**Scophthalmus Rafinesque, 1810: The valid generic name for the turbot, *S. maximus* (Linnaeus, 1758)**

*Pleuronectiformes: Scophthalmidae*

by

Nicolas BAILLY* (1) & Bruno CHANET (2)

**ABSTRACT.** - In the past 50 years, the turbot is referred to either as *Scophthalmus maximus* (Linnaeus, 1758) or *Psetta maxima* (Linnaeus, 1758) in the literature. Norman (1931) had argued that the valid name for the turbot was *Scophthalmus maximus*. However, his recommendation was never universally accepted, and today the confusing situation exists where two generic names are still being used for this species. We address this issue by analysing findings from recently published works on the anatomy, molecular and morphological phylogenetic systematics, and ecology of scophthalmid fishes. The preponderance of evidence supports the strong recommendation to use *Scophthalmus* as the valid generic name for the turbot. Acceptance of this generic name conveys the best information available concerning the systematic relationships of this species, and also serves to simplify the nomenclature of scophthalmid flatfishes in publications on systematics, fisheries and aquaculture, fishery statistics, ichthyofaunal and field guides for the general public, and in various legal and conservation-related documents. This paper reinforces the conclusions of Chanet (2003) with more arguments.


Key Words. - Scophthalmidae - *Scophthalmus* - *Psetta* - Turbot - Systematics - Nomenclature.

The turbot, *Scophthalmus maximus* (Linnaeus, 1758), is an important commercial and highly esteemed species dating back to Antiquity (Chanet, 2003). Consequently, we might imagine that the taxonomy and nomenclature of this species are both clear and stable. Unfortunately, this is not the case as there has been a long history of confusion and controversy regarding the valid genus name for the turbot, the main topic of this paper, and also regarding the existence of one or two species. In the past 50 years and up to the present days of ichthyological popular and scientific literature, the scientific name used for the turbot is either *Scophthalmus maximus* (Linnaeus, 1758) or *Psetta maxima* (Linnaeus, 1758), more or less indistinctly (the original combination is *Pleuronectes maximus* Linnaeus, 1758). The confusion/controversy regarding the valid generic name for this species persists to this day although Norman (1931) thoroughly discussed the nomenclature of *Scophthalmus* Rafinesque, 1810 and *Psetta* Swainson, 1839, and concluded that *Scophthalmus* is the valid generic name for the turbot.

The choice of *Psetta* in major check-lists, ichthyofaunas and FAO (e.g., Nielsen 1973, 1986; FAO, 2009), as well as in recent national check-lists or red lists (e.g., Plikss, 2002; Eyseeenko, 2003; Bicelenoglou et al., 2005; Fricke, 2007; Fricke et al., 2007; Plejic, 2007; Dhora, 2010) resulted in the selection of *Psetta maxima* as the current accepted name in the two major global fish databases (Eschmeyer and Fricke, 2009).

---

(1) The WorldFish Center, Aquatic Biodiversity Informatics Office, Khush Hall, IRRI, College, Los Baños, Laguna 4031, PHILIPPINES. [n.bailly@cgiar.org]

(2) MNHN, USM 603, CP 26, Département de systématique et évolution, 57 rue Cuvier 75231 Paris CEDEX 05, FRANCE. [Chanet@mnhn.fr]

* Corresponding author

Scophthalmus: the valid genus name for the turbot

Bailly & Chanet

2010; Froese and Pauly, 2010), and thus disseminated to other global catalogues (Bailly, 2009; Bisby et al., 2009, in press), although Bailly (2001) selected Scophthalmus for the European Register of Marine Species (ERMS), and by other authors (Ojaveer et al., 2003; Riede, 2004; Azevedo et al., 2007). All these works did not incur new taxonomic investigations, although the latter give information on genetics. Nelson (2006) almost alone did retain explicitly the conclusion of Chanet (2003) in the 4th edition of Fishes of the World.

