AMERICAN SOCIETY FOR MICROBIOLOGY | Journal of Clinical Microbiology®

MINIREVIEW

An Update on Novel Taxa and Revised Taxonomic Status of Bacteria (Including Members of the Phylum *Planctomycetota*) Isolated from Aquatic Host Species Described in 2018 to 2021

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ABSTRACT Increased interest in farmed aquatic species, aquatic conservation measures, and microbial metabolic end-product utilization have translated into a need for awareness and recognition of novel microbial species and revisions to bacterial taxonomy. Because this need has largely been unmet, through a 4-year literature review, we present lists of novel and revised bacterial species (including members of the phylum *Planctomycetota*) derived from aquatic hosts that can serve as a baseline for future biennial summaries of taxonomic revisions in this field. Most new and revised taxa were noted within oxidase-positive and/or nonglucose fermentative Gram-negative bacilli, including members of the *Tenacibaculum*, *Flavobacterium*, and *Vibrio* genera. Valid and effectively published novel members of the *Streptococcus*, *Erysipelothrix*, and *Photobacterium* genera are additionally described from disease pathogenesis perspectives.

KEYWORDS microbial taxonomy, *Planctomycetes*, veterinary microbiology

Aquatic microbiology is a rich area of discovery and has become especially important with the increase in farmed aquatic animal systems and in conservation efforts. As we develop methodology to cultivate aquatic bacteria, which grow at various temperatures and salinities, we can describe new species and, importantly, identify pathogens both new and old. As more interest grows in aquatic microbiology we are faced with evolving analysis of current taxa and description of new taxa that can be difficult to keep up with. Therefore, a compendium of additions and changes is critical for those working in aquatic environments and supporting aquatic animal health. Additionally, the metabolic properties of some of the species identified have important uses for denitrification, resistance to heavy metals, or breakdown of other products. Lastly, aquatic microbiology has human clinical relevance, with *Vibrio* spp. a classic example, and may prove valuable for human medical professionals.

To satisfy an unmet need in clinical veterinary microbiology practice, novel bacterial taxa and nomenclature revisions were searched from 2018 through 2021. Of the greater than 475 cumulative novel taxa/revisions, approximately 30% were related to bacteria (including members of the phylum *Planctomycetota*) of aquatic host origin. Planctomycetes are distinctive prokaryotic forms with traits that have elicited confusion among scientists for approximately one hundred years. At times, they have been thought to be comprised of a cellular architecture independent of Gram-positive and Gram-negative bacteria, to be classified as a "nucleated" bacterium, and to be devoid of peptidoglycan (1). Truly divergent characteristics of planctomycetes (which also apply to chlamydial bacteria) versus other free-living prokaryotes include asymmetrical cell division and lack of division protein FtsZ (2, 3). Newer taxa within the phylum *Planctomycetota* have been associated with diverse marine environments such as

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The authors declare no conflict of interest.

Published 31 January 2023

hydrothermal vent systems, natural or artificial marine surfaces, jellyfishes, biofilms, and kelp forests (1).

Data pertinent to prokaryotes derived from aquatic hosts are presented in the current report. Other taxonomic changes of veterinary importance relative to bacteria derived from domestic animals (4) and nondomestic wildlife animals (5) are presented in other reports in this issue of *Journal of Clinical Microbiology*.

METHODS

Valid and effectively published novel and revised taxa pertinent to prokaryotic species must satisfy two requirements. First, original investigations are published in the *International Journal of Systematic and Evolutionary Microbiology* (*IJSEM*). One example is provided (6). In addition, type strains are to be deposited into recognized culture collections in two separate countries.

As an alternative to primary publication in *IJSEM*, studies may be published in another journal, with subsequent acceptance by *IJSEM*. One past example relative to prokaryotes derived from aquatic hosts is the effective description of *Photobacterium sanguinicancri* (7), with subsequent acceptance on an *IJSEM* Validation List (8). Six times per year, *IJSEM* publishes papers that are now entitled "Valid publication of new names and new combinations effectively published outside the IJSEM." To be considered for inclusion on these validation lists, authors must submit a copy of the previously published manuscript to the editorial office of *IJSEM* for confirmation that all elements necessary for valid publication (including culture collection deposition) have been met. It must be noted that taxa within primary publication and those on validation lists may be subject to reclassification based on a synonym designation or transfer to another genus. We attempt to capture additional revisions in this report.

In such fashion, journals that have recently published studies providing an effective description of novel taxa from aquatic hosts which may be relevant to the practice of clinical veterinary microbiology include *Antonie Van Leeuwenhoek*, *Archives of Microbiology*, *Current Microbiology*, *Diseases of Aquatic Organisms*, *Frontiers in Microbiology*, *Journal of Microbiology*, *Journal of Microbiology and Biotechnology*, and *Systematic and Applied Microbiology*. Journals that have recently published studies reflecting revisions in prokaryotic taxonomy relative to aquatic hosts include *Antonie Van Leeuwenhoek* and *Frontiers in Microbiology*.

All issues of *IJSEM* published from January 2018 through December 2021 (including 24 validation lists) were searched for original articles describing new species taxonomy or accepted changes in taxonomic nomenclature. This audit was further filtered by organisms recovered from aquatic host species. Published or accepted taxa that were isolated directly from seawater or freshwater were excluded from further investigation.

RESULTS AND DISCUSSION

A compilation of novel prokaryotic taxa recovered from aquatic host species stratified by Gram reaction and cellular morphology is presented in Table 1. Correct and updated *Enterobacterales* family designations (9) for selected taxa are concomitantly provided. It should be noted that within Table 1, a subset of biochemical testing results was derived from methods that are potentially antiquated, time-consuming, and/or not routinely available in veterinary microbiology laboratories; furthermore, definitive identification of other novel taxa may necessitate molecular, MALDI-TOF MS, or sequencing modalities. Table 2 provides taxonomic revisions for organisms originally recovered from aquatic host species. It should be further noted that alternate means of classifying novel and revised species can be based on higher-level phylogenetic-based nomenclature, some of which has recently undergone significant revision at the phylum level (10).

Most new descriptions are derived from surveys of normal aquatic animal tissue or intestinal tract, which has resulted in the naming of a multitude of new taxa. Identification of normal or colonizing flora from coral, sponges, and other invertebrates as well as fish aids in understanding the breadth of diversity of bacteria, of which we know little. These

TABLE 1 Novel bacterial species (including members of the phylum *Planctomycetota*) recovered from aquatic veterinary material reported from January 2018 through December 2021

Scientific name	Family	Source	Growth characteristics	Reference(s)
Gram-positive cocci				
Tessaracoccus aquimaris sp. nov.	*Propionibacteriaceae*	Intestine of Korean rockfish (*Sebastes schlegelii*)	Aerobic, nonmotile, catalase-negative, oxidase-negative Gram-positive coccus; 0.5- to 1.0-mm diam circular, slightly convex, pale yellow colonies on Reasoner's 2A agar; optimal growth at 30°C; α-mannosidase-, α-fucosidase-, D-mannitol-, dulcitol-, D-sorbitol-, methyl α-D-galactoside-positive; C4 esterase-, methyl α-D-glucopyranoside-, inulin-, potassium 5-ketogluconate-, D-fructose-, pyruvate-negative	46
Streptococcus penaeicida sp. nov.	*Streptococcaceae*	Diseased farmed Pacific white shrimp (*Penaeus vannamei*) from Guatemala	Facultative, nonmotile, catalase-negative, oxidase-negative Gram-positive coccus; 0.75- to 1.0-mm diam α-hemolytic, circular, nonpigmented colonies on blood agar; growth range at 20–40°C; reacts with Lancefield group B antisera; positive reactions for β-galactosidase, arbutin, cellobiose, melezitose, gentiobiose, glycogen, L-sorbose, mannitol, starch; negative reactions for acetoin, arginine dihydrolase, sucrose, D-tagatose, indole, glycerol, inulin, L-arabinose	14
Salinicoccus cyprini sp. nov.	*Staphylococcaceae*	Gastrointestinal tract of mirror carp (*Cyprinus carpio* var. *Specularis*) from India	Aerobic, nonmotile, catalase-positive, oxidase-positive, non-spore-forming Gram-positive coccus; 0.8- to 1.8-mm diam smooth, circular, orange-to-pink-pigmented colonies on marine agar; optimal growth at 30°C; also cultivated on nutrient agar, Luria Bertani agar, brain heart infusion agar; limited growth on yeast mannitol agar; DNase, arginine dihydrolase-, nitrate reduction-, urease-, D-fructose-, D-glucose-, maltose-, sucrose-positive; esculin-, Voges-Proskauer-, D-galactose-, glycerol-, D-mannitol-negative	47
Pseudokineococcus galaxeicola sp. nov.	*Kineosporiaceae*	Mucus of coral (*Galaxea* spp.) from China	Aerobic, motile, catalase-positive, oxidase-positive Gram-positive coccus; opaque, deep orange colonies on tryptic soy agar; optimal growth at 25–35°C; D-mannose-positive; weakly reactive for melibiose, L-fucose, D-sorbitol, malic acid; D-arabinose-, urease-, starch-, gelatin-, nitrate reduction-, turanose-, xylitol-, glycogen-, arbutin-negative	48
Gram-positive bacilli				
Paenibacillus crassostreae sp. nov.	*Paenibacillaceae*	Pacific oyster (*Crassostrea gigas*) from Korea	Facultative, motile, catalase-positive, oxidase-positive, spore-forming Gram-positive bacillus; 1.0- to 1.5-mm diam cream-colored, circular, slightly convex colonies on tryptic soy agar; optimal growth at 25°C; hydrolyzes starch, but not urea or casein; L-arabinose-, inulin-, melibiose-, α-galactosidase-, β-galactosidase-, β-glucosidase-positive; D-fructose-, D-galactose-, gluconate-, D-mannitol-, trehalose-, D-xylose-, acid phosphatase-, alkaline phosphatase-	49

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			leucine arylamidase-, α-glucosidase-negative	
Rhodococcus electrodiphilus sp. nov.	*Nocardiaceae*	Coral reef from India	Aerobic, nonmotile, catalase-positive, oxidase-negative, non-spore-forming Gram-positive mycelium-forming filaments (in early stages of development); cells are filamentous in early growth phase, then transition to bacillus- or coccoid-shaped elements; small, smooth, convex, dark red-pigmented colonies on marine agar; optimal growth at 30°C; hydrolyzes casein and Tween 80, fails to hydrolyze urea and Tween 40; *m*-inositol-, esculin-, phenol-, cellobiose-, cellulose-, rhamnose-positive; uric acid-, sodium gluconate-, maltose-negative	11
Streptomyces reniochalinae sp. nov.	*Streptomycetaceae*	Marine sponge from China	Aerobic, nonmotile, non-acid-fast, Gram-positive mycelium-forming filaments; hooked and looped aerial hyphae differentiated into chains of smooth-surfaced spores; growth range at 20–40°C; weakly positive reactions for Tween 20 hydrolysis, L-alanine, L-arginine, L-asparagine, glycine, L-histidine, L-hydroxyproline; negative reactions for L-valine, esculin	50
Streptomyces diacarni sp. nov.	*Streptomycetaceae*	Marine sponge from China	Aerobic, nonmotile, non-acid-fast, Gram-positive mycelium-forming filaments; hooked and looped aerial hyphae differentiated into chains of smooth-surfaced spores; growth range at 20–40°C; positive reactions for Tween 20 hydrolysis, L-alanine, L-arginine, L-asparagine, glycine, L-histidine, L-hydroxyproline; weakly positive reactions for L-valine, esculin	50
Spongiactinospora rosea gen. nov., sp. nov.	*Streptosporangiaceae*	Marine sponge (*Craniella* spp.) from China	Aerobic, nonmotile, catalase-positive, Gram-positive mycelium-forming filaments; aerial hyphae differentiated into pseudosporangia and chains of ridge-surfaced spores; light yellowish/brown pigments produced on International *Streptomyces* Project (ISP) 1–3, modified Bennett, and nutrient agar media; growth range at 20–40°C; positive for gelatin hydrolysis, Tweens 20, 40, and 60 hydrolysis, milk coagulation, peptonization; negative for esculin hydrolysis, starch hydrolysis, carboxymethylcellulose hydrolysis, melanin production, H_2S production; major menaquinones MK-10(H_4), MK-10(H_6)	51
Micromonospora craniellae sp. nov.	*Micromonosporaceae*	Marine sponge (*Craniella* spp.) from China	Aerobic, nonmotile, catalase-positive, Gram-positive mycelium-forming filaments; single or clustered smooth-surfaced spores; growth range at 20–34°C; positive for nitrate reduction, gelatin hydrolysis, Tweens 40 and 60 hydrolysis, carboxymethylcellulose hydrolysis; negative for Tweens 20 and 80 hydrolysis, esculin hydrolysis, melanin production, milk coagulation and peptonization, starch	52

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			hydrolysis, H_2S production; major menaquinone MK-9(H_4); major fatty acids iso-$C_{16:0}$, iso-$C_{15:0}$, $C_{17:1}$*w8c*, $C_{18:1}$ *w9c*	
Actinomadura craniellae sp. nov.	*Thermomonosporaceae*	Marine sponge (*Craniella* spp.) from China	Aerobic, nonmotile, catalase-positive, Gram-positive mycelium-forming filaments; white aerial mycelia and curved spore-chains form on ISP 3 medium with 5–8 spherical spores; diffusible pigments absent on other media (including modified Bennett, nutrient, and tryptic soy agar); growth range at 20–40°C; positive for nitrate reduction, Tweens 20, 40, 60, and 80 hydrolysis; negative for carboxymethylcellulose hydrolysis, esculin hydrolysis, gelatin liquefaction, melanin production, milk peptonization, starch hydrolysis, H_2S production; major menaquinones MK-9(H_6), MK-9(H_8); major fatty acids iso-$C_{16:0}$, iso-$C_{18:0}$, 10-methyl $C_{17:0}$, $C_{18:1}$ *w9c*	53
Geodermatophilus marinus sp. nov.	*Geodermatophilaceae*	Marine sponge (*Leucetta chagosensis*) from China	Catalase-positive mycelium-forming filaments; black-pigmented colonies without diffusible pigments on ISP, modified Bennett, nutrient agar, potato dextrose agar, and tryptic soy agar media; growth range at 20–40°C; positive for gelatin hydrolysis; negative for carboxymethylcellulose hydrolysis, Tweens 20, 40, 60, and 80 hydrolysis, esculin hydrolysis, melanin production, milk coagulation and peptonization, nitrate reduction, starch hydrolysis, H_2S production; major fatty acids iso-$C_{16:0}$, iso-$C_{16:1}$ h; major menaquinone MK-9(H_4)	54
Erysipelothrix piscisicarius sp. nov.	*Erysipelotrichaceae*	Diseased ornamental fish from United States	Aerobic, nonmotile, catalase-negative, oxidase-negative Gram-positive bacillus; small, gray, convex, γ-hemolytic colonies on tryptic soy agar with 5% sheep blood; optimal growth at 37°C after 48 hours; phenotypically like *E. rhusiopathiae* but lacks ability to metabolize lactose and L-rhamnose; possesses surface protective antigen C (*spaC* determinant)	16
Arthrobacter ulcerisalmonis sp. nov.	*Micrococcaceae*	Ulcer of farmed Atlantic salmon (*Salmo salar*) from Chile	Aerobic, nonmotile, catalase-positive, oxidase-negative, non-spore-forming, irregular Gram-positive bacillus; 0.5-mm diam creamy/whitish to beige, nontranslucent colonies on tryptic soy agar; growth range at 10–35°C; esculin hydrolysis-, D-ribose-positive; D-xylose-, D-sorbitol-, *N*-acetyl-D-glucosamine-negative; major fatty acids anteiso-$C_{15:0}$, iso-$C_{16:0}$, anteiso-$C_{17:0}$; major menaquinone MK-9(H_2)	18
Saccharopolyspora coralli sp. nov.	*Pseudonocardiaceae*	Stony coral (*Porites* spp.) from China; taxon has been subsequently revised to novel genus *Allosaccharopolyspora* (refer to Table 2)	Aerobic, nonmotile, catalase-positive, oxidase-negative, Gram-positive mycelium-forming filaments; no soluble pigments or spores produced; white to pale yellow substrate mycelium on tryptic soy agar; optimal growth at 25–30°C; gelatin hydrolysis-, L-arabinose-, trisodium citrate-, urease-, valine arylamidase-	55

