats may be operative threats that act or have acted on the species, posing a risk of extinction for yellowtail damselfish that is cause for concern. As stated above in the petition analysis section, the petition states that four of the five causal factors in section 4(a)(1) of the ESA are adversely affecting the continued existence of yellowtail damselfish: (A) Present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial and recreational purposes; (D) inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. In the following sections, we assess the information presented in the petition and readily available in our files to determine whether the petitioned action may be warranted.

Present and Threatened Destruction, Modification, or Curtailment of Habitat or Range

The petition states that yellowtail damselfish are "dependent on live coral for shelter, reproduction, recruitment, and/or food, which makes them highly vulnerable to coral habitat loss and degradation due to ocean warming and ocean acidification and they are habitat specialists that rely on branching corals which are particularly susceptible to bleaching." First we will evaluate the petition's arguments that dependency of the yellowtail damselfish on certain species of live corals is a source of extinction risk, and then we will evaluate the arguments that climate change impacts to the species' habitat pose extinction risk that is cause for concern.

<u>Dependency on Branching Coral Species</u>

The petition cites several studies in support of the argument that the yellowtail damselfish specializes on, or relies upon, branching corals such as <u>Millepora</u> and <u>Acropora</u> species. The petition cites Allen (1991) for the proposition that juvenile yellowtail damselfish "are usually seen among branches of the yellow stinging coral Millepora." Deloach (1999) is cited for an association between juveniles and blade fire coral, M. complanata. Deloach (1999) is also cited as finding that Millepora makes up much of the early diet of yellowtail damselfish. The website www.species-identification.org is similarly cited for the statement that yellowtail damselfish are known to feed on the polyps of Millepora corals, though as the petition notes from another citation, this species is considered a facultative and not an obligate corallivore (Cole et al., 2008). Regardless of the importance as food or habitat to yellowtail damselfish, the petition does not present information that suggests Millepora corals have been affected by the numerous threats other corals face, thus we assume their role in the yellowtail damselfish's life cycle is unchanged. Additionally, Brainard et al. (2011), state "Millepora are among the first to bleach and die, but they seem to have a special aptitude for recovering by recruiting new colonies." Further, Veron (2000) describes Millepora species as "common on reefs." Therefore, we do not find population trends of Millepora pose an extinction risk that is cause for concern for yellowtail damselfish.

We also reviewed the information in the petition regarding the association between adult yellowtail damselfish and elkhorn coral. The petition cites Deloach (1999) in describing habitat use by yellowtail damselfish. In Deloach (1999), we found the statement "[l]arge females reign over widespread territories of varying sizes on reef crests, while males typically occupy deeper zones of Elkhorn rubble." This was the only information presented in the citation relative to elkhorn coral, but it does not indicate yellowtail damselfish specialize on, or rely upon, branching coral.

The petition also cites Tolimieri (1998) as a source for the premise that yellowtail damselfish are "significantly associated with Acropora corals and total live coral cover."

Tolimieri (1998), investigated microhabitat substrate use by several damselfish species on the Tague Bay Reef, St. Croix, United States Virgin Islands. This study evaluated use of Porites spp., Porites spp. rubble, Montastrea spp., Montastrea spp. rubble, Acropora spp. rubble, total live coral, boulder (unidentified coral) rubble, algae, and pavement/sand substrates. The author found that yellowtail damselfish were associated more than would be expected by random chance with dead Acropora palmata rubble, but not with live coral cover or the only live branching coral in the study area - Porites porites. The association between yellowtail damselfish and Acropora spp. coral rubble was statistically significant ($p = 0.043$), but only explained 32 percent of the variation in abundance of yellowtail damselfish between the various study sites on this reef.