The findings presented in a recent (and the only) phylogenetic analysis of all the species of the scophthalmid flatfishes (Chanet, 2003) do not provide resolution to the question of generic placement of the turbot. After a strict cladistic analysis on morphological and anatomical features, Chanet (2003) found that Scophthalmus maximus belonged to a clade that also included S. rhombus (Linnaeus, 1758) and S. aquosus (Mitchill, 1815) with the two latter species being more closely related than with S. maximus. S. rhombus and S. aquosus differ from the turbot in having: i) deeply branched anteriormost dorsal-fin rays, ii) rudimentary epural 2, iii) convex shape of the cranium in orbital region, iv) a patch of vomerine teeth. Although these synapomorphies undoubtedly support the proposed phylogeny, Chanet concluded they are not sufficient to support recognition of different generic names for the two clades. Instead, he recommended that only one genus name be used for these three species. Recognizing the monophyly of this 3-species clade within the Scophthalmidae emphasises the large amount of shared characters common to these species, whereas, recognizing two genera among this 3-species clade would emphasise the monophyly of the rhombus-aquosus clade but would de-emphasise the close relationship of the three species indicated by the characters they share in common. However, based on the topology of the cladogram, Chanet did not conclude unequivocally whether Scophthalmus or Psetta is the appropriate generic name for the turbot.

Today, we still have the situation where two generic names are in use to convey information about a single species. From a nomenclatural perspective and also from the practical standpoint of information storage and retrieval regarding knowledge about this species, continued use of two generic names for the turbot is confusing, inefficient and unacceptable. Furthermore, it may also diminish possibilities for future researchers unaware of this nomenclatural confusion to make the most meaningful choices when constructing comparative studies among the scophthalmid flatfishes.

To reconcile this situation, we provide several lines of evidence based on morphological information from Chanet’s phylogenetic study (2003), other morphological characters and genetic information not used in his cladistic analysis, as well as information on the biology, life history and ecologies of the turbot and closely related species to effectively argue for accepting Scophthalmus as the valid genus name for the turbot. As the two genus names are still in use in the recent literature, we bring here more arguments to follow the conclusions of Chanet (2003).

MATERIAL AND METHODS

Three Biodiversity Information Systems were searched early February 2010 to get updated information, references and number of uses of the two names in the literature: Catalog of Fishes (Eschmeyer, 2010); FishBase (Froese and Pauly, 2010); Biodiversity Heritage Library (2010). The two formers extracted information mostly from references after 1950, whereas the latter handles publications before 1925.

The Catalog of Fishes can be checked for information on types and nomenclatural issues.

RESULTS

In FishBase, on 135 systematic citations of the species (excluding the fish collection databases), 39 use Scophthalmus maximus from 1957 to 2007 and 84 use Psetta maxima 1964 to 2010. The frequency of use does not show differences along the years. The remaining are mentions of misidentifications and of the original name, Pleuronectes maximus Linnaeus, 1758.

None of the two names could be object of a petition to the International Commission of Zoological Nomenclature on the basis of usage.

In the Biodiversity Heritage Library, in FishBase, on 93 citations of the, 38 use Scophthalmus maximus and 55 use Psetta maxima (or P. maximus).

The use of one or the other name does not seem to be linked to particular type of publications.

DISCUSSION

Scophthalmus maximus and S. maeoticus

Presently, depending upon authors, three or four nominal species of scophthalmids are assigned to either Scophthalmus Rafinesque, 1810 or Psetta Swainson, 1839: the turbot, Scophthalmus maximus (L., 1758) or Psetta maxima (L., 1758); the brill, S. rhombus (L., 1758), the type species of Scophthalmus designated by Jordan (1917: 82); the Black Sea turbot, S. maeoticus (Pallas, 1814) or P. maeotica (Pallas, 1814), often considered a synonym of the previous species; and the windowpane, S. aquosus (Mitchill, 1815). Norman (1931: 513) assigned all four of these nominal species to Scophthalmus.