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			positive; *p*-nitrophenol-β-D-galactopyranoside-, α-chymotrypsin-, β-glucosidase-negative; major fatty acids iso-$C_{15:0}$, iso-$C_{16:0}$, $C_{17:1}$ *w8c*	
Glutamicibacter mishrai sp. nov.	*Micrococcaceae*	Coral (*Favia veroni*) from India	Aerobic, nonmotile, catalase-positive, oxidase-positive, non-spore-forming Gram-positive bacillus; 1-mm diam smooth, light yellow-pigmented colonies on marine agar; optimal growth at 28–37°C; citrate-, starch-, DNase, gelatin-, C4 esterase-, C8 esterase lipase-, and leucine arylamindase-positive; indole-, Voges Proskauer-, nitrate reduction-, urease-, esculin-, cellulose-, casein-, C14 lipase-, alkaline phosphatase-, and valine arylamidase-negative; reported susceptibility to vancomycin, ciprofloxacin, erythromycin, ampicillin, tetracycline, polymyxin B, gentamicin	56[a]
Aeromicrobium piscarium sp. nov.	*Nocardioidaceae*	Intestine of *Collichthys lucidus* from China	Facultative, nonmotile, catalase-positive, oxidase-negative Gram-positive bacillus; $<$1-mm diam circular, white smoke-pigmented colonies on marine agar; optimal growth at 28°C; positive for starch hydrolysis, gelatinase, Tweens 20 and 40 hydrolysis, α-D-glucose, D-serine, D-gluconic acid; negative for carboxymethylcellulose hydrolysis, nitrate reduction, C4 esterase, indole, urease, H_2S, casein hydrolysis, alginate hydrolysis, maltose, Tweens 60 and 80 hydrolysis	57
Streptomyces dysideae sp. nov.	*Streptomycetaceae*	Marine sponge (*Dysidea tupha*) from Croatia	Aerobic, Gram-positive mycelium-forming filaments; aerial hyphae differentiate into spiral chains of spores; growth range at 25–30°C on nutrient agar; blue pigment forms on Reasoner's 2A agar at 25°C; assimilates D-fructose, lactose, raffinose, ribose, sucrose; major menaquinones MK-9(H_4) and MK-9(H_6); major fatty acids iso-$C_{16:0}$, $C_{16:0}$, anteiso-$C_{17:1}$ *w9c*, anteiso-$C_{17.0}$, iso-$C_{16:1}$ h	58
Nocardiopsis coralli sp. nov.	*Nocardiopsaceae*	Coral (*Galaxea astreata*) from China	Nonmotile, catalase-positive, Gram-positive mycelium-forming filaments; aerial hyphae and substrate mycelia differentiated into short chains of smooth-surfaced spores; convex, irregular colonies on all media, except ISP 3 agar; color of substrate mycelium is light-yellow to orange-yellow; optimal growth at 28°C; D-xylose-, D-arabinose-, melibiose-, D-galactose-, D-glucose-positive; raffinose-, L-serine-, L-valine-, L-phenylalanine-, L-asparagine-, L-threonine-, L-glycine, L-proline-negative; major menaquinones MK-10(H_8), MK-10(H_6), MK-10(H_4)	59
Brachybacterium subflavum sp. nov.	*Dermabacteraceae*	Foregut of grass carp (*Ctenopharyngodon idella*) from China	Aerobic, nonmotile, catalase-positive, oxidase-negative, non-spore-forming Gram-positive actinobacterium; circular, smooth, pale-yellow colonies on Luria Bertani agar; growth range at 4–37°C; positive for starch hydrolysis, gelatin	60

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			hydrolysis, D-maltose, milk coagulation and peptonization, acid phosphatase, C14 lipase, β-galactosidase; negative for nitrate reduction, H_2S production, D-fructose, D-arabitol, urease, Tweens 20, 40, 60, and 80 hydrolysis; major menaquinone MK-7 (H_4); major fatty acids anteiso-$C_{15:0}$, anteiso-$C_{17:0}$, iso-$C_{16:0}$	
Rhodococcus spongiicola sp. nov.	*Nocardiaceae*	Marine sponge from China	Aerobic, nonmotile, catalase-positive, non-spore-forming Gram-positive bacillus; circular, opaque, convex, light yellow colonies; best growth on nutrient agar, with optimal growth temp 28°C; D-fructose-, glycerol-, sodium acetate-, sodium pyruvate-positive; D-ribose-, D-xylose-, Tween 80 hydrolysis-negative; weakly hydrolyzes esculin; major menaquinone MK−8(H_4); major fatty acids $C_{16:0}$, $C_{18:1}$ *w9c*	12
Rhodococcus xishaensis sp. nov.	*Nocardiaceae*	Marine sponge from China	Aerobic, nonmotile, catalase-positive, non-spore-forming Gram-positive bacillus; circular, opaque, convex, light yellow colonies; best growth on nutrient agar, with optimal growth temp 28°C; D-fructose-, glycerol-, sodium acetate-, sodium pyruvate-, D-ribose-, D-xylose-positive; Tween 80 hydrolysis-, esculin hydrolysis-negative; major menaquinone MK-8(H_4); major fatty acids $C_{16:0}$, $C_{18:0}$ 10 methyl, TBSA, $C_{18:1}$ *w9c*	12
Streptomyces bathyalis sp. nov.	*Streptomycetaceae*	Sponge collected from Atlantic Ocean	Aerobic, Gram-positive mycelium-forming filaments; aerial hyphae only observed on ISP 3, 7 agars; spores not detected on any medium; good growth on ISP 2, 3, 4, and 5 agars (sparse growth on agars 6 and 7) without diffusible pigment; optimal growth at 25–30°C; trypsin-, β-galactosidase-positive; C14 lipase-, β-glucosidase-, cellulose-negative; major menaquinone MK-9(H_8); major fatty acids iso-$C_{16:0}$, anteiso-$C_{15:0}$, iso-$C_{15:0}$	61[b]
Gram-negative cocci				
Roseomonas coralli sp. nov.	*Acetobacteraceae*	Gorgonian coral sample from China	Aerobic, nonmotile, catalase-positive, oxidase-positive, non-spore-forming Gram-negative coccus; pink-pigmented colonies on Reasoner's 2A agar; optimal growth at 28°C; capable of resisting heavy metal; D-adonitol-, methyl α-D-mannopyranoside-, methyl α-D-glucopyranoside-, lactose-, trehalose-, raffinose-, alkaline phosphatase-, acid phosphatase-positive; D-fructose-, cellobiose-, gentiobiose-, D-tagatose-negative; reported susceptibility to erythromycin, gentamicin, clindamycin, cephazolin, minocycline, levofloxacin	62
Gram-negative bacilli and coccobacilli				
Thalassotalea coralli sp. nov.	*Colwelliaceae*	Torch coral (*Euphyllia glabrescens*) from Taiwan	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 1.0- to 2.2-mm diam circular, convex, white colonies	63

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			on marine agar; optimal growth at 25–30°C; hydrolyzes starch, casein, chitin, DNA, and Tweens 20, 40, 60, and 80; fails to hydrolyze urea, alginate; C8 esterase lipase-, C14 lipase-, α-chymotrypsin-, D-fructose-, trehalose-positive; cellobiose-, D-glucose-, D-mannose-, succinate-, *N*-acetyl-β-glucosaminidase-negative; reported susceptibility to penicillin, chloramphenicol, gentamicin, tetracycline, nalidixic acid	
Litoribrevibacter euphylliae sp. nov.	*Oceanospirillaceae*	Torch coral (*Euphyllia glabrescens*) from Taiwan	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 0.5- to 1.5-mm diam circular, convex, translucent colonies on marine agar; optimal growth at 25°C; urease-, acetoin-, D-arabinose-, L-arabinose-, D-xylose-, galactose-, glucose-, rhamnose-, cellobiose-, mannose-, maltose-, lactose-, melbiose-, sucrose-, trehalose-, D-fucose-, L-fucose-, erythritol-, adonitol-, inositol-, sortibol-positive; β-galactosidase-, arginine dihydrolase-, tryptophan deaminase-, valine arylamidase-, indole-, arabinose-negative	64
Agaribacterium haliotis gen. nov., sp. nov.	*Cellvibrionaceae*	Feces from abalone (*Haliotis discus hannai*) from China	Oxidase-positive, catalase-negative Gram-negative bacillus; 0.8-mm diam white, small, circular, crater-like colonies on marine agar; optimal growth at 28–30°C; acid phosphatase-, β-galactosidase-, α-glucosidase-, nitrate reduction-positive; cellulose-, esculin-, indole-, citrate-, C8 esterase lipase-, Voges Proskauer-, H_2S-negative	65
Hydrogenophaga crassostreae sp. nov.	*Comamonadaceae*	Pacific oyster (*Crassostrea gigas*) from Republic of Korea	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; convex, elevated, circular, yellow-pigmented colonies on marine agar; optimal growth at 25°C; nitrate reduction-, hypoxanthine hydrolysis-, Tween 80 hydrolysis-, β-galactosidase-, C8 esterase lipase-, acid phosphatase-positive; denitrification-, DNase, esculin hydrolysis-, Tween 20 hydrolysis-, C4 esterase-, α-galactosidase-, α-glucosidase-, β-glucosidase-negative	66
Colwellia echini sp. nov.	*Colwelliaceae*	Sea urchin from Denmark	Facultative, motile, oxidase-positive, catalase-positive Gram-negative bacillus; circular, convex, mucoid colonies on marine agar; optimal growth at 20°C; starch hydrolysis-, agar hydrolysis-, *K*-carrageenan hydrolysis-, D-glucose-, urease-, mannitol-, alginate hydrolysis-, acid phosphatase-, naphthol-AS-BI-phosphohydrolase-positive; gelatin hydrolysis-, valine arylamidase-, trypsin-, α-chymotrypsin-, *N*-acetyl-β-glucosaminidase-negative	67
Photobacterium toruni sp. nov.	*Vibrionaceae*	Diseased farmed fish from Spain	Facultative, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 1.5-mm to 2.5-mm diam colonies on tryptic soy agar (supplemented with 1.5% NaCl) without	33

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			diffusible pigment; growth range at 4–30°C; growth on thiosulfate citrate bile salts sucrose agar; lysine decarboxylase-, acetoin-, nitrate reduction-, amylase-, D-glucose-, D-galactose-positive; indole-, ONPG-, gelatinase-, D-mannitol-, sucrose-, L-arabinose-, cellobiose-, trehalose-negative	
Acinetobacter piscicola sp. nov.	*Moraxellaceae*	Diseased farmed Murray cod (*Maccullochella peelii peelii*) from China	Facultative, nonmotile, oxidase-negative, catalase-positive, non-spore-forming Gram-negative coccobacillus; 1.0-mm to 3.0-mm diam smooth, convex, milky-yellow, circular colonies on Luria Bertani agar; optimal growth at 25–28°C; nonhemolytic on sheep blood agar; β-alanine-, L-arginine-, azelate-, citrate-, DL-lactate-, L-glutamate-, glutarate-, D-malate-positive; gelatin liquefaction-, adipate-, L-arabinose-, L-aspartate-, 2,3-butanediol-, ethanol-, L-histidine-, phenylacetate-, L-phenylalanine-negative	68
Bizionia berychis sp. nov.	*Flavobacteriaceae*	Intestinal tract of splendid alfonsino (*Beryx splendens*) from Pacific Ocean	Aerobic, nonmotile, oxidase-positive, catalase-positive, Gram-negative bacillus; 1.0-mm to 2.0-mm diam circular, smooth, glistening, yellow-pigmented colonies on marine agar; optimal growth at 25°C; no growth at 35°C; positive for casein, gelatin, L-tyrosine, Tweens 20, 60, and 80 hydrolysis; nitrate reduction-, C4 esterase-, valine arylamidase-positive; cystine arylamidase-negative; reported susceptibility to chloramphenicol and oleandomycin	69
Vitellibacter todarodis sp. nov.	*Flavobacteriaceae*	Intestinal tract of a squid (*Todarodes pacificus*) from South Korea; taxon has been subject to subsequent revision to novel genus *Aequorivita* (refer to Table 2)	Aerobic, nonmotile, oxidase-positive, catalase-positive, Gram-negative bacillus; 1.0-mm to 1.5-mm diam circular, smooth, glistening, vivid orange/yellow-pigmented colonies on marine agar; optimal growth at 30–35°C; positive for Tween 80 hydrolysis; cystine arylamidase-, trypsin-, *N*-acetyl-β-glucosaminidase-negative; weakly reactive for α-chymotrypsin; reported susceptibility to carbenicillin, tetracycline; reported resistance to penicillin G, streptomycin	70
Tenacibaculum todarodis sp. nov.	*Flavobacteriaceae*	Isolated from squid (*Todarodes pacificus*) from Korea	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 0.5-mm to 1.0-mm diam circular, slightly convex, yellow-pigmented colonies on marine agar; optimal growth at 25°C; DNase, Tween 80 hydrolysis-positive; nitrate reduction-, Tweens 20, 40, and 60 hydrolysis-, C4 esterase-, C8 esterase lipase-, α-chymotrypsin-negative; weakly reactive for cystine arylamidase	71
Winogradskyella pocilloporae sp. nov.	*Flavobacteriaceae*	Healthy tissue coral (*Pocillopora damicornis*)	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; circular, slightly convex, shiny, orange/yellow-pigmented colonies on marine agar; optimal growth at 25°C; growth on Reasoner's 2A and tryptic soy agars only when supplemented with 3% NaCl;	72

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			positive for starch hydrolysis, Tweens 40 and 60 hydrolysis; negative for tyrosine hydrolysis, Tweens 20 and 80 hydrolysis, gelatin hydrolase, cystine arylamidase; weakly reactive for leucine arylamidase, valine arylamidase	
Sansalvadorimonas verongulae gen. nov., sp. nov.	*Hahellaceae*	Marine sponge (*Verongula gigantea*) from San Salvador	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; initial punctiform, translucent colonies transition to cream/pale yellow colonies on marine agar; optimal growth at 30°C; arginine dihydrolase-, C4 esterase-, C8 esterase lipase-, dextrin-, D-cellobiose-, D-fructose-, D-mannitol-, D-mannose-, sucrose-, trehalose-, acetate-positive; nitrate reduction-, esculin-, gelatin-, β-galactosidase-, cysteine arylamidase-, D-melibiose-, L-rhamnose-negative	13
Zhouia spongiae sp. nov.	*Flavobacteriaceae*	Sponge from China	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 1-mm to 2-mm diam circular, smooth, opaque, pale yellow-pigmented colonies on marine agar; optimal growth at 28°C; hydrolyze Tweens 20, 40, and 80; β-glucosidase-, acetoin-, nitrate reduction-, denitrification-positive; starch hydrolysis-, α-chymotrypsin-, β-galactosidase-, α-fucosidase-, gelatin hydrolysis-negative	73
Aquimarina spongiicola sp. nov.	*Flavobacteriaceae*	Spongin from South Korea	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 1-mm to 2-mm diam circular, convex, opaque, orange-pigmented colonies on marine agar; optimal growth at 30°C; L-arabinose-, D-glucose-, DL-lactate-, D-mannitol-, D-mannose-, L-serine-, D-sorbitol-, C4 esterase-, C8 esterase lipase-positive; DNase, Tween 80 hydrolysis-, cellulose-, arginine dihydrolase-, inositol-, propionate-, L-rhamnose-, urease, cystine arylamidase-negative	74
Parendozoicomonas haliclonae gen. nov., sp. nov.	*Endozoicomonadaceae*	Marine sponge (genus *Haliclona*)	Facultative, motile, oxidase-positive, catalase-positive, Gram-negative bacillus; 1-mm to 2-mm diam circular, convex, shiny, transparent white-, later orange-, pigmented colonies on marine agar; optimal growth at 25–30°C; DNase, esculin-positive; gelatin hydrolysis-negative; major fatty acids summed feature 8 ($C_{18:1}$ *w7c*/$C_{18:1}$ *w6c*), summed feature 3 ($C_{16:1}$ *w7c*/$C_{16:1}$ *w6c*), $C_{16:0}$; major ubiquinone Q-9	75[c]
Lelliottia jeotgali sp. nov.	*Enterobacteriaceae*	Traditional Korean fermented clam from Republic of Korea	Facultative, motile, oxidase-negative, catalase-positive Gram-negative bacillus; 4-mm to 5-mm diam irregularly circular, smooth, translucent, flat or raised, beige-pigmented colonies on nutrient agar; optimal growth at 30°C (growth also at 45°C); growth on MacConkey, tryptic soy, Luria Bertani, M17 agars; potassium gluconate-, potassium 5-ketogluconate-,	76

