DATA NOTES

Fish Names Variability Traces the Geo-Historical Dynamics of Moroccan Fishermen Communities

ABDELAZIZ AIT HAMMOU
HICHAM MASSKI

ABSTRACT

We investigated 16 fishing sites in order to gather local fish names. A total of 691 vernacular names were assigned to the 138 species considered. Regarding the number of names, a great part of variability was of linguistic origin, and the patterns disclosed showed four groups of sites. Names of Spanish origin were predominant at the national level, and their proportion decreased southward for the benefit of names of Arabic, Amazigh, and French origins. Joint to geographic and cultural proximity, trade relationships of newly exploited species (after the 1950s) probably determined the emergence of such a pattern.

INTRODUCTION

The knowledge related to fish names is an integral part of being a fisherman and considered as a proof of competence within fishermen communities. This local knowledge is designated as folk taxonomy, and is in some ways predictably similar to the scientific (Linnaean) naming system (Berkes et al. 2001; Berlin 1992; Jernudd and Thuan 1984). Such knowledge is local in scope and thus highly variable by geographic region, language, and ethnic group depending on local culture, biodiversity patterns, and fishing practices. It is also assumed to vary in time. Due to widespread anthropogenic pressure causing the collapse of fishing stocks and local extinctions of species, young fishermen will have had little probability to meet as many species and in

such numbers as have their predecessors. This folk taxonomy knowledge in its different dimensions is intimately associated with Local Ecological Knowledge (LEK), and its description is often a prerequisite to gather local biological and ecological knowledge (Berkes et al. 2001; Eugene Hunn 2011; Freire and Pauly 2003; Haggan et al. 2007). The relevance of ecological information is likely to be anecdotal if the accuracy of taxonomic identification is not guaranteed (Albuquerque et al. 2014). Local ecological knowledge has become an essential source of information for conservation ecology (Ruddle and Davis 2013), especially in data-poor ecosystems.

Morocco presents an interesting case for examining variability in fish naming due to great diversity of species, as well as long and varied sociolinguistic

traditions. Bordered by both Mediterranean and Atlantic coastlines of Northwestern Africa, Morocco is the center of the transition zone between temperate and tropical waters, populated with diverse species communities (Masski and Tai 2014; Tai et al. 2013). For bony fish alone, FishBase (Froese and Pauly 2011) lists more than 766 species for Morocco. Fishing activity is widespread along the Moroccan coast, involving culturally diverse populations. Cultural diversity, an additional variable to consider, has its origin in the geopolitical situation of the country, which has always put indigenous people in close interaction with the people of Europe, Africa, and Arabia.

What is considered by one as a diversity of local knowledge is seen by others as a variability in seafood labelling and represents a central issue in trade control and regulation, and in fisheries science and conservation (Fraser 2012; Leunda Urretabizkaia et al. 2009). In developing countries, where the adoption of a standard for naming fish is uncommon, vernacular (folk) and common names are also used in national fisheries statistics systems (Previero et al. 2013). Due to the high variability in folk taxonomy, the same fish species can be named differently in different regions, and one name can be attributed to different fish species (Berlin 1973, 1992). Furthermore, the use of fishery statistics databases for scientific purposes is therefore restricted to well-identified species, which impedes fisheries management procedures (Kifani et al. 2008). The usual answer to such a situation is the adoption of a standard, which is the goal of the Moroccan fisheries management agencies.

The success of the targeted standardization is, in our opinion, dependent on the strength of reflection and research previously conducted. Thus, and far from wanting to carry out a comprehensive inventory of vernacular names, the present study aims to 1) build correspondence lists between folk and scientific names for a set of species in different locations along the Moroccan coast and, on this basis, 2) to analyze the structure and variability of the Moroccan folk

taxonomic system. We hope that the results from our study will help to improve the use of folk taxonomy in formal management procedures, facilitate local ecological knowledge gatherings, and clarify the view for the ways to achieve a standardization process.

METHODS AND MATERIALS

Data from Interviews with Fishermen

Interviews were conducted at 16 sites along the Moroccan coast (Figure 1) with respondents working in the fishing sector. The sampling was opportunistic and respondents were selected haphazardly, then asked to provide local names used for a set of species displayed on a laptop screen. The interviews took at least two hours, which limited the acceptance by candidates to be interviewed. Since no ruler was displayed on fish images, investigators provided the maximum length of the species to respondents who asked what size the fish was. Investigators were careful not to influence the choices made by respondents, and no action was taken to avoid confusion. The surveys were conducted over three 20-day periods in 2001 and 2002. Survey forms and tape recordings of interviews were digitized.