258

Cybium 2010, 34(3)
From Norman’s studies (1931, 1934) until Chanet (2003), there have been no detailed systematic works (i.e., based on detailed study of specimens) that evaluated the status of the nominal genera, *Scophthalmus* and *Psetta*. Some synthetic works, such as regional ichthyofaunas (e.g., Nielsen, 1986; Bilecenoglu et al., 2002), report diagnostic characters — such as the presence/absence of bony tubercles — purported to distinguish the two genera. But how informative of genetic distinctness is the presence/absence of bony tubercles in turbots? The distinction between the two nominal turbot species (*S. maximus* and *S. maeoticus*) is based solely on the presence and size of bony tubercles (Tortonese, 1971; Chanet, 2003). These tubercles are transformed elasmoid scales (Zylberberg and size of bony tubercles (Tortonese, 1971; Chanet, 2003). Azevedo et al. (2008) conducted a phylogenetic analysis of the order Pleuronectiformes based on sequences of 12S and 16S mitochondrial genes where four species of turbot is present among specimens with or without tubercles of varying sizes. Azevedo et al. (2008) showed that this problem should be addressed using molecular techniques (mitochondrial or microsatellite DNA). Suzuki et al. (2004) published an analysis of mitochondrial DNA with 66 turbot specimens sampled in the Atlantic Ocean, western Mediterranean Sea, Aegean Sea, Sea of Marmara, Black Sea off Turkey and Romania, and Azov Sea. Nielsen et al. (2004) studied eight microsatellite loci in 706 turbot specimens collected from the Bay of Biscay to the Baltic Sea. In both works the genetic divergence within these populations was found to be low and was considered by these authors to represent only intraspecific differences. Most importantly, genetic differences were not related to the presence or size of tubercles because specimens with large tubercles on both sides of their bodies occurring in the same geographic area were not closely related (Suzuki et al., 2004). Therefore, findings from morphological (Chanet, 2003) and genetic studies (Suzuki et al., 2004; Nielsen et al., 2004) are in agreement that the variation in body tubercles is not a suitable feature to define natural groups within turbots and support that only a single species of turbot is present among specimens with or without tubercles of varying sizes. Azevedo et al. (2008) used a maximum-parsimony tree of Azevedo et al. (2008: 288, fig. 2) and in the consensus tree produced by a Bayesian analysis of Azevedo et al. (2008: 288, fig. 3) *S. maximus* is more closely related to *S. aquosus* than to *S. rhombus*, contradicting the results of Chanet (2003), where *S. rhombus* and *S. aquosus* were closely related. But, in the consensus tree produced by a maximum likelihood analysis of Azevedo et al. (2008: 289, fig. 4) *S. maximus* and *S. rhombus* appear as sister-groups. However, these discrepancies on terminal branches between the analyses do not modify the problem of generic name of the turbot and are probably linked to sampling bias (Azevedo et al., 2008, only studied half of the species of the family) and to the doubtful interest of the studied genes for interspecific relationships.

**Nomenclatural history**

As for the many European teleostean species, scientific nomenclature for the turbot begins with Linnaeus (1758: 271) when he named this species *Pleuronectes maximus*. For Linnaeus (1758, 1766), *Pleuronectes* is a genus containing all of the then known species of flatfishes, which includes 16 species described in 1758 plus two more in 1766. Rafinesque (1810: 14) created the genus *Scophthalmus*, to which he assigned both *Pl. maximus* and *Pl. rhombus* (Linnaeus, 1758). Later, Cuvier (1817: 222) assigned both species to *Rhombus*, but, as Norman (1931: 511) noted, this assignment was unnecessary because *Scophthalmus* had priority over *Rhombus*. Subsequent to Cuvier’s studies, Swainson (1839: 302) created the genus *Psetta*, with the type species (*Psetta rhombus*) being the senior available name for this species. He further concluded that the problem should be addressed using molecular techniques (mitochondrial or microsatellite DNA). Suzuki et al. (2004) published an analysis of mitochondrial DNA with 66 turbot specimens sampled in the Atlantic Ocean, western Mediterranean Sea, Aegean Sea, Sea of Marmara, Black Sea off Turkey and Romania, and Azov Sea. Nielsen et al. (2004) studied eight microsatellite loci in 706 turbot specimens collected from the Bay of Biscay to the Baltic Sea. In both works the genetic divergence within these populations was found to be low and was considered by these authors to represent only intraspecific differences. Most importantly, genetic differences were not related to the presence or size of tubercles because specimens with large tubercles on both sides of their bodies occurring in the same geographic area were not closely related (Suzuki et al., 2004). Therefore, findings from morphological (Chanet, 2003) and genetic studies (Suzuki et al., 2004; Nielsen et al., 2004) are in agreement that the variation in body tubercles is not a suitable feature to define natural groups within turbots and support that only a single species of turbot is present among specimens with or without tubercles of varying sizes. Azevedo et al. (2008) conducted a phylogenetic analysis of the order Pleuronectiformes based on sequences of 12S and 16S mitochondrial genes where four scophthalmid species (*Lepidorhombus wifflagonis, S. maximus, S. aquosus and S. rhombus*) were included. These authors confirm the monophilies of the family Scophthalmidae and the genus *Scophthalmus*. Further, in the consensus maximum-parsimony tree of Azevedo et al. (2008: 288, fig. 2) and in the consensus tree produced by a Bayesian analysis of Azevedo et al. (2008: 288, fig. 3) *S. maximus* is more closely related to *S. aquosus* than to *S. rhombus*, contradicting the results of Chanet (2003), where *S. rhombus* and *S. aquosus* were closely related. But, in the consensus tree produced by a maximum likelihood analysis of Azevedo et al. (2008: 289, fig. 4) *S. maximus* and *S. rhombus* appear as sister-groups. However, these discrepancies on terminal branches between the analyses do not modify the problem of generic name of the turbot and are probably linked to sampling bias (Azevedo et al., 2008, only studied half of the species of the family) and to the doubtful interest of the studied genes for interspecific relationships.
the International Code of Zoological Nomenclature.