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			γ-glutamyltransferase-, α-glucosidase-, L-proline arylamidase-positive; arbutin-, salicin-, D-tagatose-, sucrose-, β-xylosidase-, β-glucosidase-negative	
Coralloluteibacterium stylophorae gen. nov., sp. nov.	*Lysobacteraceae*	Reef-building coral (*Stylophora* spp.) from Taiwan	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 0.5-mm to 3-mm diam round, smooth, convex, yellow-pigmented colonies on marine agar; optimal growth at 30–35°C; indole-, C14 lipase-, valine arylamidase-, cystine arylamidase-, esculin hydrolysis-positive; nitrate reductase-, trypsin-, α-chymotrypsin-, starch hydrolysis-, urease-negative	77[d]
Motiliproteus coralliicola sp. nov.	*Oceanospirillaceae*	Coral from China	Aerobic, motile, oxidase-positive, catalase-negative, non-spore-forming Gram-negative bacillus; circular, convex, light brown-pigmented colonies on 2216E agar; optimal growth at 30°C; denitrification-, acid phosphatase-, alkaline phosphatase-positive; starch-, Tween hydrolysis-, H_2S-negative	78
Hanstruepera crassostreae sp. nov.	*Flavobacteriaceae*	Pacific oyster (*Crassostrea* spp.) from China; taxon now considered to be synonym (refer to Table 2)	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 1-mm to 2-mm diam circular, convex, opaque, orange-pigmented colonies on marine agar; optimal growth at 33°C; α-chymotrypsin-, maltose-, *N*-acetyl-D-galactosamine-positive; cystine arylamidase-, urease-, ornithine decarboxylase-, gelatin-, L-proline-negative	79
Cohaesibacter celericrescens sp. nov.	*Cohaesibacteraceae*	Gut of sea catfish from China	Facultative, motile, oxidase-negative, catalase-positive Gram-negative bacillus; 1-mm to 2-mm diam circular, convex, opaque, orange-pigmented colonies on marine agar; optimal growth at 30°C; turanose-, acid phosphatase-, leucine arylamidase-, D-mannose-, cellobiose-positive; raffinose-, alkaline phosphatase-, L-rhamnose-, L-fucose-negative	80
Photobacterium andalusiense sp. nov.	*Vibrionaceae*	Diseased farmed fish from Spain	Facultative, motile, oxidase-positive, catalase-positive Gram-negative bacillus; regular colonies without diffusible pigment cultivated on tryptic soy agar supplemented with 1.5% NaCl; growth range at 4–35°C (no growth at 45°C); β-galactosidase-, ONPG-positive	34[e]
Photobacterium malacitanum sp. nov.	*Vibrionaceae*	Diseased farmed fish from Spain	Facultative, motile, oxidase-positive, catalase-positive Gram-negative bacillus; regular colonies without diffusible pigment cultivated on tryptic soy agar supplemented with 1.5% NaCl; growth range at 4–30°C (weak growth at 35°C); β-galactosidase-negative; weakly reactive for ONPG	34[e]
Motilimonas pumila sp. nov.	No family assignment	Gut of sea cucumber (*Apostichopus japonicus*) from China	Facultative, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 0.5-mm diam circular, beige-pigmented colonies on marine agar; optimal growth at 28–30°C; starch-, arginine dihydrolase-, acid	81

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TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			phosphatase-, mannose-, maltose-positive; sodium citrate-, C8 esterase lipase-negative	
Erythrobacter spongiae sp. nov.	*Erythrobacteraceae*	Sponge from China; taxon now considered to be synonym (refer to Table 2)	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 0.7-mm to 1.0-mm diam smooth, circular, opaque, orange/yellow-pigmented colonies on marine agar; optimal growth at 28°C; hydrolysis of Tweens 20, 40, and 80; C4 esterase-, C8 esterase lipase-, α-chymotrypsin-, acid phosphatase-, β-glucosidase-, capric acid-, trisodium citrate-positive; nitrate reductase-, Voges-Proskauer-, C14 lipase-, gelatin hydrolysis-, trypsin-, β-galactosidase-negative	82
Lysobacter spongiae sp. nov.	*Lysobacteraceae*	Isolated from spongin from Republic of Korea	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 0.5-mm to 2-mm diam smooth, convex, circular, yellow/orange-pigmented colonies on marine agar; optimal growth at 30°C; growth on MacConkey, Reasoner's 2A, nutrient, tryptic soy agars; L-arabinose-, malate-, L-fucose-, L-histidine-, L-proline-, D-ribose-, D-sucrose-, L-alanine-, α-chymotrypsin-, α-glucosidase-, *N*-acetyl-β-glucosaminidase-positive; valerate-, 3-hydroxy-butyrate-, malonate-, glycogen-, valine arylamidase-negative	83[f]
Altererythrobacter spongiae sp. nov.	*Erythrobacteraceae*	Sponge from China	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 0.8-mm to 1-mm diam circular, smooth, opaque, yellow-pigmented colonies on marine agar; optimal growth at 28°C; trypsin-, valine aminopeptidase-, α-chymotrypsin-, Voges-Proskauer-positive; casein hydrolysis-, β-galactosidase-, β-glucuronidase-negative	84
Pelagibaculum spongiae gen. nov., sp. nov.	*Alcanivoracaceae*	Marine sponge from Iceland	Aerobic, motile, oxidase-positive, catalase-negative, non-spore-forming Gram-negative bacillus; 1-mm to 2-mm diam circular, raised, tan-pigmented colonies on marine agar; optimal growth at 20–22°C; alkaline phosphatase-, esterase-, leucine arylamidase-positive; valine arylamidase-, trypsin-, urease-, arginine dihydrolase-, D-glucose-negative	85
Corallincola holothuriorum sp. nov.	*Psychromonadaceae*	Sea cucumber intestine from China	Facultative, motile, oxidase-positive, catalase-negative, Gram-negative bacillus; creamy, white colonies; optimal growth at 28–30°C; starch hydrolysis-, gelatin hydrolysis-, D-fructose-positive; agar hydrolysis-, sucrose-negative	86
Empedobacter tilapiae sp. nov.	*Weeksellaceae*	Intestine of Nile tilapia (*Oreochromis niloticus*) from Republic of Korea	Aerobic, nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 1-mm to 2-mm diam circular, slightly convex, smooth, pale yellow-pigmented colonies on marine agar; optimal growth at 30°C; trypsin-positive; esculin hydrolysis-, D-glucose-, starch-, α-glucosidase-negative; reported susceptibility to oleandomycin; reported	87

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TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			resistance to kanamycin, lincomycin, novobiocin, streptomycin	
Paracoccus tegillarcae sp. nov.	*Rhodobacteraceae*	Gastrointestinal tract of blood cockle (*Tegillarca granosa*) from Republic of Korea	Aerobic, nonmotile, oxidase-positive, catalase-positive, Gram-negative bacillus; circular, convex, glossy, pale yellow-pigmented colonies on marine agar; optimal growth at 20°C; valine arylamidase-, D-galactose-, potassium 5-keto-gluconate-positive; cystine arylamidase-, trisodium citrate-, D-adonitol-, D-sorbitol, maltose-, trehalose-negative	88
Oceaniglobus ichthyenteri sp. nov.	*Rhodobacteraceae*	Gut microflora of sea bass (*Dicentrarchus labrax* L.) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 0.8-mm to 1-mm diam circular, elevated, smooth, whitish/yellow-pigmented colonies on marine agar; optimal growth at 28–30°C; starch hydrolysis-, L-arabinose-, D-mannose, D-sorbitol-positive; nitrate reduction-, acid phosphatase-negative	89
Undibacterium piscinae sp. nov.	*Oxalobacteraceae*	Intestinal tract of Korean shiner (*Coreoleuciscus splendidus*) from Republic of Korea	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; creamy, translucent, colonies with a wavy rim on Reasoner's 2A agar; optimal growth at 20°C; nitrate reduction-, maltose-positive; C4 esterase-, esculin hydrolysis-, mannose-, cellobiose-negative	90
Cohaesibacter intestini sp. nov.	*Cohaesibacteraceae*	Intestine of adult abalone (*Haliotis discus hannai*) from China	Facultative, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 1-mm to 2-mm diam circular, milky white colonies on agar plate; optimal growth at 28–33°C; malic acid-, maltose-, L-arabinose-positive; urease-, lipase-, D-glucose-, D-mannose-negative	91
Parashewanella tropica sp. nov.	*Shewanellaceae*	Marine sponge from Federated States of Micronesia	Facultative, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 1-mm to 1.5-mm diam circular, convex, smooth, pale tan-pigmented colonies on marine agar; optimal growth at 24–32°C; L-glutamic acid-, L-alanine-, L-arginine-, L-aspartic acid-, Tween 40 hydrolysis-positive; gelatin hydrolysis-, esculin hydrolysis-, β-galactosidase-, L-lactic acid-negative	92
Muricauda hymeniacidonis sp. nov.	*Flavobacteriaceae*	Sponge sample (*Hymeniacidon sinapium*) from Republic of Korea	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; circular, orange-pigmented colonies on marine agar; optimal growth at 30°C; malate-, L-fucose-, 2-ketoglutarate-positive; inositol-, α-chymotrypsin-, valine arylamidase-negative	93
Pseudomonas tructae sp. nov.	*Pseudomonadaceae*	Kidney of moribund rainbow trout	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming gram-negative bacillus; can grow on tryptic soy agar, nutrient agar, and cytophaga medium; optimal growth at 25–30°C; gelatinase-, glucose-, arginine dihydrolase-positive; esculin hydrolysis-negative	94

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TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
Ottowia flava sp. nov.	*Comamonadaceae*	Fish intestine from China	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; smooth, yellow-pigmented colonies on tryptic soy agar; optimal growth at 28°C; gelatin hydrolysis-, adipic acid-, phenylacetic acid-, alkaline-phosphatase-, C14 lipase-, cystine arylamidase-, acid phosphatase-, trypsin-, valine arylamidase-positive; nitrate reduction-, esculin hydrolysis-, maltose-, malic acid-, urease-negative	95[g]
Pedobacter nototheniae sp. nov.	*Sphingobacteriaceae*	Black rock cod (*Notothenia coriiceps*) from Chilean Antarctica	Nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; <0.5-mm diam circular, smooth, pink-pigmented colonies on tryptic soy agar; optimal growth at 25°C; no growth on MacConkey and thiosulfate citrate bile salts sucrose agars; starch hydrolysis-, C8 esterase lipase-, leucine arylamidase-, α-galactosidase-, β-galactosidase-, α-glucosidase-, β-glucosidase-, gelatin-positive; casein hydrolysis-, C4 esterase-, α-chymotrypsin-, nitrate reduction-, L-arabinose-, malic acid-negative	96[g]
Flammeovirga pectinis sp. nov.	*Flammeovirgaceae*	Gut of Korean scallop (*Patinopecten yessoensis*) from Korea	Aerobic, motile, oxidase-positive, catalase-negative, Gram-negative bacillus; reddish orange-pigmented colonies on marine agar; optimal growth at 25°C; L-fucose-positive; trehalose-, α-chymotrypsin-negative	97
Roseovarius spongiae sp. nov.	*Rhodobacteraceae*	Marine sponge from China	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 0.5-mm to 1-mm diam circular, opaque, smooth, pale yellow-pigmented colonies on marine agar; optimal growth at 37°C; urea hydrolysis-, acid phosphatase-, valine aminopeptidase-positive; Voges-Proskauer-, D-glucose, L-arabinose, D-mannose-negative; reported susceptibility to minocycline, furazolidone, ampicillin; reported resistance to erythromycin, kanamycin, tetracycline, vancomycin, polymyxin B	98
Paracoccus luteus sp. nov.	*Rhodobacteraceae*	Intestinal tract of grass carp (*Ctenopharyngodon idella*) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; punctiform, circular, convex, smooth, orange yellow-pigmented colonies on Luria Bertani agar; optimal growth at 25–28°C; nitrate reduction-, trypsin-, valine arylamidase-, rhamnose-positive; acid phosphatase-, cystine arylamidase-, D-mannitol-negative	99
Pseudooceanicola onchidii sp. nov.	*Rhodobacteraceae*	Marine invertebrate (*Onchidium* spp.) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive, Gram-negative bacillus; smooth, convex, opaque, cream-pigmented colonies; optimal growth at 35–37°C; D-galactose-, D-mannitol-, D-gluconate-, trisodium citrate-positive; esculin hydrolysis-, phenylacetic acid-, cystine arylamidase-negative	100

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TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
Muricauda alvinocaridis sp. nov.	*Flavobacteriaceae*	Shrimp gill sample from China	Aerobic, motile, oxidase-negative, catalase-negative Gram-negative bacillus; round, regular, smooth, yellow-pigmented colonies on marine agar; optimal growth at 37°C; starch hydrolysis-, C8 esterase lipase-, α-glucosidase-positive; urease-, L-arabinose-, D-xylose-, trypsin-, β-glucosidase-negative	101
Mangrovimonas spongiae sp. nov.	*Flavobacteriaceae*	Marine sponge from China	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 1-mm to 2-mm diam smooth, circular, opaque, yellow-pigmented colonies on marine agar; optimal growth at 25°C; esterase-, cystine aminopeptidase-, β-galactosidase-, arginine dihydrolase-positive; casein hydrolysis-, α-glucosidase-, D-glucose-, L-arabinose-negative	102
Carideicomes alvinocaridis gen. nov., sp. nov.	*Rhodobacteraceae*	Shrimp gill sample from China	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; round, regular, smooth, white colonies on marine agar; optimal growth at 37°C; starch hydrolysis-, cystine arylamidase-, valine arylamidase-positive; acid phosphatase-, α-galactosidase-, β-glucosidase-negative	103
Endozoicomonas coralli sp. nov.	*Endozoicomonadaceae*	Coral (*Acropora* spp.) from Taiwan	Aerobic, nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 0.5-mm to 2-mm diam circular, convex, creamy white colonies with irregular margins on marine agar; optimal growth at 30°C; starch hydrolysis-, C4 esterase-, *p*-nitrophenyl-β-galactosidase-, C8 esterase lipase-, trypsin-, L-fucose-, D-mannitol-, glucuronamide-, L-histidine-positive; esculin-, DNase, cystine arylamidase-, α-galactosidase-, *N*-acetyl-β-glucosaminidase-, L-alanine-, L-serine-, gentibiose-, sucrose-negative	104[h]
Fulvivirga aurantia sp. nov.	*Fulvivirgaceae*	Marine sponge (*Aplysina fistularis*) from the Bahamas	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; smooth, glistening, deep orange-pigmented colonies on marine agar; optimal growth at 30–37°C; L-alanine-, D-arabitol-, L-histadine-, citric acid-positive; β-glucosidase-, stachyose-, D-salacin-, glycyl-L-proline-negative	105
Xanthovirga aplysinae gen. nov., sp. nov.	*Flammeovirgaceae*	Marine sponge (*Aplysina fistularis*) from the Bahamas	Aerobic, nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; smooth, shiny, slightly raised, translucent to yellow colonies on marine agar; optimal growth at 30–37°C; nitrate reduction-, L-arginine dihydrolase-, D-galactose-positive; D-mannose-, α-hydroxy-butyric acid-negative	105
Tabrizicola piscis sp. nov.	*Rhodobacteraceae*	Whole intestinal tract of Korean indigenous freshwater fish (*Acheilognathus koreensis*)	Aerobic, nonmotile, oxidase-positive, catalase-positive, Gram-negative bacillus; creamy-pink colonies on marine agar; optimal growth at 30°C; α-galactosidase-, β-glucuronisase-, acid phosphatase-,	106

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TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			gentiobiose-positive; alkaline phosphatase-, D-glucose-, D-galactose-negative	
Teredinibacter waterburyi sp. nov.	*Cellvibrionaceae*	Gills of wood-boring mollusc (*Bankia setacea*) from United States	Aerobic, motile, Gram-negative bacillus; <0.5-mm diam circular, translucent, white to beige colonies; optimal growth at 20°C; cellulose hydrolysis-positive; agar hydrolysis-negative	107
Pseudomonas piscis sp. nov.	*Pseudomonadaceae*	Profound head ulcers of farmed Murray cod (*Maccullochella peelii peelii*) from China	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 4-mm to 5-mm diam circular, smooth, light yellow-pigmented colonies on tryptic soy agar; optimal growth at 28°C; maltose-, capric acid-, melibiose-, lysine decarboxylase-positive; gelatin hydrolysis-, D-mannitol-, trehalose-negative	108
Pelagivirga dicentrarchi sp. nov.	*Rhodobacteraceae*	Gut microflora of sea bass (*Dicentrarchus labrax* L.) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 0.3-mm to 1.0-mm diam convex, opaque, circular, pale yellow-pigmented colonies on marine agar; optimal growth at 28–30°C; Tween 20 hydrolysis-, nitrate reduction-, glycerol-, D-tagatose-, L-alanine-, L-glutamic acid-, acetoacetic acid-, propionic acid-, acid phosphatase-, alkaline phosphatase-, decarboxylase/dihydrolase enzymes-positive; Tween 40 hydrolysis-, casein hydrolysis-, D-adonitol-, D-fucose-, L-malic acid-, tryptophan deaminase-negative	109[i]
Patiriisocius marinistellae gen. nov., sp. nov.	*Flavobacteriaceae*	Surface of starfish (*Patiria pectinifera*) from Japan	Aerobic, nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; circular, slightly convex, yellow-pigmented colonies; optimal growth at 25°C; flexirubin-, gelatin hydrolysis-positive; urease-, acetoin production-negative; reported weak susceptibility to gentamycin, neomycin; reported resistance to kanamycin	110
Pukyongiella litopenaei gen. nov., sp. nov.	*Rhodobacteraceae*	Gut content of whiteleg shrimp (*Litopenaeus vannamei*) from South Korea	Aerobic, nonmotile, oxidase-positive, catalase-negative, non-spore-forming Gram-negative bacillus; <2-mm diam circular, flat, bright ivory-pigmented colonies on marine agar; optimal growth at 30°C; alkaline phosphatase-, C4 esterase-, cystine arylamidase-, trypsin-positive; urea hydrolysis-, L-rhamnose-, melibiose-negative	111
Photobacterium lucens sp. nov.	*Vibrionaceae*	Cultured shrimp (*Penaeus vannamei*) from Mexico	Facultative, motile, oxidase-positive, catalase-negative Gram-negative bacillus; isolate cultivated on thiosulfate citrate bile salts sucrose agar; lysine decarboxylase-, β-galactosidase-, O/129 (10 μg and 150 μg)-, D-fructose-negative; variable mannitol reactivity; D-ribose-, sucrose-negative	112[a]
Yersinia thracica sp. nov.	*Yersiniaceae*	Unknown source from fish (also isolated from pig, bird, and wild boar); archival isolate from reference laboratory in France	Facultative, oxidase-negative Gram-negative bacillus; 50% of strains nonmotile when tested at 28°C; 2.5-mm diam circular colonies with deep red center surrounded by pale transparent border on cefsulodin-irgasan-novobiocin agar at 28°C; urease-,	113