The petition presents Wilkes et al. (2008) for an association of adult yellowtail damselfish with live branching staghorn coral in the Dry Tortugas, Florida. Wilkes et al. (2008) described their study objective as determining what effect, if any, on damselfish could be discerned from much of the live staghorn coral in Dry Tortugas National Park having been reduced to rubble by extreme cold snaps and disease. Wilkes et al. (2008) compared damselfish densities on the largest remaining live staghorn coral formation and nearby staghorn coral rubble habitat, but did not directly investigate damselfish use of any other habitat types in the park. This study found that the density of adult yellowtail damselfish was greater at sites with live staghorn coral compared to nearby sites comprised of dead and broken staghorn coral rubble. There was no significant difference in density of juvenile yellowtail damselfish between the two sites. These authors suggest that "complex reef topography of branching corals like Acropora are thought to be a major factor affecting reef fish distribution and abundance" and that the higher adult densities observed in this study "may be related to the increase in three-dimensional habitat that would provide predator refuge dimensions more conducive to adult body sizes that require larger shelter spaces." The authors conclude that "reductions in damselfish density are the likely outcome in reefs where expanses of live branching coral are in decline and are being replaced by relatively low-dimensional fields of reef rubble." Finally, Wilkes et al. (2008) note that "some damselfish species may require the habitat complexity provided by branching corals, whereas others are better suited to exploit a wide range of habitat types and display no specific coral preference." However, the authors make no conclusion about yellowtail damselfish and their habitat usage, though they do note another study (Wallman et al., 2006) that found that patch reefs lacking in live branching corals within Dry Tortugas National Park support populations of adult yellowtail damselfish.

In our files we also have available Waldner and Robertson (1980) that considers patterns of spatial distribution and resource partitioning in damselfish to explain how ecologically similar reef fishes can co-exist on various spatial scales. Field surveys recorded yellowtail damselfish in Puerto Rico between 1976 and 1978 at both inshore and offshore reefs and recorded substrate within 15 cm (5.9 inches) of where the species was observed or the substrate where the fish sought refuge when rapidly approached by a diver. A total of 54 adult yellowtail damselfish were reported on 4 out of 6 substrate types: 48 percent of observations were associated with non-branching massive corals such as Montastraea annularis, 24 percent of the observations were associated each with elkhorn (A. palmata) and staghorn (A. cervicornis) coral, and 4 percent were associated with Millepora spp. When the amount of the different substrate types within the transect area was considered, elkhorn coral was found to be a most-used substrate. Waldner and Robertson (1980) then compared their results with the results of other studies that occurred throughout the West Indies in the 1970's and concluded their results were in agreement in most cases that adult yellowtail damselfish were most characteristically associated with elkhorn coral and Millepora in very shallow to moderate depth range.

Prior to the 1980's, Acropora corals were the overwhelmingly dominant reef-building coral on Caribbean reefs, to the extent that depth zones were named after these species ("elkhorn zone," "staghorn zone") (Goreau, 1959). Given the dominance of these corals, it is reasonable to expect that yellowtail damselfish and many other reef fishes were found associated with acroporids then as well. For example, Waldner and Robertson (1980) found a significant association between yellowtail damselfish and elkhorn corals in the 1970's. During the 1980's, a massive die-off of Acropora species occurred in the Caribbean. The decline in Acropora species was greater than 90 percent (Ginsburg, 1994; Hughes, 1994; McClanahan and Muthiga, 1998). As the SEFSC RVC data indicate, yellowtail damselfish abundance declined in fore-reef, spur and groove habitats in the Florida Keys in the 1980's. The initial decline in yellowtail damselfish abundance is likely linked to the widespread die-off of corals. However, the yellowtail damselfish population has remained stable since 1991. Although the Florida Keys population is at a lower level than it was in the 1970's and 1980's, the stability in abundance indicates that it is not so low that depensatory processes, such as declining mate-finding ability or escalating risk of predation, are an extinction risk factor. Therefore, we conclude that the yellowtail damselfish is not dependent on acroporid corals to the extent that the decline of Acropora habitat presents an extinction risk that is cause for concern.

In summary, we acknowledge that yellowtail damselfish was historically associated with Acropora corals in the Caribbean (Waldner and Robertson, 1980), and exhibited a population decline in habitats dominated by Acropora concurrent with the massive die-off of corals in the 1980s. However, the available information demonstrates yellowtail damselfish associate with a variety of coral species and habitats (Tolimieri, 1998; Wilkes et al, 2008) within the coral-reef ecosystem (e.g., branching, boulder, and dead rubble), and appear in at least one instance (Florida Keys) to have inhabited reef areas at stable population levels for over 20 years after the widespread decline of acroporids. Therefore, the loss of the branching elkhorn and staghorn corals does not constitute an extinction risk for the yellowtail damselfish that is a cause for concern.