In addition to close relationship as indicated in the cladogram presented in Chanet (2003) and in Azzevedo et al. (2008), the three species also show a high similarity with respect to their morphology, biology and ecology. They differ from other scophthalmid species by being large, epibenthic and stenohaline species (Able and Fahay, 1988; Nielsen, 1986; Morse and Able, 1995; Quéro and Vayne, 1997; Person-Le Ruyet, 2000; Bond and Lydzwoski-Schultz, 2006; Chanet and Branellec, 2008).

CONCLUSION

Systematics deals with communication of all information on living organisms on Earth. This field of study aims at discovering, synthesising and organising all of what we may know about individuals we observe (Systematics Agenda 2000, 1994), so that we are able to speak about their morphological features, biological and ecological characteristics in a synthetic and simplified manner (hence the grouping of individuals in species, species in genera, genera in families, etc.). For such a purpose, and as its fundamental framework, systematics uses the result of taxonomy that delivers both a phylogenetic/classification backbone and scientific names. These scientific names are used as the gateways for indexing and retrieving all information. Scientific names are the access points to communicate, through oral discussions, printed documents, and more recently, electronic medias, especially database- and web-based Biodiversity Information Systems, about species and other taxa. Scientific nomenclature should convey the best available information concerning the evolutionary relationships of the taxa under discussion. At the same time, keeping the nomenclature as simple or as uncomplicated as possible should also be a goal for every taxonomist.

Situations, such as the present one, where two generic names are available for a species, are unacceptable. Duplicity of generic assignment of any species is counterproductive to the goals of nomenclature and creates an inefficient and confusing situation concerning information storage and retrieval regarding that species. Determining whether or not *Scophthalmus* or *Psetta* is the valid genus name for the turbot, requires the analysis of a variety of morphological and biological data, as well as conformation to the rules for scientific nomenclature. The preponderance of evidence evaluated indicates close relationship among three scophthalmid species, *S. aquosus*, *S. rhombus* and *S. maximus* (with *S. maeoticus* being a junior synonym of the later). Acceptance of *Scophthalmus* as the valid genus name for the turbot, as assessed by Norman (1931), thereby relegating *Psetta* as a junior synonym of *Scophthalmus*, conveys the best information regarding the relationship of this species to the other Scophthalmidae, and synthesizes in the best way the shared morphological, anatomical, biological and ecological traits of the three species compared to the other species in the family. Furthermore, in adopting *Scophthalmus* as the valid genus name for this taxon eliminates any further confusion resulting from the use of two generic names for this species, and to that end will help stabilize and simplify nomenclature within the Scophthalmidae. Recognizing the turbot as a member of *Scophthalmus* best reflects our information regarding the relationships of this species among the Scophthalmidae, provides a measured step towards stabilizing the nomenclature of this species, and improves the practical aspects of information storage and retrieval for this species.

**Acknowledgements.** - We express our deepest thanks to T.A. Munroee (National Systematics Laboratory, NMFS/NOAA, NMNH, Washington D.C., USA) for advice, useful discussions and reviewing with great care the preliminary versions of this manuscript.

**REFERENCES**


SWAINSON W., 1839. - On the natural history and classification of fishes, amphibians reptiles or monocardian animals, 2. 448 p. London: A. Spottiswoode.


Cybium 2010, 34(3) 261

Reçu le 2 février 2010.
Accepté pour publication le 20 avril 2010.

Scophthalmus: the valid genus name for the turbot