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TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			ornithine decarboxylase (75% of tested strains)-, β-galactosidase (75% of tested strains)-positive; citrate-, arginine dihydrolase-, lysine decarboxylase-, tryptophan deaminase-, indole-, Voges Proskauer-, gelatinase-negative	
Poritiphilus flavus gen. nov., sp. nov.	*Flavobacteriaceae*	Stony coral (*Porites lutea*) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; circular, smooth, yellow-pigmented colonies on marine agar; growth at 15–33°C; arginine dihydrolase-, urease-, gelatin hydrolysis-, arabinose-positive; maltose-negative	114
Aliikangiella coralliicola sp. nov.	*Kangiellaceae*	Stony coral (*Porites lutea*) from China	Aerobic, motile, oxidase-negative, catalase-positive, non-spore-forming Gram-negative bacillus; circular, pale yellow-pigmented colonies on marine agar; optimal growth at 25–30°C; starch hydrolysis-, β-glucosidase-, β-galactosidase-positive; Tween 40 hydrolysis-, Tween 80 hydrolysis-negative	115
Tenacibaculum singaporense sp. nov.	*Flavobacteriaceae*	Commercially reared Asian seabass (*Lates calcarifer*) with symptoms of tenacibaculosis from Singapore	Aerobic, motile, oxidase-positive, catalase-positive, Gram-negative bacillus; 10-mm to 15-mm diam circular, iridescent, nonadherent, orange-pigmented colonies on LBM medium; growth range at 20–45°C; growth in 1–7% NaCl; nitrate reductase-, chymotrypsin-positive; trypsin-negative	20[j]
Tenacibaculum piscium sp. nov.	*Flavobacteriaceae*	Skin ulcer of farmed Atlantic salmon from Norway	Aerobic, motile, oxidase-positive, catalase-positive, filamentous Gram-negative bacillus; shiny, circular, iridescent, bright yellow-pigmented colonies with undulating margins on marine agar; optimal growth at 15–22°C; nonhemolytic colonies on blood agar with 2% NaCl; gelatin-, trypsin-positive; H_2S-, casein hydrolysis-, L-tyrosine hydrolysis-, C8 esterase lipase-negative; weakly reactive for L-proline, D-(+)-sucrose, D-(–)-ribose	21
Tenacibaculum finnmarkense sp. nov.	*Flavobacteriaceae*	Skin ulcer of farmed Atlantic salmon from Norway	Aerobic, motile, oxidase-positive, catalase-positive, filamentous Gram-negative bacillus; shiny, circular, pale yellow-pigmented colonies with undulating margins on marine agar; growth range at 4–15°C; no growth on blood agar with 2% NaCl; gelatin-, H_2S-, casein hydrolysis-, L-tyrosine hydrolysis-, C8 esterase lipase-positive; D-(+)-sucrose, D-(–)-ribose-, trypsin-negative	21
Flavobacterium salmonis sp. nov.	*Flavobacteriaceae*	Atlantic salmon (*Salmo salar*) fry culture from Chile	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; circular, convex, yellowish colonies on tryptic soy agar; translucent, circular, orange-pigmented colonies on tryptone yeast extract salts agar; nonhemolytic colonies on Columbia agar; optimal growth at 25°C; sucrose-,	22

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			nitrate reduction-, C14 lipase-positive; trehalose-, cellobiose-, D-mannose-, *N*-acetyl-D-glucosamine-, *N*-acetyl-D-galactosamine-, D-fructose-, L-malate-negative	
Flavobacterium bizetiae sp. nov.	*Flavobacteriaceae*	Diseased fish from Canada	Aerobic, motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; yellow-pigmented colonies on tryptic soy and Reasoner's 2A agars; optimal growth at 25°C; *N*-acetyl-D-galactosamine-, melibiose-, L-rhamnose-, α-glucosidase-, nitrate reductase-positive; variable reactions for L-arabinose, *N*-acetyl-D-glucosamine, α-galactosidase, β-glucosidase	23
Pseudopuniceibacterium antarcticum sp. nov.	*Rhodobacteraceae*	Marine sponge from west Antarctica	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 1.0-mm diam smooth, round, pale, opaque colonies on tryptone yeast extract sea salt agar; optimal growth at 25°C; β-galactosidase-, citrate-, β-glucosidase-, D-xylose-, D-glucose-, L-rhamnose-, D-mannitol-, D-arabitol-positive; arabinose-, C4 esterase-, D-fucose-, L-lactic acid-, formic acid-negative	116
Lacinutrix chionocetis sp. nov.	*Flavobacteriaceae*	Gut of red snow crab	Aerobic, nonmotile, oxidase-positive, catalase-positive gram-negative bacillus; 0.5- to 1.0-mm diam circular, convex, glistening, yellow-pigmented colonies on marine agar; optimal growth at 20°C; hydrolysis of esculin, starch, Tween 40, Tween 60; D-glucose-, D-mannose-, D-maltose-, leucine arylamidase-positive; L-arabinose-, D-mannitol-, trypsin-negative; reported resistance to gentamicin; reported susceptibility to penicillin, vancomycin, nalidixic acid, chloramphenicol, erythromycin, tetracycline	117[k]
Pseudomonas ovata sp. nov.	*Pseudomonadaceae*	Skin ulcer of farmed Murray cod (*Maccullochella peelii peelii*) tail from China	Aerobic, motile, oxidase-negative, catalase-positive, non-spore-forming Gram-negative bacillus; isolates cultivated between 4–37°C (optimal growth at 28°C); L-arabinose-, phenylacetic acid-, D-fucose-, 5-ketogluconate-positive; gelatinase-, arginine dihydrolase-, nitrate reduction-, D-arabinitol-, D-arabinose-, D-sucrose-, D-mannitol-, D-sorbitol-, β-glucosidase-negative	118[k]
Jannaschia marina sp. nov.	*Rhodobacteraceae*	Gut of gastropod (*Onchidium reevesii*) from China	Aerobic, nonmotile, oxidase-positive, catalase-negative, Gram-negative bacillus; 1.0- to 1.5-mm diam smooth, regular, pale orange/yellow-pigmented colonies on marine agar; optimal growth at 30°C; urease-, esculin-, β-galactosidase-, C14 lipase-positive; gelatin hydrolysis-, ornithine decarboxylase-, arginine dihydrolase-, citrate-, tryptophan deaminase-, gelatinase-, glucose-, mannitol-, α-chymotrypsin-,	119

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			α-galactosidase-, α-glucosidase-negative; weakly reactive for cystine aminopeptidase, β-glucosidase	
Lysobacter penaei sp. nov.	*Lysobacteraceae*	Intestinal content of Pacific white shrimp (*Penaeus vannamei*) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive, Gram-negative bacillus; 0.5-mm diam light yellow, circular, convex, smooth colonies on marine agar; optimal growth at 20–30°C; positive for Tween 20 hydrolysis, negative for Tween 80 hydrolysis; nitrate reduction-, D-glucose-, *N*-acetyl-glucosamine-, maltose-positive; starch hydrolysis-, C14 lipase-, trypsin-, α-galactosidase-, α-glucosidase-, denitrification-, L-arabinose, D-mannose-, D-mannitol-negative	120
Pseudorhodobacter turbinis sp. nov.	*Rhodobacteraceae*	Gut of Korean turban shell (*Turbo cornutus*) from Republic of Korea	Aerobic, motile, oxidase-positive, catalase-positive, Gram-negative bacillus; cream-pigmented colonies on marine agar; optimal growth at 30°C; alkaline phosphatase-, D-fructose-, L-fucose-, glycerol-, *N*-acetyl-β-D-mannosamine-, inosine-, α-keto-butyric acid-, L-alanine-, L-histidine-, D-malic acid-, propionic acid-positive; α-galactosidase-, β-galactosidase-, α-glucosidase-, maltose-, trehalose-, formic acid-, citric acid-, D-galactose-, α-D-glucose-, L-arginine-, *N*-acetyl-D-glucosamine-negative	121
Pseudomonas mucoides sp. nov.	*Pseudomonadaceae*	Rainbow trout (*Oncorhynchus mykiss*) from Turkey	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 4-mm diam round, opaque, γ-hemolytic, very mucoid, beige-pigmented colonies on King B agar; growth range at 4–37°C; fluorescein pigment produced, not pyocyanin; positive for nitrate reduction, gelatin hydrolysis, *N*-acetyl-D-glucosamine assimilation, D-galacturonic acid, D-galactonic acid lactone, myo-inositol, D-glucuronic acid, D-saccharic acid; negative for indole, phenylacetate, inosine	122
Pseudomonas neuropathica sp. nov.	*Pseudomonadaceae*	Rainbow trout (*Oncorhynchus mykiss*) from Turkey	Aerobic, motile, oxidase-positive Gram-negative bacillus; 5-mm diam round, opaque, β-hemolytic, mucoid, beige-pigmented colonies on King B agar; growth range at 4–37°C; fluorescein pigment produced, not pyocyanin; positive for gelatin hydrolysis, Tween 40 hydrolysis, trehalose, D-arabitol, *N*-acetyl-D-glucosamine, L-histidine, L-malic acid; negative for glycyl-L-proline, myo-inositol, L-pyroglutamic acid, D-serine, formic acid	122
Pseudomonas piscicola sp. nov.	*Pseudomonadaceae*	Rainbow trout (*Oncorhynchus mykiss*) from Turkey	Taxon designated *Pseudomonas piscium* in primary publication; aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 1- to 2-mm diam round, opaque, α-hemolytic, flat beige-pigmented colonies on King B agar; growth range at 4–37°C; fluorescein pigment produced, not pyocyanin; positive for indole, phenylacetate, Tween	122

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			40 hydrolysis, inosine; negative for nitrate reduction, gelatin hydrolysis, *N*-acetyl-D-glucosamine assimilation, D-galacturonic acid, D-galactonic acid lactone, myo-inositol, D-glucuronic acid, D-saccharic acid	
Pseudomonas pisciculturae sp. nov.	*Pseudomonadaceae*	Rainbow trout (*Oncorhynchus mykiss*) from Turkey	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 2-mm diam round, translucent, γ-hemolytic, flat, beige-pigmented colonies on King B agar; growth range at 4–37°C; fluorescein pigment produced, not pyocyanin; indole-, esculin-, phenylacetate-, *p*-hydroxy-phenylacetic acid-, D-galactonic acid lactone-, D-malic acid-, L-rhamnose-positive; nitrate reduction-, adipate-, gelatin-, Tween 40 hydrolysis-, sucrose-, D-fructose-6-phosphate-, D-serine-negative	122
Mesobaculum littorinae gen. nov., sp. nov.	*Rhodobacteraceae*	Sea snail (*Littorina scabra*) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; smooth, white colonies on ISP 4 agar; optimal growth at 28°C; positive for Tween 60 hydrolysis, urease, L-arabinose, sorbitol, D-xylose, turanose, D-tagatose, D-arabinitol, potassium gluconate, β-galactosidase, α-glucosidase; negative for trehalose, melezitose, raffinose, xylitol, valine arylamidase; reported resistance to ampicillin, gentamicin, tetracycline, nalidixic acid, vancomycin, erythromycin, chloramphenicol, novobiocin	123
Flavobacterium muglaense sp. nov.	*Flavobacteriaceae*	Healthy rainbow trout (*Oncorhynchus mykiss*) from Turkey	Aerobic, nonmotile, oxidase-negative, catalase-positive Gram-negative bacillus; 2.9- to 3.2-mm diam convex, circular, yellow-pigmented colonies on Reasoner's 2A agar; optimal growth at 25°C; growth also observed on thiosulfate citrate bile salts sucrose, tryptic soy, tryptone yeast extract salts agars; flexirubin pigment present; starch hydrolysis-, sucrose-, α-glucosidase, β-glucosidase-, *N*-acetyl-β-glucosaminidase-, gelatin-, dextrin-, D-mannose-, maltose-positive; D-mannitol-, trypsin-negative; resistant to nalidixic acid, aztreonam, tetrazolium blue	24
Pseudomonas arcuscaelestis sp. nov.	*Pseudomonadaceae*	Healthy rainbow trout (*Oncorhynchus mykiss*) from Turkey	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 3- to 5-mm diam flat, opaque, beige-pigmented colonies with irregular margins on Luria Bertani agar; growth range at 4–37°C; fluorescein pigment produced, not pyocyanin; nitrate reduction-, gluconate-, glycogen-, L-aspartic acid-, L-glutamic acid-, L-histidine-, L-pyroglutamic acid-, formic acid-positive; esculin hydrolysis-, arabinose-, mannitol-, *N*-acetyl-D-glucosamine-, phenylacetate-, *p*-hydroxy-phenyl acetic acid-, D-galacturonic acid-, sucrose-, inosine-negative	124

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
Chitinibacter bivalviorum sp. nov.	*Chromobacteriaceae*	Gut of freshwater mussel (*Anodonta arcaeformis*) from Republic of Korea	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; raised, circular, milky-white colonies on tryptic soy agar; optimal growth at 30°C; growth observed on Luria Bertani, MacConkey, Reasoner's 2A agars, but not nutrient agar; D-ribose-, cellobiose-, maltose-, D-mannose-, turanose-, nitrate reduction-, α-glucosidase-, D-fructose-6-phosphate-, glucuronamide-positive; raffinose-, starch-, glycerol-, gelatin hydrolysis-, D-mannose-, L-alanine-, L-aspartic acid-, L-glutamic acid-, L-histidine-, L-serine-negative	125
Cochleicola gelatinilyticus gen. nov., sp. nov.	*Flavobacteriaceae*	Marine gastropod (*Reichia luteostoma*) from Korea	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 1.0-mm diam convex, viscous, yellow, circular colonies on marine agar; optimal growth at 25°C; flexirubin-type pigments not observed; casein hydrolysis-, gelatin hydrolysis-, L-tyrosine hydrolysis-, starch hydrolysis-, Tweens 40, 80 hydrolysis, C4 esterase-, C8 esterase lipase-, α-chymotrypsin-positive; nitrate reduction-, DNase, trypsin-, carboxymethylcellulose hydrolysis-negative; isoprenoid quinone is MK-6	126[f]
Flavobacterium kayseriense sp. nov.	*Flavobacteriaceae*	Diseased rainbow trout (*Oncorhynchus mykiss*) from Turkey	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 1.8 to 2.0-mm diam convex, circular, undulate, yellow-pigmented colonies on Reasoner's 2A agar; optimal growth at 25°C; no growth on MacConkey, marine, and thiosulfate citrate bile salts sucrose agars; positive for Tween 80 hydrolysis, starch hydrolysis, arginine dihydrolase, D-mannitol, trypsin, D-galacturonic acid, L-galactonic acid lactone, glycerol, D-glucuronic acid, acetate, bromo-succinic acid; negative for D-mannose, β-glucosidase, D-raffinose, α-D-lactose, D-trehalose, quinic acid, D-saccharic acid	25[f]
Flavobacterium turcicum sp. nov.	*Flavobacteriaceae*	Diseased rainbow trout (*Oncorhynchus mykiss*) from Turkey	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 2.0 to 2.4-mm diam convex, circular, entire, yellow-pigmented colonies on Reasoner's 2A agar; optimal growth at 25°C; no growth on MacConkey, marine, and thiosulfate citrate bile salts sucrose agars; positive for D-mannose, β-glucosidase, D-raffinose, α-D-lactose, D-trehalose, quinic acid, D-saccharic acid; negative for Tween 80 hydrolysis, starch hydrolysis, arginine dihydrolase, D-mannitol, trypsin, D-galacturonic acid, L-galactonic acid lactone, glycerol, D-glucuronic acid, acetate, bromo-succinic acid	25[f]
Pseudidiomarina piscicola sp. nov.	*Idiomarinaceae*	Cultured European seabass (*Dicenthrarchus labrax*) from Spain	Aerobic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; opaque and transparent colonies propagated from liver of fish specimen on marine agar;	127[f]