FIGURE 1. Geographic situation of study sites (ports and fishing sites) targeted by the surveys.

The surveys in the 16 study sites resulted in 28 interviews, with 25 individual respondents and three groups. Their ages ranged between 26 and 67 years, and they were active or retired fishermen, fish wholesalers, fish market criers, and technician biologists. Most of them have held various jobs related to fishing throughout their working lives. Their knowledge related to nomenclature did not necessarily correlate with their experience in the fishing industry. Some young respondents had a diverse and precise knowledge, while two of the oldest were subsequently eliminated due to an unusually high number of confusions made during the interviews.

Test Species Set

A set of 138 species was selected for the interviews. The most abundant species from among commercial bony fishes, sharks, rays, cephalopods, and crustaceans were selected (71 species). We added 57 uncommon species and 10 non-commercial ones in order to test the relevance of the information provided by the respondents and their knowledge levels. A collection of images for these 138 species was downloaded directly from FishBase (Fishbase.org).

Transcription and Counting

The interviews were conducted in local dialects: Moroccan Arabic and Amazigh. The transcription of the names was made in French auditory syllables. The names collected were stripped to the root name and its origin. Then, the differences in pronunciation and linguistic origin of modifications to the root name were identified. For example, one of the names of the common seabream (pagrus pagrus) is '*pajou azeggagh*'; '*pajou*' is of French origin '*Pageot*', which has had Arabic influence, and the modifier '*azeggagh*' is Amazigh (i.e., red). Lexicological morphology studies by Lataoui (1999), who analyzed the linguistics of Moroccan fish names, were used as reference in order to better identify the root names and their origins. This offered the possibility to perform statistical analyses on these

names, the origins of their roots, and of their modifications.

Analysis of the Data

All statistical analyses were performed using the 'R' statistical software (R Development Core Team 2013) and associated packages. A linear model was performed to analyze the sources of the disparities observed between the different sites and their significance (Table 1). Response variable was defined as the number of vernacular names and the explanatory variables considered were the numbers of redundant names, the numbers of unknown species, the numbers of respondents, whether they were in a group or not, and the area (Mediterranean vs. Atlantic). Other variables were included to take into account the importance of the study sites in terms of fishing activity (mean annual catch) and the distance between them. The linear model was selected according to the Akaike information criterion (AIC). An analysis of variance was then performed after the use of the 'gvlma' package for a global validation of linear model assumptions.

The study sites were classified according to their listed names, using a hierarchical clustering (Ward, Euclidean) based on the first four principal components of a standardized principal components analysis (PCA). The principal components analysis was applied to the table of presence/absence of fish names (as individuals) in the study sites (as variables). We used the 'ade4' package to perform principal components analysis and the 'pvclust' package for the clustering.

RESULTS

Designing the Vernacular Name Lists

The initial objective was to establish a single list for each study site by aggregating fish names gathered from at least two interviews. This condition could not be met in seven study sites because of the scarcity of respondents in four cases and because respondents

TABLE 1. Survey statistics from interviews conducted with fishermen in 16 study sites throughout the Moroccan coast, by number of respondents, whether they were in a group or not, number of listed names, percentage of unrecognized species during the interviews, number of names appearing more than once in the list (redundancy,) and number of combinations between scientific and vernacular names in each names list.

Area	Study site*	No. respondent	Individual or Group	No. names	Unrecognized species (%)	No. redundancy	No. combination scientific/ vernacular
W - Mediterranean -E	RAS KEBDANA	2	I	116	23.9	54	225
	NADOR	2	I	112	11.3	94	240
	AL HOCEIMA	1	I	79	8.5	65	153
	M'DIQ	2	I	130	9.2	94	251
	TANGER	2	I	124	6	69	207
S - Atlantic - N	LARACHE	16	G	114	1.46	49	163
	BOUSSELHAM*	1	I	80	9.9	69	159
	MEHDIA	2	I	120	10.9	64	221
	BOUREGREG*	1	I	79	15.5	51	150
	CASABLANCA	8	G	95	7	48	150
	EL JADIDA	1	I	93	9.2	40	144
	OUALIDIA*	14	G	91	15.5	46	156
	SAFI	2	I	139	4.9	82	238
	ESSAOUIRA	2	I	122	3.9	72	212
	AGADIR	3	I	166	5.2	104	309
	SIDI IFNI	2	I	125	15.8	66	233
Min				79	1.4	40	144
Max				166	23.9	104	309

came forward in groups in the other three cases. The composition of the name lists built in the 16 study sites showed real disparities (Table 1). The number of names in the lists ranged between 144 and 309, including redundancies (names appearing more than once in a list), which varied between 40 and 104. The percentage of unknown species was also variable between the lists, ranging from 1 to 24%.