Climate Change Impacts to Coral Reef Ecosystems Generally as a Threat to Yellowtail Damselfish

The petition discusses at length climate change impacts to corals and coral reefs and future predictions for worsening impacts to corals at a global scale, and argues that these impacts pose extinction risk to yellowtail damselfish through destruction, modification or curtailment of its habitat. As discussed above, while the petition establishes an association with live branching coral species for yellowtail damselfish, we have established that they also associate with other coral species and forms within the coral-reef ecosystem and are not reliant upon branching corals for habitat.

Many of the references provided in the petition offer global predictions on future rises in sea surface temperature (Donner et al., 2005; Donner, 2009), ocean acidity (Hoegh-Guldberg et al., 2007), or coral reef decline in general (Hoegh-Guldberg, 1999; Veron et al., 2009). Emission rates of greenhouse gases (GHG) associated with ocean warming have in recent years met or exceeded levels found in the worst-case scenarios considered by the Intergovernmental Panel on Climate Change (IPCC), resulting in all scenarios underestimating the projected future climate condition. New information suggests that regardless of the emission concentration pathway, more than 97 percent of reefs will experience severe thermal stress by 2050 (Meissner et al., 2012). At the same time new information also highlights the spatial and temporal "patchiness" of warming (79 FR 53851; September 10, 2014). This patchiness moderates vulnerability of corals to extinction because most species are not limited to one habitat type but occur in numerous types of reef environments that are predicted, on local and regional scales, to experience variable thermal regimes and ocean chemistry at any given point in time (79 FR 53851; September 10, 2014). Overall, there is ample evidence that climate change (including that which is already committed to occur from past GHG emissions and future emissions reasonably certain to occur) and will lead to a worsening environment for corals.

If many coral species are to survive anticipated global warming, corals and their zooxanthellae will have to undergo significant acclimatization and/or adaptation. There has been a recent research emphasis on the processes of acclimatization and adaptation in corals. For example, the results of a study funded by NOAA and conducted by the agency's scientists and its academic partners suggests some coral species may be able to adapt to moderate climate warming, improving their chance of surviving through the end of this century, if there are large reductions in carbon dioxide emissions (Logan et al, 2013). Results of this study further suggest some corals have already adapted to part of the warming that has occurred in the past. The study modeled a range of possible coral adaptive responses to thermal stress, and projected that, through processes such as genetic adaptation, acclimation, and symbiont shuffling, the reefs could reduce the rate of temperature-induced bleaching by 20 to 80 percent of levels currently projected to occur by the year 2100, if there are large reductions in carbon dioxide emissions. The authors emphasize the caveat that coral adaptation will not significantly slow the loss of coral reefs if there is no decrease in GHG emissions and further, that not all species will be able to adapt fast enough or to the same extent.

Thus, as a whole, the body of research on coral adaptation to global warming is inconclusive on how these processes may affect particular coral species' extinction risk, given the projected intensity and rate of ocean warming (Brainard et al., 2011).

Similarly, because of the increase in carbon dioxide and other GHGs in the atmosphere since the industrial revolution, ocean acidification has already occurred throughout the world's oceans, including in the Caribbean, and is predicted to considerably worsen between now and 2100. Overall, available information demonstrates that most corals exhibit declining calcification rates with rising carbon dioxide concentrations, declining pH, and declining carbonate saturation state – although the rate and mode of decline can vary among species (79 FR 53851; September 10, 2014). Spatially, while carbon dioxide levels in the surface waters of the ocean are generally in equilibrium with the lower atmosphere, there can be considerable spatial variability in seawater pH across reef-building coral habitats, resulting in colonies of a species experiencing high spatial variability in exposure to ocean acidification (79 FR 53851; September 10, 2014).

As we have discussed elsewhere (79 FR 53851; September 10, 2014), vulnerability of a coral species to a threat is a function of susceptibility and exposure, considered at the appropriate spatial and temporal scales. Susceptibility of a coral species to a threat is primarily a function of biological processes and characteristics, and can vary greatly between and within taxa (i.e., family, genus, or species). Susceptibility depends on direct effects of the threat on the species, and it also depends on the cumulative (i.e., additive) and interactive (i.e., synergistic or antagonistic) effects of multiple threats acting simultaneously on the species. For example, ocean warming affects coral colonies through the direct effect of bleaching, together with the interactive effect of bleaching and disease, because bleaching increases disease susceptibility.