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			optimal growth at 26–30°C; positive for gelatin hydrolysis; negative results for urea hydrolysis, esculin hydrolysis, C4 esterase, C8 esterase lipase, trypsin, α-chymotrypsin, valine arylamidase, cystine arylamidase, β-glucosidase, α-mannosidase, D-fructose, amygdalin, arbutin, cellobiose, sucrose, trehalose	
Pseudomonas anatoliensis sp. nov.	*Pseudomonadaceae*	Abdominal cavity of rainbow trout (*Oncorhynchus mykiss*) from Turkey	Motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 3- to 6-mm diam round, flat, beige, opaque colonies on Luria Bertani agar; optimal growth at 30°C; Tween 40 hydrolysis-, gelatin hydrolysis-, phenylacetate-, D-galacturonic acid-, D-trehalose-, D-glucuronic acid-, mucic acid-positive; arginine dihydrolase-, D-galactonic acid lactone-negative; unable to grow in lithium chloride	128[f]
Pseudomonas iridis sp. nov.	*Pseudomonadaceae*	Abdominal cavity of rainbow trout (*Oncorhynchus mykiss*) from Turkey	Motile, oxidase-positive, catalase-positive, non-spore-forming Gram-negative bacillus; 3- to 6-mm diam round, flat, beige, opaque colonies on Luria Bertani agar; optimal growth at 30°C; gelatin hydrolysis-, phenylacetate-, D-galacturonic acid-, D-trehalose-, D-glucuronic acid-, mucic acid-, arginine dihydrolase-, D-galactonic acid lactone-positive; weak hydrolysis of Tween 40; able to grow in lithium chloride	128[f]
Marixanthomonas spongiae sp. nov.	*Flavobacteriaceae*	Marine sponge from China	Aerobic, nonmotile, oxidase-negative, catalase-positive Gram-negative bacillus; 0.8- to 1.0-mm diam circular, smooth, yellow, opaque colonies on marine agar; optimal growth at 28°C; positive for cystine aminopeptidase; negative for casein hydrolysis, Tween 80 hydrolysis; weak reactions for C8 esterase lipase, acid phosphatase; major fatty acids iso-$C_{15:0}$, anteiso-$C_{15:0}$, iso-$C_{17:0}$ 3-OH	129
Muricauda onchidii sp. nov.	*Flavobacteriaceae*	Mouth of marine invertebrate (*Onchidium* spp.) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 0.45- to 0.55-mm diam circular, moist, convex, cream-pigmented colonies on marine agar; optimal growth at 30°C; α-chymotrypsin-, cystine arylamidase-, C4 esterase-, valine arylamidase-positive; α-galactosidase-, β-galactosidase-, β-glucosidase-, α-mannosidase-negative; weakly reactive for C8 esterase lipase, trypsin, α-glucosidase; respiratory quinone MK-6	130
Ruegeria haliotis sp. nov.	*Rhodobacteraceae*	Gut of abalone (*Haliotis rubra*) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 1.5-mm diam smooth, circular white-pigmented colonies on marine agar; optimal growth at 25–28°C; positive for casein hydrolysis, alginate hydrolysis, urease, L-arabinose-, D-glucose, D-fructose, D-cellobiose, D-maltose, D-turanose,	131[b]

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			D-arabitol, C4 esterase; negative for Tween 80 hydrolysis, D-mannose, D-melibiose, D-melezitose, L-fucose, α-galactosidase, *N*-acetyl-glucosaminidase	
Tamlana haliotis sp. nov.	*Flavobacteriaceae*	Gut of abalone (*Haliotis rubra*) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 1-mm diam smooth, circular, yellow-pigmented colonies on marine agar; optimal growth at 25°C and with 2% NaCl; positive for D-turanose, starch hydrolysis, alginate hydrolysis, *N*-acetyl-glucosaminidase, α-chymotrypsin; negative for Tween 80 hydrolysis, D-galactose, amygdalin, D-cellobiose, gentiobiose, β-galactosidase, α-glucosidase	132[b]
Algibacter onchidii sp. nov.	*Flavobacteriaceae*	Marine invertebrate (*Onchidium* spp.) from China	Aerobic, nonmotile, oxidase-positive, catalase-positive Gram-negative bacillus; 1- to 2-mm diam smooth, convex, orange colonies on marine agar; positive for nitrate reduction, denitrification, *N*-acetyl-β-glucosaminidase; D-glucose-, β-galactosidase-, β-glucosidase-, α-fucosidase-negative; weak hydrolysis of Tweens 20 and 80; weakly reactive for C14 lipase, trypsin, α-chymotrypsin	133
Pseudoalteromonas ostreae sp. nov.	*Pseudoalteromonadaceae*	Hemolymph of oyster (*Ostrea edulis*) from France	Aerobic, motile, non-spore-forming Gram-negative bacillus; 2- to 3-mm diam convex, opaque, cream/orange-pigmented colonies on marine agar; growth range at 4–30°C; growth also observed on tryptic soy agar and Mueller-Hinton agar; no growth on MacConkey or cetrimide agars; trypsin-, α-chymotrypsin-, maltose-, trisodium citrate-positive; nitrate reduction-, esculin hydrolysis-, arginine dihydrolase-, C4 esterase-, cystine arylamidase-, α-galactosidase-, β-glucosidase-, L-arabinose-, D-mannose-, D-mannitol-, adipic acid-negative	134
Paenihalocynthiibacter styelae gen. nov., sp. nov.	*Rhodobacteraceae*	Intestine of stalked sea squirt (*Styela clava*) from Republic of Korea	Aerobic, nonmotile, catalase-positive, oxidase-positive Gram-negative bacillus; 1- to 2-mm diam circular, grayish yellow, smooth colonies on marine agar; optimal growth at 20–25°C; nitrate reduction-, hypoxanthine hydrolysis-, L-tyrosine hydrolysis-, acetate-, citrate-, succinate-, acid phosphatase-positive; esculin hydrolysis-, D-fructose-, D-glucose-, cellobiose-, pyruvate-, salicin-, α-glucosidase-negative; reported susceptibility to lincomycin, novobiocin, polymyxin B	135
Curved bacteria				
Arcobacter haliotis sp. nov.	*Arcobacteraceae*	Abalone species (*Haliotis gigantea*) from Japan; taxon now considered to be a synonym (refer to Table 2)	Aerobic/microaerophilic, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 1-mm diam white colonies on marine agar; optimal growth at 25°C, no growth at 37°C or 42°C; no growth on MacConkey agar or *Campylobacter* blood-	136

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			free charcoal cefoperazone deoxycholate agar; tolerates 4% NaCl and 0.01% 2,3,5-triphenyl tetrazolium chloride; urease-, nitrate reduction-, indoxyl acetate-positive; γ-glutamyltransferase-, pyrrolidonyl arylamidase-, alkaline phosphatase-, esculin-, hippurate-, starch-, gelatin-, DNase-negative	
Vibrio echinoideorum sp. nov.	*Vibrionaceae*	Epidermal lesions of green sea urchin (*Strongylocentrotus droebachiensis*) from Norway	Facultative, motile, oxidase-positive, catalase-positive Gram-negative bacillus; 1.5- to 2-mm diam circular, smooth, slightly convex, beige-pigmented colonies on marine agar; growth range at 4–28°C; appear as green colonies on thiosulfate citrate bile salts sucrose agar; β-galactosidase-, arginine dihydrolase-, gelatin hydrolysis-, nitrate reduction-, gentibiose-, malate-, D-galactose-, D-mannose-, glycogen-positive; acetoin-, esculin hydrolysis-, C14 lipase-, valine arylamidase-, trypsin-, raffinose-, xylitol-negative; susceptible to O/129	30
Helicobacter delphinicola sp. nov.	*Helicobacteraceae*	Gastric fluid of common bottlenose dolphin (*Tursiops truncates*) with gastric disease from Japan	Microaerophilic, motile, oxidase-positive, catalase-positive, non-spore-forming, curved Gram-negative bacillus; 2- to 5-mm diam translucent, α-hemolytic, nonswarming circular colonies on blood agar; growth observed at 37°C (no growth at 42°C); urease-, γ-glutamyl transpeptidase-positive; nitrate reduction-, indoxyl acetate-, alkaline phosphatase-, hippurate-, triphenyl-tetrazolium chloride reduction-negative; susceptible to cephalothin and nalidixic acid	35[m]
Poseidonibacter parvus sp. nov.	*Arcobacteraceae*	Squid from Republic of Korea; taxon now considered to be a synonym (refer to Table 2)	Aerobic (can grow in microaerophilic conditions), motile, oxidase-positive, catalase-positive Gram-negative bacillus; circular, convex, pinkish-brown colonies on marine agar; optimal growth at 25°C; no growth on MacConkey, Reasoner's 2A, tryptic soy agars or on nutrient agar supplemented with 4% sea salt; indole-, hippurate-, nitrate reduction-, alkaline phosphatase-positive; C4 esterase-, leucine arylamidase-, valine arylamidase-negative; weakly reactive for DNase, C8 esterase lipase	137
Teredinibacter franksiae sp. nov.	*Cellvibrionaceae*	Gill and cecum of shipworm (*Bankia setacea*) from United States	Microaerophilic, motile, slightly curved Gram-negative bacillus; small translucent colonies initially observed on Bacto agar shipworm basal medium (supplemented with cellulose), with transition to inverted dome of cells with off-white or beige coloration beneath agar surface; clearing zone due to hydrolysis of cellulose; growth range at 15–20°C; marine salt (magnesium, calcium) requirement; negative for nitrogen fixation, 0.1% starch, 0.1% chitin, 0.1% dextran, 0.1% pyruvate	138

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
Teredinibacter haidensis sp. nov.	*Cellvibrionaceae*	Gill and cecum of shipworm (*Bankia setacea*) from United States	Microaerophilic, motile, slightly curved Gram-negative bacillus; small translucent colonies initially observed on Bacto agar shipworm basal medium (supplemented with cellulose), with transition to inverted dome of cells with off-white or beige coloration beneath agar surface; clearing zone due to hydrolysis of cellulose; growth range at 15–30°C; no marine salt (magnesium, calcium) requirement; positive for nitrogen fixation, 0.1% starch, 0.1% chitin, 0.1% dextran, 0.1% pyruvate	138
Teredinibacter purpureus sp. nov.	*Cellvibrionaceae*	Gill and cecum of shipworm (*Bankia setacea*) from United States	Microaerophilic, motile, slightly curved Gram-negative bacillus; small translucent colonies initially observed on Bacto agar shipworm basal medium (supplemented with cellulose), with transition to inverted dome of cells with deep purple coloration beneath agar surface; clearing zone due to hydrolysis of cellulose; growth range at 10–25°C; marine salt (magnesium, calcium) requirement; positive for 0.1% pyruvate; negative for nitrogen fixation, 0.1% starch, 0.1% chitin, 0.1% dextran	138
Curvivirga aplysinae gen. nov., sp. nov.	*Kiloniellaceae*	Marine sponge (*Aplysina fistularis*) from the Bahamas	Aerobic, motile, oxidase-positive, catalase-positive, curved-to-spiral Gram-negative bacillus; circular, smooth, shiny, light-yellow to beige colonies on marine agar; optimal growth at 30–37°C; NaCl is required for growth (range 0.5–10%); casein hydrolysis-, starch hydrolysis-, acid phosphatase-positive; nitrate reduction-, glucose fermentation-, urease-, esculin hydrolysis-, gelatin hydrolysis-, C14 lipase-negative	139
Vibrio ulleungensis sp. nov.	*Vibrionaceae*	Mussel (*Mytilus coruscus*) from Republic of Korea	Facultative, motile, oxidase-positive, catalase-positive, non-spore-forming, Gram-negative bacillus; 0.8- to 1.4-mm diam smooth, convex, light-yellow-pigmented colonies on marine agar; optimal growth at 25–30°C; gelatin hydrolysis-, β-galactosidase-, β-glucosidase-, salicin-, acetate-, L-proline-, D-ribose-, C8 esterase lipase-, valine arylamidase-positive; indole-, arginine dihydrolase-, D-mannose-, maltose-, gluconate-, citrate-, glycogen-, *N*-acetyl-β-glucosaminidase-negative	140
Acid-fast bacilli				
Mycobacterium syngnathidarum sp. nov.	*Mycobacteriaceae*	Clinically ill lined seahorse (*Hippocampus erectus*) and alligator pipefish (*Syngnathoides biaculeatus*) from United States	Rapid-growing (3–5 days of incubation between 30°C and 37°C) acid-fast bacillus; growth demonstrated on 7H11, Lowenstein Jensen and 5% sheep blood agars; catalase-, arylsulfatase-positive; oxidase-, Tween 80 hydrolysis-negative; no growth observed in mannitol, myoinositol, sorbitol, trehalose, and L-rhamnose; susceptibility to clarithromycin, amikacin; resistance/elevated minimum inhibitory concn values for tobramycin, linezolid, doxycycline, fluoroquinolones, imipenem,	39

(Continued on next page)

TABLE 1 (Continued)

Scientific name	Family	Source	Growth characteristics	Reference(s)
			cefoxitin, ceftriaxone, trimethoprim-sulfamethoxide	
Phylum *Planctomycetota*				
Planctopirus ephydatiae sp. nov.	*Planctomycetaceae*	Sponge (*Ephydatia* spp.) from freshwater lake	Ovoid-shaped, motile cells forming in aggregates in liquid culture, producing large amounts of fibers; crateriform structures distributed evenly over cell surface; pink-pigmented colonies on MM1 medium supplemented with *N*-acetyl-D-glucosamine; optimal growth at 30°C; alkaline phosphatase, esterase, esterase lipase, naphthol-AS-BI-phosphohydrolase, and α-galactosidase activities observed	141[j]
Aureliella helgolandensis gen. nov., sp. nov.	*Pirellulaceae*	Jellyfish (*Aurelia aurita*) from Helgoland (Germany)	Acorn-shaped cells with aggregate formations; crateriform structure at one pole, holdfast structure present at opposite pole; lucid white-pigmented colonies on M1H NAG artificial seawater medium; optimal growth at 27°C; aerobic heterotroph	142[k]
Poriferisphaera corsica gen. nov., sp. nov.	*Phycisphaeraceae*	Calcareous sponge (*Clathrina clathrus*) from France	Spherical, motile cells forming in aggregates; cell surface covered with outer membrane vesicles; no crateriform, stalk, or holdfast structures observed; white-pigmented colonies on M1H NAG artificial seawater medium solidified with gellan gum; optimal growth at 27°C; aerobic heterotroph	143[m]

[a]Taxonomic designation subsequently accepted in Validation List no. 195 (144).
[b]Taxonomic designation subsequently accepted in Validation List no. 202 (145).
[c]Taxonomic designation subsequently accepted in Validation List no. 182 (146).
[d]Taxonomic designation subsequently accepted in Validation List no. 183 (147).
[e]Taxonomic designation subsequently accepted in Validation List no. 185 (148).
[f]Taxonomic designation subsequently accepted in Validation List no. 187 (149).
[g]Taxonomic designation subsequently accepted in Validation List no. 191 (150).
[h]Taxonomic designation subsequently accepted in Validation List no. 192 (151).
[i]Taxonomic designation subsequently accepted in Validation List no. 193 (152).
[j]Taxonomic designation subsequently accepted in Validation List no. 196 (153).
[k]Taxonomic designation subsequently accepted in Validation List no. 198 (154).
[l]Taxonomic designation subsequently accepted in Validation List no. 200 (155).
[m]Taxonomic designation subsequently accepted in Validation List no. 199 (156).

include representatives from familiar families like *Nocardiaceae* which includes *Rhodococcus electrodiphilus* (11), an electroactive bacterium that can provide electrical power during metabolism and is an important area of investigation for alternative fuels. Also, numerous actinomycotic Gram-positive bacilli, including *Rhodococcus xishaensis* sp. nov. (12) and multiple *Streptomyces* spp., have been identified which are remarkably thermotolerant with optimal growth at 20 to 40°C. Other familiar genera such as *Pseudomonas* are present in this review, as well as more obscure genera that colonize aquatic species like *Sansalvadorimonas* gen. nov. (13).