At this level, we wanted to know if the disparities observed could be explained by documented variables in the database. The modelling of the number of vernacular names appeared highly significant, and statistical assumptions tested were all met. Analysis of variance revealed that among the six variables considered, only the number of respondents was not significant, in addition to the variable 'Area', which was withdrawn because of its degrading effect on the quality of the linear model. Thus, the number of respondents does not appear to have any impact on the number of names in the lists; however, whether they were in a group or not appeared to have a

significant effect. Fishing activity in the study sites and their geographic location had significant effects on the number of names. The redundancy was of very high significance, suggesting that the longest lists contain more redundancies while the number of unknown species may reduce list size.

The Corpus of Vernacular Names

The gross general corpus of vernacular names collected for the 138 selected species amounted to 691 nouns. This number rose to 1,317 for the combinations 'Scientific Name – Vernacular Name' because of the attribution of the same vernacular name to distinct species. One species had 21 different names (Figure 2). The median of the number of vernacular names per species was nine, and only 15 species had less than three names. These statistics changed greatly when dealing separately with the name lists in each of the study sites; the maximum number of names assigned to the same species in one place was seven, with 81% of species having between two and three names.

The diversity of names given to a species is due to multiple reasons that can be identified more or less accurately. The first reason is the variability in the pronunciation that occurs when a syllable is changed or reversed. For instance, a common name given to the sea bream (*Diplodus sp.*) taken by region, forms '***Chergho***', '***Chargho***', '***Pargho***' or '***Tchergho***'. This corresponds to 23% of the matches 'Scientific Name – Common Name'. A name can be put into the plural, resulting, in the case of the sea bream, in the name '***chraghi***' or '*Chragho*', a practice that remains very marginal (1%). Names can be affected by assimilation into a local language and provide, for the same example, '***Achraghi***' with Amazigh influence, which relates to 32% of the names. An adjective can be attached to the name to distinguish a particular species, so one of the names of the Zebra sea bream (*Diplodus cervinus*) is '***Chergho choldhao***' (2%). The use of synonyms or translations of the same name can extend the list, especially when the name comes from borrowing names of land animals, which is responsible for 4% of the allocation of multiple names.
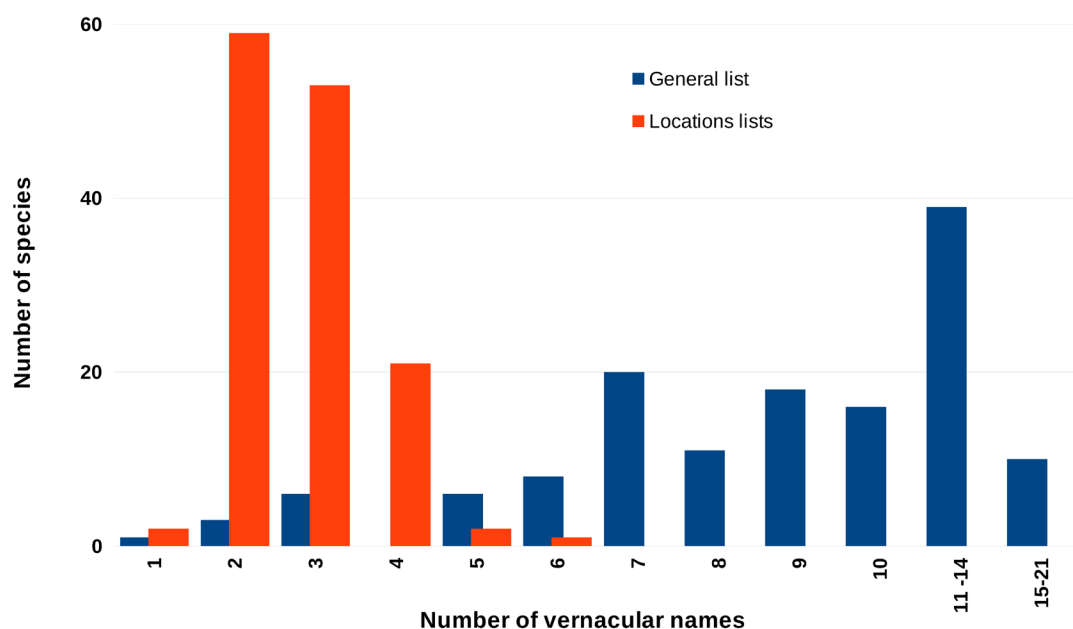