Vulnerability of a coral species to a threat also depends on the proportion of colonies and populations that are exposed to the threat. Exposure is primarily a function of the distribution of the threat. The degree or intensity of exposure to a threat is primarily a function of physical processes and characteristics that limit or moderate the intensity of the threat across the range of the species. In our final listing rule responding to a petition to list 83 species of corals, we found that not all coral species are highly vulnerable to the threats associated with global climate change (79 FR 53851; September 10, 2014). Even some species found to be susceptible to ocean warming were found not warranted for listing because they may have a buffering capacity to resist adverse effects on their status, due to high abundance, wide range, and/or high habitat heterogeneity.

With information indicating yellowtail damselfish associate with a variety of coral habitats, and because susceptibility of coral species to climate change impacts is highly variable, we cannot infer any level of extinction risk from habitat loss due to climate change for yellowtail damselfish. Further, in a review of six studies examining the effects of coral bleaching on coral-reef fishes, Pratchett et al. (2008) found the density of 45 of 116 fish species' showed significant changes 1-3 years post-bleaching. The responses ranged from local extinction to several-fold increases in abundance. Though the damselfishes included in their study showed mixed results, Pratchett et al. (2008) found "fishes that increased in abundance were mostly dietary and habitat generalist species," but some herbivores also showed increases. Thus, we do not view this study as providing any reliable prediction of yellowtail damselfish responses to coral bleaching. The petition also cites Bonin (2012) for effects of coral bleaching on damselfish. The paper concludes that as a result of coral mortality from bleaching, "[fish] specialists will increasingly be forced to use alternative recruitment habitats, and that is likely to reduce population replenishment." As noted above, however, yellowtail damselfish is not a specialist on any particular coral species. Bonin (2012) further states that the "available evidence suggests that the presence of conspecifics provides a stronger cue for settlement than does microhabitat (Booth, 1992; Lecchini et al., 2005a; 2005b)." Thus, the presence of established individuals of the same fish species was more important for settling recruits than was habitat in that study. A third study cited by the petition, Booth and Beretta (2012), provided examples of fish recruit abundance decline independent of coral bleaching and concluded "these examples highlight the stochastic nature of recruitment, and caution against the hasty attribution of cause and effect in explaining changes in recruitment through time." Graham et al. (2007) was also cited by the petition as an example of the effects of bleaching on coral-reef fishes. The authors concluded that "of the indirect effects of bleaching that we have identified, one of the most significant for the reef ecosystem as a whole is likely to be the decline in smaller size classes of herbivorous fishes (mainly surgeonfishes and parrotfishes with some rabbitfishes and two species of damselfish)." The petition also cites Wilson et al. (2006) for effects of bleaching on coral-reef fishes; however, Wilson et al. (2006) found "abundances of species reliant on live coral for food and shelter consistently declined during this time frame, while abundance of some species that feed on invertebrates, algae and/or detritus increased. The response of species, particularly those expected to benefit from the immediate loss of coral, is variable." Thus, given that yellowtail damselfish is not an obligate corallivore and has a varied diet including algae and invertebrates, this study is not indicative of potential adverse impacts to yellowtail damselfish from coral bleaching. Finally, the petition cites Bonin et al. (2009) for effects of bleaching on coral-reef fishes. This study examined the effects of bleaching on two species of gobies that are live-coral symbionts. Again, this information does not allow us to infer any level of extinction risk from coral reef habitat loss due to climate change impacts for yellowtail damselfish.

Therefore, we find that the petition does not provide substantial scientific or commercial information indicating that listing yellowtail damselfish as threatened or endangered may be warranted due to loss or degradation of coral habitat that may result from global climate change.

Overutilization for Commercial and Recreational Purposes

The petition provides information indicating damselfish are the most commonly harvested group of fishes in the global trade of marine aquarium fish. The petition does not include any information specific to the collection of yellowtail damselfish, nor does it provide any explanation of how harvest of yellowtail damselfish is an extinction risk to the species. Due to the pugnacious behavior of yellowtail damselfish and its solitary nature (Robins et al., 1986), it is likely a less desirable species for use in aquaria compared to damselfish that are schooling planktivores such as the blue-green chromis. Though we do not have information in our files for harvest and trade impacts across the entire range of the species, we do have information in our files about harvest of damselfish in Florida for the aquarium trade; 9,780 damselfish were collected in 2009 from Florida waters for the aquarium trade. There are 14 species of damselfish in Florida waters and yellowtail damselfish is considered "common" (Humann, 1999), but specific information regarding the contribution of yellowtail damselfish to the aquarium trade harvest in Florida is not available (FWRI, 2009). Even if we assumed the entire Florida harvest in 2009 was comprised of yellowtail damselfish and is representative of ongoing harvest levels, we do not believe the collection of nearly 10,000 individuals in Florida annually would constitute an extinction risk that is cause for concern to the status of yellowtail damselfish. Because field surveys throughout the Florida Keys forereef, high relief spur and groove habitat indicate yellowtail damselfish have remained stable in frequency and density for the last 22 years (NMFS SEFSC, 2014), we believe harvest is not contributing to a decline in total numbers within Florida. In summary, we find the petition and information in our files do not present substantial scientific or commercial information to suggest that listing yellowtail damselfish as threatened or endangered may be warranted due to overutilization for commercial, recreational, educational, or scientific purposes.