Novel taxa. Of the four Gram-positive cocci described, *Streptococcus penaeicida* sp. nov. (14) is ascribed clinical significance in Pacific white shrimp. Isolated from the hepatopancreas of diseased shrimp, it adds another pathogen to the small but important group of streptococcal species (*Streptococcus iniae*, *Streptococcus agalactiae*, *Streptococcus dysgalactiae*, *Streptococcus parauberis*, and *Streptococcus phocae*) impacting fish and other aquatic animal health (15). This is the first full description of a *Streptococcus* spp. causing health impacts in shrimp, which is of concern, as most bacterial disease prevention and treatment in the industry has focused on Gram-negative bacilli. *S. penaeicida* sp. nov. is thermotolerant with growth up to 40°C, relatively salt tolerant, and grows in a highly

TABLE 2 Revised bacterial taxa (including members of the phylum *Planctomycetota*) relative to aquatic veterinary material reported from January 2018 through December 2021

Former name	Revised name	Other information	Reference(s)
Gram-positive bacilli			
Verrucosispora andamanensis	*Micromonospora andamanensis* comb. nov.	Initial description and recovery of the former *V. andamanensis* from marine sponge found in (157)	158[a]
Bacillus crassostreae	*Metabacillus crassostreae* comb. nov.	Initial description and recovery of the former *B. crassostreae* from oyster (*Crassostrea hongkongensis*) found in (159)	160
Bacillus galliciensis	*Metabacillus galliciensis* comb. nov.	Initial description and recovery of the former *B. galliciensis* from feces of wild seahorses (*Hippocampus guttulatus*) found in (161)	160
Bacillus hemicentroti	*Alkalihalobacillus haemicentroti* comb. nov.	Initial description and recovery of the former *B. hemicentroti* from sea urchin (*Hemicentrotus pulcherrimus*) found in (162)	160
Bacillus aquimaris	*Rossellomorea aquimaris* comb. nov.	Initial description and recovery of the former *B. aquimaris* from seawater found in (163); recovery of this organism from shrimp found in (164)	165
Saccharopolyspora coralli	*Allosaccharopolyspora coralli* comb. nov.	Initial description and recovery of the former *S. coralli* from stony coral found in (55) and Table 1	166
Gram-negative bacilli and coccobacilli			
Hanstruepera crassostreae	*Pseudobizionia ponticola*	Initial description and recovery of the former *H. crassostreae* from oyster found in (79); *H. crassostreae* (Table 1) is a later heterotypic synonym of *P. ponticola*	167
Idiomarina aquimaris	*Pseudidiomarina aquimaris* comb. nov.	Initial description and recovery of the former *I. aquimaris* from reef-building coral (*Isopora palifera*) found in (168)	169[b]
Labilibacter aurantiacus	*Saccharicrinis aurantiacus* comb. nov.	Initial description and recovery of the former *L. aurantiacus* from sea squirt (*Styela clava*) found in (170)	171[c]
Formosa spongicola	*Xanthomarina spongicola* comb. nov.	Initial description and recovery of the former *F. spongicola* from marine sponge (*Hymeniacidon flavia*) found in (172)	171[c]
Labrenzia alba	*Roseibium album* comb. nov.	Initial description and recovery of the former *Stappia alba* from Mediterranean oysters found in (173) and accepted (174); subsequent revision to *Labrenzia alba* documented in (175)	171[d]
Flavobacterium spartansii	*Flavobacterium tructae*	Initial description and recovery of the former *F. spartansii* from kidney of feral adult Chinook salmon (*Oncorhynchus tshawytscha*) found in (42); *F. spartansii* is a later heterotypic synonym of *F. tructae*	22
Altererythrobacter troitsensis	*Tsuneonella troitsensis* comb. nov.	Initial description and recovery of the former *A. troitsensis* from sea urchin *Strongylocentrotus intermedius* found in (176)	177
Erythrobacter spongiae	*Aurantiacibacter spongiae* comb. nov.	Initial description and recovery of the former *E. spongiae* from marine sponge found in (81) and Table 1	177
Duganella danionis	*Pseudoduganella danionis*	Initial description and recovery of the former *D. danionis* from beaked whales found in (178) and accepted (153); initial description and recovery of *P. danionis* from zebrafish found in (179); *D. danionis* is a later homotypic synonym of *P. danionis*	153, 178
Pseudomonas pachastrellae	*Halopseudomonas pachastrellae* comb. nov.	Initial description and recovery of the former *P. pachastrellae* from sponge (*Pachastrella* spp.) found in (180)	181
Vitellibacter todarodis	*Aequorivita todarodis* comb. nov.	Initial description and recovery of the former *V. todarodis* from squid found in (70) and Table 1	182
Curved bacteria			
Arcobacter haliotis	*Arcobacter lekithochrous*	Initial description and recovery of the former *A. haliotis* from abalone species *Haliotis gigantea* found in (136); *A. haliotis* (Table 1) is a later heterotypic synonym of *A. lekithrochrous*	183
Vibrio aestuarianus	*Vibrio aestuarianus* subsp. *aestuarianus* subsp. nov.	Initial description and recovery of the former *Vibrio aestuarianus* from Pacific oyster (*Crassostrea gigas*) found in (184)	44
Vibrio aestuarianus	*Vibrio aestuarianus* subsp. *cardii* subsp. nov.	Initial description and recovery of the former *Vibrio aestuarianus* from Pacific oyster (*Crassostrea gigas*) found in (184); *Vibrio aestuarianus* subsp. *Cardii* subsp. nov. isolated from edible cockles (*Cerastoderma edule*) in France	44

(Continued on next page)

TABLE 2 (Continued)

Former name	Revised name	Other information	Reference(s)
Vibrio aestuarianus	*Vibrio aestuarianus* subsp. *francensis* subsp. nov.	Initial description and recovery of the former *Vibrio aestuarianus* from Pacific oyster (*Crassostrea gigas*) found in (184); *V. aestuarianus* subsp. *Francensis* subsp. nov. isolated from a diseased oyster in France	44
Poseidonibacter parvus	*Arcobacter parvus* comb. nov.	Initial description of the former *P. parvus* from squid found in (137) and Table 1	185
Phylum *Planctomycetota*			
Blastopirellula cremea	*Bremerella cremea* comb. nov.	Initial description and recovery of the former *B. cremea* from dead ark clam (*Scapharca broughtonii*) found in (186)	187[e]

[a]Taxonomic designation subsequently accepted in Validation List no. 184 (188).
[b]Taxonomic designation subsequently accepted in Validation List no. 185 (148).
[c]Taxonomic designation subsequently accepted in Validation List no. 193 (152).
[d]Taxonomic designation subsequently accepted in Validation List no. 194 (189).
[e]Taxonomic designation subsequently accepted in Validation List no. 198 (154).

alkaline pH. In comparison to other aquatic streptococcal species, *S. penaeicida* sp. nov. utilizes a large variety of sugars as carbon sources.

Two novel Gram-positive bacilli taxa were described as causing disease in ornamental fish and Atlantic salmon. *Erysipelothrix piscisicarius* sp. nov. (16) was originally isolated from multiple types of ornamental fish with various lesions, including cellulitis, dermatitis, myositis, and more systemic infection (17). The isolates from diseased fish were originally identified as *Erysipelothrix rhusiopathiae*, an important pathogen of swine and poultry, as well as being a zoonotic agent of infection. Further genetic characterization determined that the isolates were significantly divergent from *E. rhusiopathiae* due to the presence of a *spaC* gene and likely represented a new taxon. Interestingly, a closely related *spaC*-positive *Erysipelothrix* spp. has been isolated from swine but was not included in this description. *E. piscisicarius* sp. nov. is slow growing in comparison to *E. rhusiopathiae* with colonies prominent at 60 h. *E. piscisicarius* sp. nov. further differs in carbohydrate utilization as it does not metabolize L-rhamnose or lactose.

The second novel taxon, *Arthrobacter ulcerisalmonis* sp. nov. (18), was isolated from ulcers from Atlantic salmon. This organism adds to the long list of bacilli (majority Gram-negative) associated with cutaneous lesions in salmonids. However, the pathogenicity of this isolate can be debated as it was found accompanying *Flavobacterium psychrophilum*, a significant and well-known pathogen of salmon. *Arthrobacter* spp. have been uncommonly associated with human infection and only described in immunocompromised patients (19). Taken together, this genus is considered widespread in the environment but of low pathogenicity.

Most pathogenic taxa described in Table 1 are Gram-negative bacilli or curved bacilli, which is consistent with groups of bacteria affecting aquatic species most. The *Flavobacteriaceae* family is well represented, with eight novel species divided between the *Tenacibaculum* (20, 21) and *Flavobacterium* (22–25) genera. Both genera historically contain common pathogens of fish, including *Tenacibaculum maritimum*, causing significant cutaneous lesions in numerous marine fish species (26), and *Flavobacterium pyschrophilum* and *Flavobacterium columnaris*, causing bacterial cold-water disease in freshwater-raised salmonids and columnaris disease in multiple freshwater fish species (27, 28). These bacteria are known for gliding motility and can be difficult to culture. Three new *Tenacibaculum* spp. include *Tenacibaculum singaporense* sp. nov. (20) from farmed Asian seabass, and *Tenacibaculum piscium* sp. nov. and *Tenacibaculum finnmarkense* sp. nov. (21) from farmed Atlantic salmon. Disease associated with all species was consistent with traditional tenacibaculosis in farmed marine environments. *Flavobacterium bizetiae* sp. nov. (23) was initially isolated in the late 1970s from diseased freshwater fish for which no description of fish species or details on clinical disease was given. Despite subsequent full characterization and taxon description, pathogenicity of this species remains unclear due to lack of clinical information or *in vivo* infection studies. *Flavobacterium kayseriense* sp. nov. and

Flavobacterium turcicum sp. nov. were isolated from the kidney and spleen of farmed rainbow trout demonstrating signs of systemic disease, including skin discoloration, exophthalmia, and swimming abnormalities (25). While *F. kayseriense* sp. nov. and *F. turcicum* sp. nov. are genetically closely related, they do express phenotypic differences in sugar and carbon utilization. These novel species also possess important differences in antimicrobial susceptibility profiles, with *F. kayseriense* sp. nov. demonstrating resistance to important classes such as folate pathway inhibitors and quinolones.

Vibrionaceae is an important family of marine pathogenic Gram-negative bacilli and curved bacteria affecting aquatic animals and humans. The most well-known of these organisms is *Vibrio cholerae*, an important diarrheal disease of humans (29). Other important species, including *Vibrio parahaemolyticus* and *Vibrio vulnificus*, affect aquatic animals and can be zoonotic when humans are exposed to seafood and marine environments. Novel *Vibrio* spp. taxa described in Table 1 include *Vibrio echinoideorum* sp. nov. (30), which was recently isolated from a lesion on the hard exoskeleton (test) of a sea urchin. The organism was determined to be a member of the *Vibrio splendidus* clade, with utilization of glycogen and gentiobiose among other biochemical differences aiding in discrimination from other members. *Photobacterium* is a second important genus within the *Vibrionaceae* family. Perhaps the most well-known member is *Photobacterium damselae* (now designated *Photobacterium damselae* subsp. *damselae*), first reported in 1982 as a cause of wound infection in six people (31) and later isolated from numerous marine animals with a variety of cutaneous and systemic manifestations (32). Three effectively published *Photobacterium* spp. were isolated from diseased redbanded seabream in Spain and published within the past 5 years: *Photobacterium toruni* sp. nov., *Photobacterium andalusiense* sp. nov., and *Photobacterium malacitanum* sp. nov. (33, 34). All were obtained from culture of internal organs during outbreaks of an undescribed disease and were determined to be genetically distinct from known *Photobacterium* spp. The isolates have similar utilization of sugars and amino acids but differ in lipase activity.

An additional Gram-negative bacillus of clinical interest, *Helicobacter delphinicola* sp. nov. (35), was isolated from gastric fluid of a captive common bottlenose dolphin and is a member of the *Helicobacteraceae* family. The dolphin was diagnosed with gastric ulcers and a spiral-shaped bacterium was isolated from the affected area. Because helicobacters are commonly implicated in gastric pathology in humans and cetaceans (36–38), this report provided additional support for the role of *Helicobacter* spp. in causing disease across multiple human and animal species. While genetic similarity to *Helicobacter cetorum* was high utilizing selected housekeeping genes, *H. delphinicola* sp. nov. was biochemically distinct due to resistance to 2% NaCl, which had not previously been described in the *Helicobacter* genus. Interestingly, captivity or stranding appears to be associated with the development of gastric ulcers in cetaceans and, similar to human disease, appears multifactorial.

Lastly, one new mycobacterial species associated with clinical disease in multiple marine animals (captive lined seahorse and alligator pipefish) was validly and effectively published as *Mycobacterium syngnathidarum* sp. nov. (39). Mycobacteria are important, difficult-to-manage aquatic pathogens which frequently impact the health of captive or farmed aquatic animals (40). Additionally, aquatic nontuberculosis mycobacteria (NTM) cause sporadic human infection and are of zoonotic concern, with *Mycobacterium marinum* a common example (41). *M. syngnathidarum* sp. nov. is a nonpigmented, rapidly growing *Mycobacterium* spp., with growth observed in 3 to 5 days. As NTM can be intrinsically resistant to common antimicrobial agents, it is important to note this species has variable susceptibility to commonly used agents, including linezolid, doxycycline, moxifloxacin, and trimethoprim/sulfamethoxide.

Taxonomic revisions. In addition to reports of novel species within the *Flavobacterium* genera, several taxonomic designations have been revised. *Flavobacterium spartansii*, originally isolated from Chinook salmon and described in 2014 (42), has subsequently been determined to be a heterotypic synonym of *Flavobacterium tructae* (22). *F. tructae*

was originally isolated from diseased rainbow trout (43) and validly published the same year as the valid and effective publication of *F. spartansii*. Subsequent analysis during the description of a closely related species, *Flavobacterium salmonis* (22), determined these two species should not be separately named based on an average nucleotide identity of ~98%, *in silico* DNA-DNA hybridization of ~80%, and 100% similarity between 16S rRNA genes. Interestingly, significant phenotypic differences appear to exist, relative to motility and nitrate reduction.

Vibrio aestuarianus, a significant cause of mortality in oysters, has been assigned three subspecies designations (44). *Vibrio aestuarianus* subsp. *aestuarianus* was assigned to the original isolate originating from various American aquatic animals. *Vibrio aestuarianus* subsp. *cardii* was assigned to an isolate obtained from diseased edible cockles, and *Vibrio aestuarianus* subsp. *francensis* to an isolate from a diseased oyster in France. While phenotypic variation was noted to be significant enough to warrant consideration of subspecies designation in 2008 for the pathogenic oyster strain *V. aestuarianus* subsp. *francensis* (45), this was fully realized in the evaluation of the edible cockle strain (44) and thus three subspecies were proposed. Differences between the subspecies were noted through genetic and phenotypic characterizations; however, most important differences relate to virulence. The type subspecies *V. aestuarianus* subsp. *aestuarianus* is not pathogenic for oysters and is quite salt tolerant, while *V. aestuarianus* subsp. *francensis* and *V. aestuarianus* subsp. *cardii* have demonstrated to be pathogenic in oysters and cockles, respectively.

CONCLUSION

An incredible microbial diversity is being uncovered in aquatic environments. Bacteria impacting aquatic animal health have become a more pressing issue with the increased reliance on farmed products to spare wild stocks. We face similar challenges to aquatic animal production as in terrestrial food production where diseases of management have significant impacts. Additionally, population-limiting bacterial infections in threatened or endangered aquatic species are increasingly challenging with stresses to the environment in waterways. Human health is impacted by disease transmission directly from these special environments and/or animals through contaminated food products (food safety), as we rely on aquaculture in place of capture fisheries, for food security. Lastly, bacteria from aquatic and aquatic animal habitats with unique metabolism or by-products can aid in combating some of our most critical challenges in waste mitigation and energy utilization.

ACKNOWLEDGMENT

This report was not subject to influence from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Devos DP, Lage OM, Sutcliffe IC. 2020. Bringing the diversity of Planctomycetes into the light: introduction to papers from the special issue on novel taxa of *Planctomycetes*. Antonie Van Leeuwenhoek 113:1715–1726. https://doi.org/10.1007/s10482-020-01499-y.
2. Rivas-Marín E, Canosa I, Devos DP. 2016. Evolutionary cell biology of division mode in the bacterial *Planctomycetes-Verrucomicrobia-Chlamydiae* superphylum. Front Microbiol 7:1964. https://doi.org/10.3389/fmicb.2016.01964.
3. Rivas-Marin E, Peeters SH, Claret Fernández L, Jogler C, van Niftrik L, Wiegand S, Devos DP. 2020. Non-essentiality of canonical cell division genes in the planctomycete *Planctopirus limnophila*. Sci Rep 10:66. https://doi.org/10.1038/s41598-019-56978-8.
4. Munson E, Lawhon SD, Burbick CR, Zapp A, Villaflor M, Thelen E. 2023. An update on novel taxa and revised taxonomic status of bacteria isolated from domestic animals described in 2018–2021. J Clin Microbiol. https://doi.org/10.1128/jcm.00281-22.
5. Lawhon SD, Burbick CR, Munson E, Zapp A, Thelen E, Villaflor M. 2023. Update on novel taxa and revised taxonomic status of bacteria isolated from non-domestic animals described in 2018–2021. J Clin Microbiol https://doi.org/10.1128/jcm.01425-22.
6. Kämpfer P, Irgang R, Busse HJ, Poblete-Morales M, Kleinhagauer T, Glaeser SP, Avendaño-Herrera R. 2016. *Undibacterium danionis* sp. nov. isolated from a zebrafish (*Danio rerio*). Int J Syst Evol Microbiol 66:3625–3631. https://doi.org/10.1099/ijsem.0.001244.
7. Gomez-Gil B, Roque A, Rotllant G, Romalde JL, Doce A, Eggermont M, Defoirdt T. 2016. *Photobacterium sanguinicancri* sp. nov. isolated from marine animals. Antonie Van Leeuwenhoek 109:817–825. https://doi.org/10.1007/s10482-016-0681-x.
8. Oren A, Garrity GM. 2016. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 66:3761–3764. https://doi.org/10.1099/ijsem.0.001321.
9. Adeolu M, Alnajar S, Naushad S, Gupta RS. 2016. Genome-based phylogeny and taxonomy of the 'Enterobacteriales': proposal for *Enterobacterales* ord. nov. divided into the families *Enterobacteriaceae*, *Erwiniaceae* fam. nov., *Pectobacteriaceae* fam. nov., *Yersiniaceae* fam. nov., *Hafniaceae* fam. nov., *Morganellaceae* fam. nov., and *Budviciaceae* fam. nov. Int J Syst Evol Microbiol 66:5575–5599. https://doi.org/10.1099/ijsem.0.001485.
10. Oren A, Garrity GM. 2021. Valid publication of the names of forty-two phyla of prokaryotes. Int J Syst Evol Microbiol 71:e005056. https://doi.org/10.1099/ijsem.0.005056.