FIGURE 2. Number of vernacular names by species in the whole list and within location lists.

Finally, the reasons most difficult to grasp are mistakes and confusions. To judge errors, it is necessary to dispose of a valid reference, which we avoided in the conduct of this study. Therefore, except for isolated cases, such as when a shad is named 'sardine', we chose not to consider what sometimes might be seen as errors. However, we noted that some species were subject to conscious categorization – so, despite the existence of recognized differences, a similar name was assigned.

Geographic and Linguistic Disparities Analysis

The names of Spanish origin were preponderant in the national names list (43%) and surpassed the total of Arabic and Amazigh names (40%). The French and Portuguese names were of least frequency, with respectively 13% and 2%. The pattern disclosed by the local lists was variable and differed markedly from that of the national list. The clustering of the study sites, according to their row names list, revealed four groups at the significance threshold of 95% (Figure 3). The isolated groups had a coherent geographical dimension, and boundaries can be drawn between the groups: one in the Moroccan Mediterranean at Al Hoceima and two in the Moroccan Atlantic coast at Larache and Oualidia. The considered area of the Moroccan Atlantic was divided into three groups: The first group consisted of sites south of Safi, the second group grouped together sites between Oualidia and My. Bousselham, and the third group included the study sites surrounding the Strait of Gibraltar and extended to the Mediterranean. The last group included study sites from the eastern Moroccan Mediterranean coast.
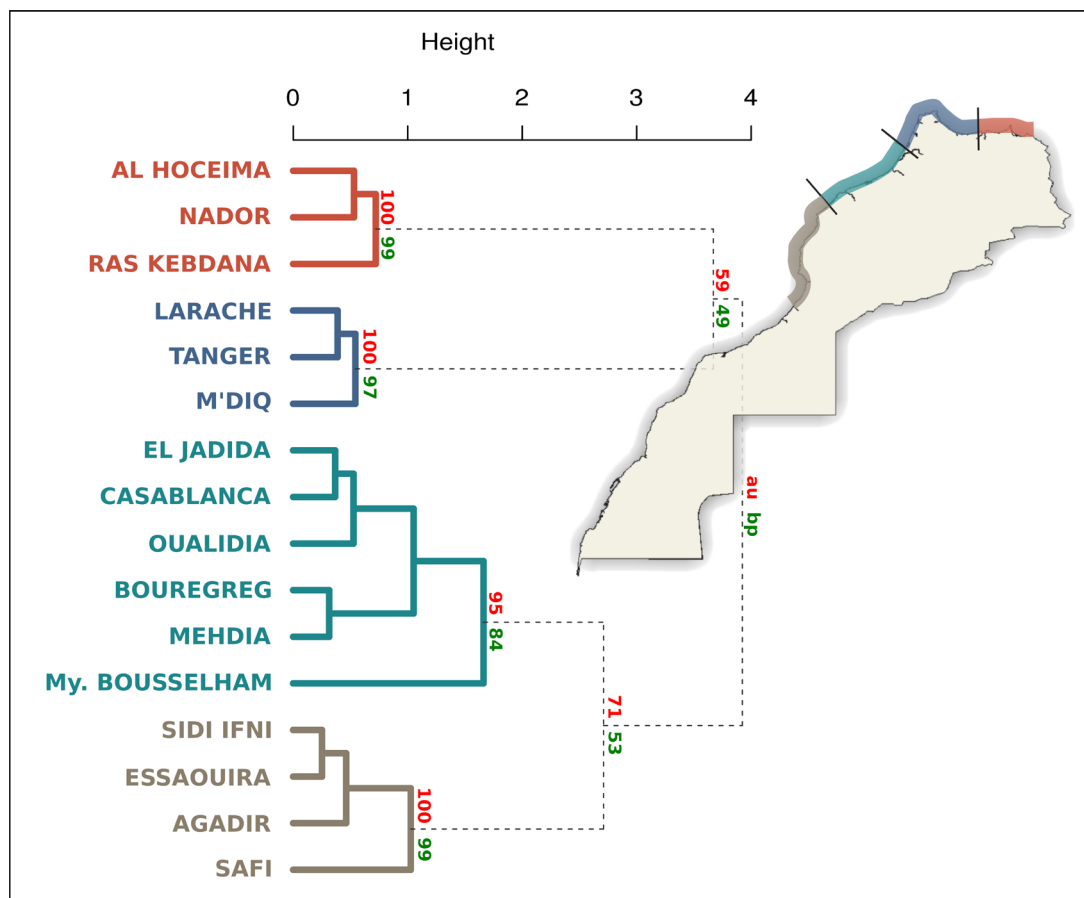