Inadequacy of Existing Regulatory Mechanisms

The petition states the regulatory mechanisms addressing greenhouse gas pollution, protecting coral reef habitat, and controlling the aquarium trade are inadequate to protect the yellowtail damselfish and that the "widespread and growing trade in coral-reef fish and corals adds to the cumulative stresses…from ocean warming and ocean acidification." The petition states that both international and domestic laws controlling greenhouse gas emissions are inadequate and/or have failed to control emissions, "as acknowledged by NMFS in its Status Review Report of 82 Candidate Coral Species and Accompanying Management Report." We concur there is information in the petition, readily available in our files, and from scientific literature that indicates GHG emissions and associated ocean warming, acidification and other synergistic effects are contributing to extinction risk for some species of reef building corals (79 FR 53851; September 10, 2014), and that existing regulatory mechanisms are inadequate to prevent these emissions from causing serious harmful impacts to corals. However, we do not have information in our files, and we are not aware of any literature, indicating GHG emissions are negatively affecting yellowtail damselfish (e.g., through sensory impacts, discussed below). As discussed above, yellowtail damselfish associate with a variety of coral-reef habitats and we have no information from which to conclude the impacts of GHG emissions on coral reefs present extinction risk that is cause for concern for yellowtail damselfish. Therefore, we also cannot conclude that inadequacy of regulatory mechanisms to control these emissions is causing extinction risk that is cause for concern for this species.

The petition states that existing regulatory mechanisms are inadequate to protect coral reef habitats from local threats (e.g., overfishing), despite international and domestic efforts to reduce threats to reefs. The petition cites Burke et al. (2011), as concluding that "[m]ore than 60% of the world's coral reefs are under immediate and direct threat from one or more local sources," and that "[of] local pressures on coral reefs, overfishing—including destructive fishing—is the most pervasive immediate threat, affecting more than 55 percent of the world's reefs." The petition states "this high level of threat clearly indicates that existing regulatory mechanisms are inadequate to protect the coral reefs on which the petitioned Pomacentrids depend." However, the petition fails to discuss how yellowtail damselfish may be susceptible to this generalized threat to coral reefs.

The petition states that regulation of the aquarium trade is inadequate to control trade and prevent collection detrimental to the species' survival. The petition cites Tissot et al. (2010) for evidence of "weak governance capacity in major source countries such as Indonesia and the Philippines; high international demand, particularly from the United States…and inadequate enforcement of the few existing laws, allowing collectors to use illegal and harmful collection methods such as sodium cyanide." Drawing inferences based on Indo-Pacific species and the regulatory mechanisms governing their collection is inappropriate because yellowtail damselfish do not occur in the foreign countries in the Indo-Pacific discussed as having inadequate governance and enforcement of laws. There is no information in our files indicating yellowtail damselfish is a highly prized, collected, or traded marine organism. We conclude the threats characterization in the petition regarding inadequacy of regulatory mechanisms to control harmful harvest of yellowtail damselfish is unsubstantiated.

In summary we find the petition does not provide substantial scientific or commercial information to suggest that existing regulatory mechanisms related to any identified threats to the species are inadequate such that they may be causing an extinction risk for the yellowtail damselfish.

Other Natural or Manmade Factors

The petition states that ocean acidification and ocean warming, in addition to causing habitat loss, "directly threaten the survival of the petitioned species through a wide array of adverse impacts that are predicted to lead to negative fitness consequences and population declines." The petition states "ocean acidification impairs the sensory capacity and behavior of larval clownfish and damselfish." The petition refers to a number of sources to demonstrate that in the laboratory, behavioral responses of larval fish can be affected by elevated carbon dioxide levels.