11. Ramaprasad EVV, Mahidhara G, Sasikala C, Ramana CV. 2018. *Rhodococcus electrodiphilus* sp. nov., a marine electro active actinobacterium isolated from coral reef. Int J Syst Evol Microbiol 68:2644–2649. https://doi.org/10.1099/ijsem.0.002895.
12. Zhang D, Su ZY, Li L, Tang WZ. 2021. *Rhodococcus spongiicola* sp. nov. and *Rhodococcus xishaensis* sp. nov., from marine sponges. Int J Syst Evol Microbiol 71:e04863. https://doi.org/10.1099/ijsem.0.004863.
13. Goldberg SR, Haltli BA, Correa H, Kerr RG. 2018. Description of *Sansalvadorimonas verongulae* gen. nov., sp. nov., a gammaproteobacterium isolated from the marine sponge *Verongula gigantea*. Int J Syst Evol Microbiol 68:2006–2014. https://doi.org/10.1099/ijsem.0.002781.
14. Morales-Covarrubias MS, Del Carmen Bolan-Mejia M, Vela Alonso AI, Fernandez-Garayzabal JF, Gomez-Gil B. 2018. *Streptococcus penaeicida* sp. nov., isolated from a diseased farmed Pacific white shrimp (*Penaeus vannamei*). Int J Syst Evol Microbiol 68:1490–1495. https://doi.org/10.1099/ijsem.0.002693.
15. Mishra A, Nam GH, Gim JA, Lee HE, Jo A, Kim HS. 2018. Current challenges of *Streptococcus* infection and effective molecular, cellular, and environmental control methods in aquaculture. Mol Cells 41:495–505. https://doi.org/10.14348/molcells.2018.2154.
16. Pomaranski EK, Griffin MJ, Camus AC, Armwood AR, Shelley J, Waldbieser GC, LaFrentz BR, Garcia JC, Yanong R, Soto E. 2020. Description of *Erysipelothrix piscisicarius* sp. nov., an emergent fish pathogen, and assessment of virulence using a tiger barb (*Puntigrus tetrazona*) infection model. Int J Syst Evol Microbiol 70:857–867. https://doi.org/10.1099/ijsem.0.003838.
17. Pomaranski EK, Reichley SR, Yanong R, Shelley J, Pouder DB, Wolf JC, Kenelty KV, Van Bonn B, Oliaro F, Byrne B, Clothier KA, Griffin MJ, Camus AC, Soto E. 2018. Characterization of *spaC*-type *Erysipelothrix* sp. isolates causing systemic disease in ornamental fish. J Fish Dis 41:49–60. https://doi.org/10.1111/jfd.12673.
18. Kämpfer P, Busse HJ, Schumann P, Criscuolo A, Clermont D, Irgang R, Poblete-Morales M, Glaeser SP, Avendaño-Herrera R. 2020. *Arthrobacter ulcerisalmonis* sp. nov., isolated from an ulcer of a farmed Atlantic salmon (*Salmo salar*), and emended description of the genus *Arthrobacter sensu lato*. Int J Syst Evol Microbiol 70:1963–1968. https://doi.org/10.1099/ijsem.0.004002.
19. Funke G, Hutson RA, Bernard KA, Pfyffer GE, Wauters G, Collins MD. 1996. Isolation of *Arthrobacter* spp. from clinical specimens and description of *Arthrobacter cumminsii* sp. nov. and *Arthrobacter woluwensis* sp. nov. J Clin Microbiol 34:2356–2363. https://doi.org/10.1128/jcm.34.10.2356-2363.1996.
20. Miyake S, Soh M, Azman MN, Ngoh SY, Orbán L, Seedorf H. 2020. Insights into the microbiome of farmed Asian sea bass (*Lates calcarifer*) with symptoms of tenacibaculosis and description of *Tenacibaculum singaporense* sp. nov. Antonie Van Leeuwenhoek 113:737–752. https://doi.org/10.1007/s10482-020-01391-9.
21. Olsen AB, Spilsberg B, Nilsen HK, Lagesen K, Gulla S, Avendaño-Herrera R, Irgang R, Duchaud E, Colquhoun DJ. 2020. *Tenacibaculum piscium* sp. nov., isolated from skin ulcers of sea-farmed fish, and description of *Tenacibaculum finnmarkense* sp. nov. with subdivision into genomovars *finnmarkense* and *ulcerans*. Int J Syst Evol Microbiol 70:6079–6090. https://doi.org/10.1099/ijsem.0.004501.
22. Kämpfer P, Irgang R, Glaeser SP, Busse HJ, Criscuolo A, Clermont D, Avendaño-Herrera R. 2020. *Flavobacterium salmonis* sp. nov. isolated from Atlantic salmon (*Salmo salar*) and formal proposal to reclassify *Flavobacterium spartansii* as a later heterotypic synonym of *Flavobacterium tructae*. Int J Syst Evol Microbiol 70:6147–6154. https://doi.org/10.1099/ijsem.0.004510.
23. Mühle E, Abry C, Leclerc P, Goly GM, Criscuolo A, Busse HJ, Kämpfer P, Bernardet JF, Clermont D, Chesneau O. 2021. *Flavobacterium bizetiae* sp. nov., isolated from diseased freshwater fish in Canada at the end of the 1970s. Int J Syst Evol Microbiol 71:e004576. https://doi.org/10.1099/ijsem.0.004576.
24. Duman M, Ay H, Altun S, Sahin N, Saticioglu IB. 2021. *Flavobacterium muglaense* sp. nov. isolated from internal organs of apparently healthy rainbow trout. Int J Syst Evol Microbiol 71:e004903. https://doi.org/10.1099/ijsem.0.004903.
25. Saticioglu IB, Ay H, Altun S, Duman M, Sahin N. 2021. *Flavobacterium turcicum* sp. nov. and *Flavobacterium kayseriense* sp. nov. isolated from farmed rainbow trout in Turkey. Syst Appl Microbiol 44:126186. https://doi.org/10.1016/j.syapm.2021.126186.
26. Avendaño-Herrera R, Toranzo AE, Magariños B. 2006. Tenacibaculosis infection in marine fish caused by *Tenacibaculum maritimum*: a review. Dis Aquat Organ 71:255–266. https://doi.org/10.3354/dao071255.
27. Declercq AM, Haesebrouck F, Van den Broeck W, Bossier P, Decostere A. 2013. Columnaris disease in fish: a review with emphasis on bacterium-host interactions. Vet Res 44:27. https://doi.org/10.1186/1297-9716-44-27.
28. Duchaud E, Boussaha M, Loux V, Bernardet JF, Michel C, Kerouault B, Mondot S, Nicolas P, Bossy R, Caron C, Bessières P, Gibrat JF, Claverol S, Dumetz F, Le Hénaff M, Benmansour A. 2007. Complete genome sequence of the fish pathogen *Flavobacterium psychrophilum*. Nat Biotechnol 25:763–769. https://doi.org/10.1038/nbt1313.
29. Clemens JD, Nair GB, Ahmed T, Qadri F, Holmgren J. 2017. Cholera. Lancet 390:1539–1549. https://doi.org/10.1016/S0140-6736(17)30559-7.
30. Hira J, Bentdal S, Devold H, Stensvag K, Landfald B. 2019. *Vibrio echinoideorum* sp. nov., isolated from an epidermal lesion on the test of a green sea urchin (*Strongylocentrotus droebachiensis*). Int J Syst Evol Microbiol 69:2277–2282. https://doi.org/10.1099/ijsem.0.003462.
31. Morris JG, Jr., Miller HG, Wilson R, Tacket CO, Hollis DG, Hickman FW, Weaver RE, Blake PA. 1982. Illness caused by *Vibrio damsela* and *Vibrio hollisae*. Lancet 1:1294–1297. https://doi.org/10.1016/s0140-6736(82)92853-7.
32. Rivas AJ, Lemos ML, Osorio CR. 2013. *Photobacterium damselae* subsp. *damselae*, a bacterium pathogenic for marine animals and humans. Front Microbiol 4:283. https://doi.org/10.3389/fmicb.2013.00283.
33. Labella AM, Arahal DR, Lucena T, Manchado M, Castro D, Borrego JJ. 2017. *Photobacterium toruni* sp. nov., a bacterium isolated from diseased farmed fish. Int J Syst Evol Microbiol 67:4518–4525. https://doi.org/10.1099/ijsem.0.002325.
34. Labella AM, Castro MD, Manchado M, Lucena T, Arahal DR, Borrego JJ. 2018. *Photobacterium malacitanum* sp. nov., and *Photobacterium andalusiense* sp. nov., two new bacteria isolated from diseased farmed fish in Southern Spain. Syst Appl Microbiol 41:444–451. https://doi.org/10.1016/j.syapm.2018.04.005.
35. Segawa T, Ohno Y, Tsuchida S, Ushida K, Yoshioka M. 2020. Corrigendum: *Helicobacter delphinicola* sp. nov., isolated from common bottlenose dolphins *Tursiops truncatus* with gastric diseases. Dis Aquat Org 142:145–145. https://doi.org/10.3354/dao03511_c.
36. Kusters JG, van Vliet AH, Kuipers EJ. 2006. Pathogenesis of *Helicobacter pylori* infection. Clin Microbiol Rev 19:449–490. https://doi.org/10.1128/CMR.00054-05.
37. Abollo E, López A, Gestal C, Benavente P, Pascual S. 1998. Long-term recording of gastric ulcers in cetaceans stranded on the Galician (NW Spain) coast. Dis Aquat Organ 32:71–73. https://doi.org/10.3354/dao032071.
38. Harper CG, Feng Y, Xu S, Taylor NS, Kinsel M, Dewhirst FE, Paster BJ, Greenwell M, Levine G, Rogers A, Fox JG. 2002. *Helicobacter cetorum* sp. nov., a urease-positive *Helicobacter* species isolated from dolphins and whales. J Clin Microbiol 40:4536–4543. https://doi.org/10.1128/JCM.40.12.4536-4543.2002.
39. Fogelson SB, Camus AC, Lorenz W, Phillips A, Bartlett P, Sanchez S. 2018. *Mycobacterium syngnathidarum* sp. nov., a rapidly growing mycobacterium identified in syngnathid fish. Int J Syst Evol Microbiol 68:3696–3700. https://doi.org/10.1099/ijsem.0.002978.
40. Jacobs JM, Stine CB, Baya AM, Kent ML. 2009. A review of mycobacteriosis in marine fish. J Fish Dis 32:119–130. https://doi.org/10.1111/j.1365-2761.2008.01016.x.
41. Aubry A, Mougari F, Reibel F, Cambau E. 2017. *Mycobacterium marinum*. Microbiol Spectr 5. https://doi.org/10.1128/microbiolspec.TNMI7-0038-2016.
42. Loch TP, Faisal M. 2014. *Flavobacterium spartansii* sp. nov., a pathogen of fishes, and emended descriptions of *Flavobacterium aquidurense* and *Flavobacterium araucananum*. Int J Syst Evol Microbiol 64:406–412. https://doi.org/10.1099/ijs.0.051433-0.
43. Zamora L, Vela AI, Sánchez-Porro C, Palacios MA, Moore ERB, Domínguez L, Ventosa A, Fernández-Garayzábal JF. 2014. *Flavobacterium tructae* sp. nov. and *Flavobacterium piscis* sp. nov., isolated from farmed rainbow trout (*Oncorhynchus mykiss*). Int J Syst Evol Microbiol 64:392–399. https://doi.org/10.1099/ijs.0.056341-0.
44. Garcia C, Mesnil A, Tourbiez D, Moussa M, Dubreuil C, G, de Sa A, Chollet B, Godfrin Y, Dégremont L, Serpin D, Travers MA. 2021. *Vibrio aestuarianus* subsp. *cardii* subsp. nov., pathogenic to the edible cockles *Cerastoderma edule* in France, and establishment of *Vibrio aestuarianus* subsp. *aestuarianus* subsp. nov. and *Vibrio aestuarianus* subsp. *francensis* subsp. nov. Int J Syst Evol Microbiol 71:e004654. https://doi.org/10.1099/ijsem.0.004654.
45. Garnier M, Labreuche Y, Nicolas JL. 2008. Molecular and phenotypic characterization of *Vibrio aestuarianus* subsp. *francensis* subsp. nov., a pathogen of the oyster *Crassostrea gigas*. Syst Appl Microbiol 31:358–365. https://doi.org/10.1016/j.syapm.2008.06.003.