FIGURE 3. Hierarchical classification of the study sites lists on the basis of the results of a standardized PCA. The study sites are grouped at a significance threshold of 95%. au: approximately unbiased p-value; bp: bootstrap probability value. Height: euclidian distance between clusters.

In addition to geographic coherence, the classification appeared to be imbued with linguistic consistency suspected to be predominant in explaining the identified sets. The major trend, starting from the Eastern Mediterranean, was the decrease of the names of Iberian origin, mainly Spanish, in favor of names from other languages (Figure 4). The proportion of Arabic names rose from 7 to 30% between the East and West Mediterranean (W. Med), while the Amazigh names decreased from 14 to 8%. These names rose slightly between the West Mediterranean and the North Atlantic (N. Atl), and while Amazigh names continued to rise between the North Atlantic and South Atlantic (S. Atl), Arabic names decreased. French names had a low proportion (7%) in the Mediterranean, which rose to 22% in the N. Atl before decreasing to 17% in the South Atlantic.

DISCUSSION

The diversity of the Moroccan folk taxonomy reflects the cultural diversity of the country and the historical mix of the Amazigh indigenous populations with populations from Arabia and Europe through centuries. A missing component was the sub-Saharan one which did not, or could not, be identified in the fish names corpus, despite a shared history through trade and slavery. The Saharan region from Morocco (southward Sidi Ifni to Cap Blanc) was excluded from this study because indigenous fishing activities were inexistent along this desert coastline (Gruvel 1906). Similar to the fishing activities of the Amazigh people from the Souss region in Morocco (Agadir) (Gruvel 1927; Laoust 1923; Montagne 1923), those of the Imraghen people from the actual Mauritania were studied and described for the end of the 19th
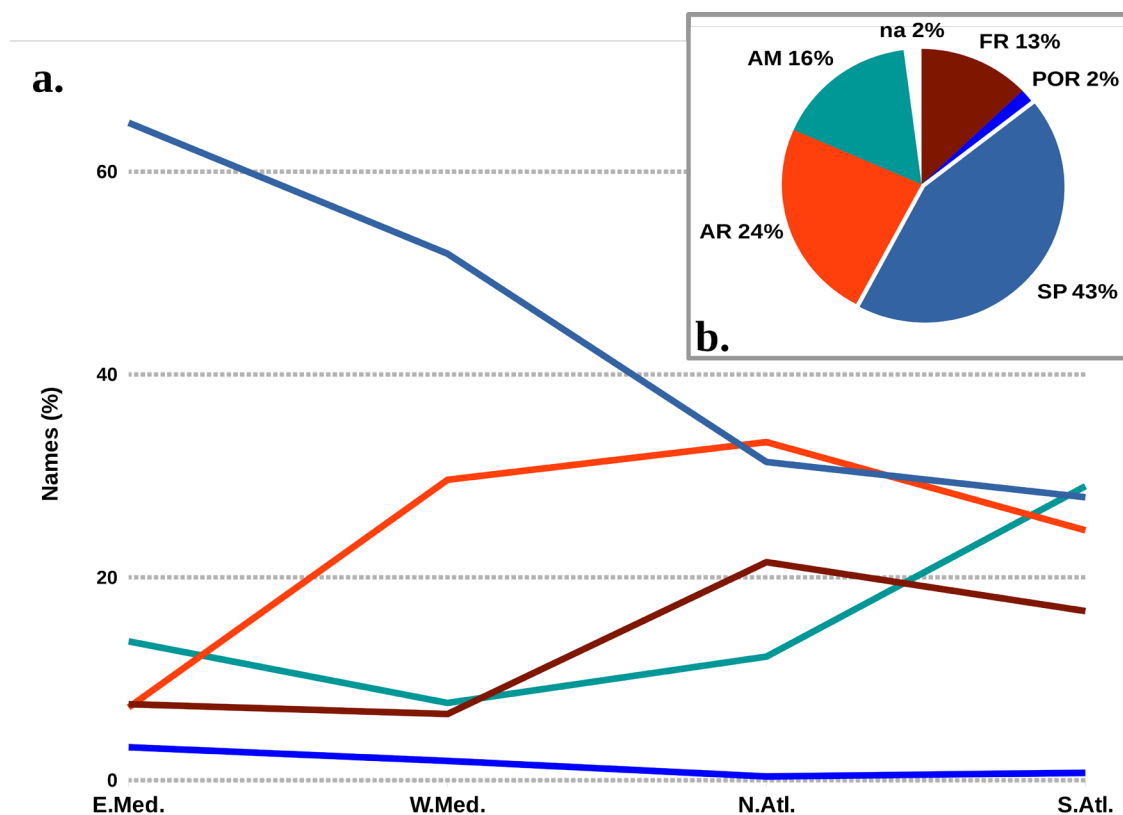