The petition states "research on the effects of ocean acidification on six species of larval damselfish found that elevated carbon dioxide levels expected within this century impair damselfish smell, vision, learning, behavior, and brain function, leading to a higher risk of mortality." Results from two of these six damselfish are from Munday et al. (2010) who found that "700 ppm carbon dioxide is close to the threshold at which adaptation of behavioral responses might be possible in reef fishes, provided that the variation in sensitivity to elevated carbon dioxide we observed between individuals at this concentration has a genetic basis. The olfactory capacity of approximately one-half of the larvae was unaffected by exposure to 700 ppm carbon dioxide, and these individuals exhibited less risky behavior in the field (remained closer to shelter) compared with affected individuals." The effect on olfactory capacity appears to be an individual response and not necessarily a population response. A variable individual response does not constitute a risk to the entire population and therefore, there is not sufficient evidence of extinction risk to yellowtail damselfish posed by elevated carbon dioxide impacts on olfactory capacity.

Results from the other four of these six damselfish species are from Ferrari et al. (2011), where the effects of carbon dioxide exposure on the antipredator responses of four sympatric species who share the same ecology and life history was tested; all four are congeners in a different genus than yellowtail damselfish and all are found in the Pacific Ocean. The four damselfish in the Ferrari et al. (2011) study were specifically selected to compare similar species response to carbon dioxide in order to predict ecological impacts on marine communities. The concentrations of carbon dioxide tested ranged from those similar to recent atmospheric concentrations (390 ppm) to those representing highly elevated (700 and 850 ppm) atmospheric levels. This was accomplished by placing juveniles collected in traps into 35 L rearing aquariums that were either aerated with 390 ppm (current-day control), 728 ± 88, or 1008 ± 78 ppm (mean ± SD) carbon dioxide enriched air (Munday et al., 2009; Dixson et al., 2010) creating environments with 700 and 850 ppm CO^2 (see Munday et al. (2010) for more details). While Ferrari et al. (2011) predicted the difference in behavioral response in the lab would translate into differential survival in the field, the "four congeneric species showed striking and unexpected variation in CO_2 tolerance." The antipredator responses were reduced at the 700 ppm level, but did not disappear, while at the 850 ppm level, three out of four species did not show an adaptive antipredator response, and the fourth maintained an antipredator response similar to the response level of the 700 ppm exposure. Additionally, all fish displayed antipredator responses to odors from injured conspecifics, which is considered a reliable cue of general predation risk (Ferrari et al., 2010). The results by Ferrari et al. (2011) were described by the petitioner as highlighting how individual effects from elevated carbon dioxide are highly uncertain and constitute an extinction risk for the petitioned species. However, merely identifying factors that could negatively impact a species does not constitute substantial information that listing may be warranted. Because Ferrari et al. (2011) found "marked intraspecific variation," we interpret these results to demonstrate variability in physiological responses within the functional group examined (functional groups were defined by their carbon dioxide tolerance). Further, Ferrari et al. (2011) found predation rates and prey selectivity were impacted by exposure to elevated levels of dissolved carbon dioxide, but the outcome of the interaction was dependent on the size of juvenile prey, not on the species. Additionally, Ferrari et al. (2011) concluded that if the negative effects of carbon dioxide were balanced between prey and predators, we would not expect any change in overall mortality rate. These data do not provide reliable information for conclusions about the response of the yellowtail damselfish, much less a population-level response that might occur if the carbon dioxide levels tested are eventually reached. Finally, Ferrari et al. (2011) note that their experimental results may represent a worst case scenario in that it assumes absence of adaptation. We do not have information in our files, and we are not aware of any literature, indicating increased carbon dioxide levels have reduced fitness of any western Atlantic damselfish, or that increased levels may pose an extinction risk that is cause for concern for yellowtail damselfish.