FIGURE 4. Linguistic composition in the general list (b.) and of the grouped lists (a.) according to the clustering results. AR: Arabic, AM: Amazigh, SP: Spanish, FR: French, POR: Portuguese, na: unidentified.

and the beginning of the 20th century (Gruvel 1906; Revol 1937). Hence, exchanges regarding the traditional knowledge associated to fish naming have been limited from both sides of the desert zone.

As the approach is intra- or trans-institutional, no exemption can be made as to the most comprehensive inventory of the names of the common species in landings. This study, as well as preceding studies, may serve as references (Lataoui 1999; Lloris and Rucabado 1998). For the hundred or so common species considered here, despite the limited number of informants in each of the places visited, few names inventoried in previous lists have been identified as missing. For selected species in this study, 434 names are inventoried in the old lists, with 78 names different from those collected. Moreover, the consistency of the clusters identified by hierarchical clustering, which are similar to those described by Lataoui (1999), gives confidence about the methodological choices adopted.

Regarding the origin of the names, those of Spanish origin were predominant in the general list, and even more in the Mediterranean lists. The geographic proximity and the shared history with the Spanish people can be presented as a major argument to explain the high proportion of names of Spanish origin. But the fact that deep sea fish have Spanish names suggests that these aliases were borrowed after the industrial development of the Moroccan fisheries, operated by the French administration in the 1950s, when Morocco was under protectorate regime (1912-1956). The trade relationships for seafood with Spanish populations is likely to have played a major role in the naming of species that did not have specific local names before.

The local name lists appeared to be of variable richness and all included what is considered a nomenclature issue by regulation agencies. Several species had more than one name, and the same name could be attributed to different species. The extent of the 'problem' arises when dealing with the national list. For the restricted number of species considered in this study (138), we found that the number of vernacular names assigned was 691 – a mean of five names per species, and the median with nine names. A large part of this variability was due to pronunciation and assimilation practices, which do not affect the structure of the root name. Pronunciation aside, the greater part of the variability is of linguistic origin. This diversity is being regarded as a barrier to the formalization imposed by the current trade needs and those inherent in scientific procedures necessary to the management of fish stocks (Hamilton and Walter 1993; Jacquet and Pauly 2008; Miller and Mariani 2010). The usual answer to this problem is standardization (Leunda et al. 2009) with the creation of standards of common names often adopted by statute, lined with bodies responsible for their maintenance.

From the viewpoint of fishery biologists, it seems simple to decide the selection of a common name list for the management of trade flows in an organization in charge of marketing. The adoption of a standard table to take into account local cultural diversity in order to enhance standardization acceptance throughout the local population is a complex issue, however.

Abdelaziz Ait Hammou, *Institut National de Recherche Halieutique*, aithammou@mtds.com

Hicham Masski, *Fisheries Biology and Ecology Laboratory, Institut National de Recherche Halieutique*, hmasski@gmail.com

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