The petition also states that elevated sea surface temperatures "can influence the physiological condition, developmental rate, growth rate, early life history traits, and reproductive performance of coral reef fishes, all of which can affect their population dynamics, community structure, and geographical distributions," citing Nilsson et al. (2009). We reviewed Nilsson et al. (2009) and found the results show physiological responses to changes in water temperature. Nilsson et al. (2009) examined the capacity of five species of marine fish to perform aerobically (aerobic scope). They found that all five species exhibited a decline in aerobic capacity at elevated water temperatures (31, 32, or 33°C) compared to the control (29°C); the three damselfish species tested retained over half their aerobic scope at 33°C, while all capacity for additional oxygen uptake was exhausted at 33°C for the two cardinalfish species tested. One damselfish species' oxygen uptake was reduced from 142% at 29°C to 81% at 31°C while another species' uptake went from 300% at 29°C to 178% at 33°C. These results indicate that damselfish are thermally tolerant and as Nilsson et al. (2009) state, "populations of thermally tolerant species are likely to persist at higher temperatures, but populations of thermally sensitive species could decline on low-latitude reefs if individual performance falls below levels needed to sustain viable populations.

The petition cites several other sources, primarily Johansen and Jones (2011), which found increasing temperatures have negative effects on the aerobic capacity and swimming performance of some damselfish, though the species tested did not include the yellowtail damselfish or any of its congeners. These studies also revealed inter-specific differences in the response to elevated temperature and discussed how acclimation, developmental plasticity, and adaptation can alleviate temperature-related physiological impacts. All but one of these studies were single generation studies and did not evaluate trans-generational plasticity for any species to determine if the species are able to adapt or acclimate to new environmental conditions over time. In fact, the one study that did (Donelson et al., 2011) found that "complete compensation in aerobic scope occurred when both parents and offspring were reared throughout their lives at elevated temperature. Such acclimation could reduce the impact of warming temperatures and allow populations to persist across their current range. This study reveals the importance of trans-generational (across generations) acclimation as a mechanism for coping with rapid climate change and highlights that single generation studies risk underestimating the potential of species to cope." The petition does not provide any information about the aerobic scope of yellowtail damselfish, nor do we have any information in our files. Therefore, we do not believe Nilsson et al. (2009), Donelson et al. (2011), and Johansen and Jones (2011), are reliable sources for the premise that elevated sea temperatures will affect the physiological response of yellowtail damselfish to the extent it poses an extinction risk of concern to the species.

Results from a study by Munday et al. (2008) are also included in the petition to indicate how larval growth rates and recruitment of some reef fishes can increase with warmer water. Munday et al. (2008) documented high variability in response at both the individual and species level. Many coral reef fishes have geographical ranges spanning a wide temperature gradient and some have short generation times. These characteristics are conducive to acclimation or local adaptation to climate change and provide potential for more resilient species to persist (Munday et al., 2008).

Thus, we conclude the petition did not explain, nor do we have information in our files explaining, how physiological effects of elevated carbon dioxide or elevated temperature would have negative effects on yellowtail damselfish. As we have noted, many of the references presented by the petition show highly variable physiological responses by individuals and species to various stimuli (elevated carbon dioxide or increased temperatures) and no reliable inference to yellowtail damselfish population responses can be drawn. We conclude the petition does not provide reliable support for the premise that the effects of ocean warming or ocean acidification may be posing extinction risk that is cause for concern for yellowtail damselfish.

In summary, we conclude the petitions' characterization of ocean acidification and ocean warming as posing negative fitness consequences to be broad statements of generalized threats and do not indicate that ocean acidification and ocean warming directly threaten the survival or pose extinction risk that is cause for concern to the yellowtail damselfish. Therefore, we conclude the petition does not present substantial scientific or commercial information indicating the petitioned action may be warranted due to other natural or manmade factors.

Synergistic threats

Additionally, we do not find that the combination of proposed threats to yellowtail damselfish poses extinction risk that is cause for concern for yellowtail damselfish. The proposed threat from loss of habitat or habitat degradation is overstated because not all coral species are highly vulnerable to the threats associated with global climate change, some coral species will survive, and yellowtail damselfish are capable of habitat adaptations in response to changes in composition of coral species on reefs; harvest of the species is minimal; and physiological responses to increased carbon dioxide levels and sea temperature vary widely. Therefore, we do not believe these proposed threats act synergistically on yellowtail damselfish to pose extinction risk that is cause for concern.

Finding

After reviewing the information contained in the petition, as well as information readily available in our files, we conclude the petition does not present substantial scientific or commercial information indicating that listing the yellowtail damselfish as either an endangered species or as a threatened species may be warranted.

References Cited

A complete list of all references is available on our website:

http://sero.nmfs.noaa.gov/protected_resources/listing_petitions/species_esa_consideration/index.html .

Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

Dated: February 11, 2015.

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Samuel D. Rauch, III,
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National Marine Fisheries Service.

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