46. Tak EJ, Kim HS, Lee JY, Kang W, Hyun DW, Kim PS, Shin NR, Bae JW. 2018. *Tessaracoccus aquimaris* sp. nov., isolated from the intestine of a Korean rockfish, *Sebastes schlegelii*, from a marine aquaculture pond. Int J Syst Evol Microbiol 68:1065–1072. https://doi.org/10.1099/ijsem.0.002626.
47. Talwar C, Singh AK, Choksket S, Korpole S, Lal R, Negi RK. 2020. *Salinicoccus cyprini* sp. nov., isolated from the gut of mirror carp, *Cyprinus carpio* var. *specularis*. Int J Syst Evol Microbiol 70:4111–4118. https://doi.org/10.1099/ijsem.0.004247.
48. Li Q, Zheng Y, Guo A, Chen Y, Zhang S, Li J. 2020. *Pseudokineococcus galaxeicola* sp. nov., isolated from mucus of a stony coral. Int J Syst Evol Microbiol 70:5671–5675. https://doi.org/10.1099/ijsem.0.004460.
49. Shin SK, Kim E, Yi H. 2018. *Paenibacillus crassostreae* sp. nov., isolated from the Pacific oyster *Crassostrea gigas*. Int J Syst Evol Microbiol 68:58–63. https://doi.org/10.1099/ijsem.0.002444.
50. Li L, Wang J, Zhou YJ, Lin HW, Lu YH. 2019. *Streptomyces reniochalinae* sp. nov. and *Streptomyces diacarni* sp. nov., from marine sponges. Int J Syst Evol Microbiol 69:99–104. https://doi.org/10.1099/ijsem.0.003109.
51. Li L, Gui YH, Xu QH, Lin HW, Lu YH. 2019. *Spongiactinospora rosea* gen. nov., sp. nov., a new member of the family *Streptosporangiaceae*. Int J Syst Evol Microbiol 69:427–433. https://doi.org/10.1099/ijsem.0.003165.
52. Li L, Zhu HR, Xu QH, Lin HW, Lu YH. 2019. *Micromonospora craniellae* sp. nov., isolated from a marine sponge, and reclassification of *Jishengella endophytica* as *Micromonospora endophytica* comb. nov. Int J Syst Evol Microbiol 69:715–720. https://doi.org/10.1099/ijsem.0.003209.
53. Li L, Xu QH, Wang XT, Lin HW, Lu YH. 2019. *Actinomadura craniellae* sp. nov., isolated from a marine sponge in the South China Sea. Int J Syst Evol Microbiol 69:1207–1212. https://doi.org/10.1099/ijsem.0.003295.
54. Li L, Zhang D, Tang WZ, Lin HW, Lu YH. 2019. *Geodermatophilus marinus* sp. nov., isolated from the marine sponge *Leucetta chagosensis*. Int J Syst Evol Microbiol 69:2973–2978.
55. Zhou Y, Pei S, Xie F, Gu L, Zhang G. 2020. *Saccharopolyspora coralli* sp. nov. a novel actinobacterium isolated from the stony coral *Porites*. Int J Syst Evol Microbiol 70:3241–3246. https://doi.org/10.1099/ijsem.0.004162.
56. Das L, Deb S, Das SK. 2020. *Glutamicibacter mishrai* sp. nov., isolated from the coral *Favia veroni* from Andaman Sea. Arch Microbiol 202:733–745. https://doi.org/10.1007/s00203-019-01783-0.
57. Zhao LH, Xing X, Liu YY, Sha S, Song C, Sun YH, Xianyu DW, Zhu Q. 2020. *Aeromicrobium piscarium* sp. nov., isolated from the intestine of *Collichthys lucidus*. Int J Syst Evol Microbiol 70:5280–5286. https://doi.org/10.1099/ijsem.0.004407.
58. Glaeser SP, Rückert C, Abdelmohsen UR, Winkler A, Blom J, Goesmann A, Kalinowski J, Hentschel U, Busse HJ, Kämpfer P. 2019. *Streptomyces dysideae* sp. nov., isolated from a marine Mediterranean sponge *Dysidea tupha*. Int J Syst Evol Microbiol 71:e004672. https://doi.org/10.1099/ijsem.0.004672.
59. Li F, Xie Q, Zhou S, Kong F, Xu Y, Ma Q, Wu W, Huang D, Zhao Y, Huang X. 2021. *Nocardiopsis coralli* sp. nov. a novel actinobacterium isolated from the coral *Galaxea astreata*. Int J Syst Evol Microbiol 71:e004817. https://doi.org/10.1099/ijsem.0.004817.
60. Ming H, Cheng LJ, Yi BF, Xia TT, Niu MM, Zhao ZY, Liu BB, Nie GX, Cui CX. 2021. *Brachybacterium subflavum* sp. nov., a novel actinobacterium isolated from the foregut of grass carp. Int J Syst Evol Microbiol 71:e004839.
61. Risdian C, Landwehr W, Rohde M, Schumann P, Hahnke RL, Spröer C, Bunk B, Kämpfer P, Schupp PJ, Wink J. 2021. *Streptomyces bathyalis* sp. nov., an actinobacterium isolated from the sponge in a deep sea. Antonie Van Leeuwenhoek 114:425–435. https://doi.org/10.1007/s10482-021-01528-4.
62. Li F, Huang Y, Hu W, Li Z, Wang Q, Huang S, Jiang F, Pan X. 2021. *Roseomonas coralli* sp. nov., a heavy metal resistant bacterium isolated from coral. Int J Syst Evol Microbiol 71:e004624. https://doi.org/10.1099/ijsem.0.004624.
63. Sheu DS, Sheu SY, Xie PB, Tang SL, Chen WM. 2018. *Thalassotalea coralli* sp. nov., isolated from the torch coral *Euphyllia glabrescens*. Int J Syst Evol Microbiol 68:185–191. https://doi.org/10.1099/ijsem.0.002478.
64. Sheu SY, Xie PB, Sheu DS, Tang SL, Chen WM. 2018. *Litoribrevibacter euphylliae* sp. nov., isolated from the torch coral *Euphyllia glabrescens*. Int J Syst Evol Microbiol 68:432–437. https://doi.org/10.1099/ijsem.0.002529.
65. Huang Z, Lai Q, Zhang D, Shao Z. 2017. *Agaribacterium haliotis* gen. nov., sp. nov., isolated from abalone faeces. Int J Syst Evol Microbiol 67:3819–3823. https://doi.org/10.1099/ijsem.0.002199.
66. Baek C, Kim E, Shin SK, Choi S, Yi H. 2017. *Hydrogenophaga crassostreae* sp. nov., isolated from a Pacific oyster. Int J Syst Evol Microbiol 67:4045–4049. https://doi.org/10.1099/ijsem.0.002244.
67. Christiansen L, Bech PK, Schultz-Johansen M, Martens HJ, Stougaard P. 2018. *Colwellia echini* sp. nov., an agar- and carrageenan-solubilizing bacterium isolated from sea urchin. Int J Syst Evol Microbiol 68:687–691. https://doi.org/10.1099/ijsem.0.002568.
68. Liu Y, Rao Q, Tu J, Zhang J, Huang M, Hu B, Lin Q, Luo T. 2018. *Acinetobacter piscicola* sp. nov., isolated from diseased farmed Murray cod (*Maccullochella peelii peelii*). Int J Syst Evol Microbiol 68:905–910. https://doi.org/10.1099/ijsem.0.002608.
69. Kim YO, Park IS, Park S, Nam BH, Kim DG, Choi SG, Bae JW, Yoon JH. 2018. *Bizionia berychis* sp. nov., isolated from intestinal tract of a splendid alfonsino (*Beryx splendens*). Int J Syst Evol Microbiol 68:1227–1232. https://doi.org/10.1099/ijsem.0.002656.
70. Kim HC, Kim YO, Park S, Nam BH, Kim DG, Park JM, Yoon JH. 2018. *Vitellibacter todarodis* sp. nov., isolated from intestinal tract of a squid (*Todarodes pacificus*). Int J Syst Evol Microbiol 68:1233–1237. https://doi.org/10.1099/ijsem.0.002655.
71. Shin SK, Kim E, Yi H. 2018. *Tenacibaculum todarodis* sp. nov., isolated from a squid. Int J Syst Evol Microbiol 68:1479–1483. https://doi.org/10.1099/ijsem.0.002692.
72. Franco A, Busse HJ, Schubert P, Wilke T, Kampfer P, Glaeser SP. 2018. *Winogradskyella pocilloporae* sp. nov. isolated from healthy tissue of the coral *Pocillopora damicornis*. Int J Syst Evol Microbiol 68:1689–1696. https://doi.org/10.1099/ijsem.0.002731.
73. Zhuang L, Lin B, Qin F, Luo L. 2018. *Zhouia spongiae* sp. nov., isolated from a marine sponge. Int J Syst Evol Microbiol 68:2194–2198. https://doi.org/10.1099/ijsem.0.002808.
74. Choi KD, Lee GE, Park JS. 2018. *Aquimarina spongiicola* sp. nov., isolated from spongin. Int J Syst Evol Microbiol 68:990–994. https://doi.org/10.1099/ijsem.0.002575.
75. Bartz JO, Blom J, Busse HJ, Mvie JB, Hardt M, Schubert P, Wilke T, Goessmann A, Wilharm G, Bender J, Kämpfer P, Glaeser SP. 2018. *Parendozoicomonas haliclonae* gen. nov. sp. nov. isolated from a marine sponge of the genus *Haliclona* and description of the family *Endozoicomonadaceae* fam. nov. comprising the genera *Endozoicomonas*, *Parendozoicomonas*, and *Kistimonas*. Syst Appl Microbiol 41:73–84. https://doi.org/10.1016/j.syapm.2017.11.004.
76. Yuk KJ, Kim YT, Huh CS, Lee JH. 2018. *Lelliottia jeotgali* sp. nov., isolated from a traditional Korean fermented clam. Int J Syst Evol Microbiol 68:1725–1731. https://doi.org/10.1099/ijsem.0.002737.
77. Chen WM, Xie PB, Tang SL, Sheu SY. 2018. *Coralloluteibacterium stylophorae* gen. nov., sp. nov., a new member of the family *Lysobacteraceae* isolated from the reef-building coral *Stylophora* sp. Arch Microbiol 200:473–481. https://doi.org/10.1007/s00203-017-1458-y.
78. Wang G, Xu S, Su H, Chen B, Huang W, Liang J, Wang Y, Yu K. 2018. *Motiliproteus coralliicola* sp. nov., a bacterium isolated from coral. Int J Syst Evol Microbiol 68:3292–3295. https://doi.org/10.1099/ijsem.0.002984.
79. He RH, Liang QY, Zhao JX, Du ZJ. 2018. *Hanstruepera crassostreae* sp. nov., a novel marine bacterium of the family *Flavobacteriaceae* isolated from an oyster. Int J Syst Evol Microbiol 68:3647–3651. https://doi.org/10.1099/ijsem.0.003053.
80. Li YX, Wang NN, Chen GJ, Du ZJ. 2019. *Cohaesibacter celericrescens* sp. nov., isolated from sea catfish. Int J Syst Evol Microbiol 69:255–260. https://doi.org/10.1099/ijsem.0.003146.
81. Wang FQ, Ren LH, Lin YW, Sun GH, Du ZJ, Zhao JX, Liu XJ, Liu LJ. 2019. *Motilimonas pumila* sp. nov., isolated from the gut of sea cucumber *Apostichopus japonicus*. Int J Syst Evol Microbiol 69:811–815. https://doi.org/10.1099/ijsem.0.003242.
82. Zhuang L, Lin B, Xu L, Li G, Wu CJ, Luo L. 2019. *Erythrobacter spongiae* sp. nov., isolated from marine sponge. Int J Syst Evol Microbiol 69:1111–1116. https://doi.org/10.1099/ijsem.0.003278.
83. Choi H, Im WT, Park JS. 2018. *Lysobacter spongiae* sp. nov., isolated from spongin. J Microbiol 56:97–103. https://doi.org/10.1007/s12275-018-7462-3.
84. Zhuang L, Lin B, Chen D, Li G, Zhang B, Luo L. 2019. *Altererythrobacter spongiae* sp. nov., a novel member of the genus *Altererythrobacter* isolated from marine sponge. Int J Syst Evol Microbiol 69:2043–2048. https://doi.org/10.1099/ijsem.0.003423.
85. Knobloch S, Daussin A, Johannsson R, Marteinsson V. 2019. *Pelagibaculum spongiae* gen. nov., sp. nov., isolated from a marine sponge in South-West Iceland. Int J Syst Evol Microbiol 69:2129–2134. https://doi.org/10.1099/ijsem.0.003448.
86. Xia HF, Chen GJ, Du ZJ. 2019. *Corallincola holothuriorum* sp. nov., a facultative anaerobe isolated from sea cucumber intestine. Int J Syst Evol Microbiol 69:2258–2262. https://doi.org/10.1099/ijsem.0.003456.

87. Kim YO, Park S, Park IS, Nam BH, Kim DG, Yoon JH. 2019. *Empedobacter tilapiae* sp. nov., isolated from an intestine of Nile tilapia (*Oreochromis niloticus*). Int J Syst Evol Microbiol 69:2781–2786. https://doi.org/10.1099/ijsem.0.003558.
88. Lee JY, Hyun DW, Yun JH, Jung MJ, Shin NR, Bae JW. 2019. *Paracoccus tegillarcae* sp. nov., isolated from the gastrointestinal tract of a blood cockle (*Tegillarca granosa*). Int J Syst Evol Microbiol 69:2815–2822. https://doi.org/10.1099/ijsem.0.003561.
89. Wang NN, Zhou LY, Wang XP, Li YX, Du ZJ. 2019. *Oceaniglobus ichthyenteri* sp. nov., isolated from the gut microflora of sea bass (*Dicentrarchus labrax* L.) and emended description of the genus *Oceaniglobus*. Int J Syst Evol Microbiol 69:2892–2898. https://doi.org/10.1099/ijsem.0.003573.
90. Lee SY, Kang W, Kim PS, Kim HS, Sung H, Shin NR, Whon TW, Yun JH, Lee JY, Lee JY, Jung MJ, Jeong YS, Tak EJ, Han JE, Hyun DW, Kang MS, Lee KE, Lee BH, Bae JW. 2019. *Undibacterium piscinae* sp. nov., isolated from Korean shiner intestine. Int J Syst Evol Microbiol 69:3148–3154. https://doi.org/10.1099/ijsem.0.003604.
91. Liu M, Huang Z, Zhao Q, Shao Z. 2019. *Cohaesibacter intestini* sp. nov., isolated from the intestine of abalone, *Haliotis discus hannai*. Int J Syst Evol Microbiol 69:3202–3206. https://doi.org/10.1099/ijsem.0.003610.
92. Namirimu T, Park MJ, Yang SH, Zo YG, Kwon KK. 2019. *Parashewanella tropica* sp. nov., a mesophilic bacterium isolated from a marine sponge from Chuuk lagoon, Federated States of Micronesia, and emended description of the genus *Parashewanella*. Int J Syst Evol Microbiol 69:3262–3267.
93. Park JS. 2019. *Muricauda hymeniacidonis* sp. nov., isolated from sponge of *Hymeniacidon sinapium*. Int J Syst Evol Microbiol 69:3800–3805. https://doi.org/10.1099/ijsem.0.003683.
94. Oh WT, Jun JW, Giri SS, Yun S, Kim HJ, Kim SG, Kim SW, Kang JW, Han SJ, Kwon J, Kim JH, Smits THM, Park SC. 2019. *Pseudomonas tructae* sp. nov., novel species isolated from rainbow trout kidney. Int J Syst Evol Microbiol 69:3851–3856. https://doi.org/10.1099/ijsem.0.003696.
95. Shi SB, Li GD, Yang LF, Liu C, Jiang MG, Li QY, Wu JF, Zhang K, Jiang LQ, Shen NK, Jiang CL, Jiang Y. 2019. *Ottowia flava* sp. nov., isolated from fish intestines. Antonie Van Leeuwenhoek 112:1567–1575. https://doi.org/10.1007/s10482-019-01284-6.
96. Kämpfer P, Irgang R, Fernández-Negrete G, Busse HJ, Poblete-Morales M, Fuentes-Messina D, Glaeser SP, Avendaño-Herrera R. 2019. Proposal of *Pedobacter notothenia*e sp. nov., isolated from the spleen of a black rock cod (*Notothenia coriiceps*, Richardson 1844) from the Chilean Antarctica. Antonie Van Leeuwenhoek 112:1465–1475. https://doi.org/10.1007/s10482-019-01275-7.
97. Jeong YS, Kang W, Sung H, Lee JY, Yun JH, Shin NR, Kim HS, Lee SY, Han JE, Lee JY, Tak EJ, Kim PS, Hyun DW, Jung MJ, Whon TW, Kang MS, Lee KE, Lee BH, Bae JW. 2020. *Flammeovirga pectinis* sp. nov., isolated from the gut of the Korean scallop, *Patinopecten yessoensis*. Int J Syst Evol Microbiol 70:499–504. https://doi.org/10.1099/ijsem.0.003783.
98. Zhuang L, Luo L. 2020. *Roseovarius spongiae* sp. nov., a bacterium isolated from marine sponge. Int J Syst Evol Microbiol 70:274–281. https://doi.org/10.1099/ijsem.0.003750.
99. Ming H, Cheng LJ, Ding CL, Niu MM, Zhao ZL, Ji WL, Zhang LY, Zhang YM, Meng XL, Nie GX. 2020. *Paracoccus luteus* sp. nov., isolated from the intestine of grass carp. Int J Syst Evol Microbiol 70:543–549. https://doi.org/10.1099/ijsem.0.003790.
100. Yin Q, Song ZM, Liang J, Wang Y, Zheng X, Li S, Xu Y. 2020. *Pseudooceanicola onchidii* sp. nov., isolated from a marine invertebrate from the South China Sea. Int J Syst Evol Microbiol 70:1224–1230. https://doi.org/10.1099/ijsem.0.003905.
101. Liu L, Yu M, Zhou S, Fu T, Sun W, Wang L, Zhang XH. 2020. *Muricauda alvinocaridis* sp. nov., isolated from shrimp gill from the Okinawa Trough. Int J Syst Evol Microbiol 70:1666–1671. https://doi.org/10.1099/ijsem.0.003953.
102. Zhuang L, Lin B, Luo L. 2020. *Mangrovimonas spongiae* sp. nov., a novel member of the genus *Mangrovimonas* isolated from marine sponge. Int J Syst Evol Microbiol 70:1982–1986. https://doi.org/10.1099/ijsem.0.004006.
103. Wang Y, Liu L, Yu M, Zhou S, Fu T, Sun W, Du R, Zhang XH. 2020. *Carideicomes alvinocaridis* gen. nov., sp. nov., a marine bacterium isolated from shrimp gill in a hydrothermal field of Okinawa Trough. Int J Syst Evol Microbiol 70:1777–1784. https://doi.org/10.1099/ijsem.0.003971.
104. Chen WM, Lin KR, Sheu SY. 2019. *Endozoicomonas coralli* sp. nov., isolated from the coral *Acropora* sp. Arch Microbiol 201:531–538. https://doi.org/10.1007/s00203-018-1591-2.
105. Goldberg SR, Correa H, Haltli BA, Kerr RG. 2020. *Fulvivirga aurantia* sp. nov. and *Xanthovirga aplysinae* gen. nov., sp. nov., marine bacteria isolated from the sponge *Aplysina fistularis*, and emended description of the genus *Fulvivirga*. Int J Syst Evol Microbiol 70:2766–2781. https://doi.org/10.1099/ijsem.0.004108.
106. Han JE, Kang W, Lee JY, Sung H, Hyun DW, Kim HS, Kim PS, Tak EJ, Jeong YS, Lee JY, Lee SY, Yun JH, Jung MJ, Shin NR, Whon TW, Kang MS, Lee KE, Lee BH, Bae JW. 2020. *Tabrizicola piscis* sp. nov., isolated from the intestinal tract of a Korean indigenous freshwater fish, *Acheilognathus koreensis*. Int J Syst Evol Microbiol 70:2305–2311. https://doi.org/10.1099/ijsem.0.004034.
107. Altamia MA, Shipway JR, Stein D, Betcher MA, Fung JM, Jospin G, Eisen J, Haygood MG, Distel DL. 2020. *Teredinibacter waterburyi* sp. nov., a marine, cellulolytic endosymbiotic bacterium isolated from the gills of the woodboring mollusc *Bankia setacea* (Bivalvia: Teredinidae) and emended description of the genus *Teredinibacter*. Int J Syst Evol Microbiol 70:2388–2394. https://doi.org/10.1099/ijsem.0.004049.
108. Liu Y, Rao Q, Blom J, Lin Q, Luo T. 2020. *Pseudomonas piscis* sp. nov., isolated from the profound head ulcers of farmed Murray cod (*Maccullochella peelii peelii*). Int J Syst Evol Microbiol 70:2732–2739. https://doi.org/10.1099/ijsem.0.004101.
109. Li CM, Wang XP, Zhou LY, Chen GJ, Du ZJ. 2020. *Pelagivirga dicentrarchi* sp. nov., a member of the family *Rhodobacteraceae* isolated from the gut microflora of sea bass (*Dicentrarchus labrax* L.). Antonie Van Leeuwenhoek 113:293–301. https://doi.org/10.1007/s10482-019-01337-w.
110. Kawano K, Ushijima N, Kihara M, Itoh H. 2020. *Patiriisocius marinistellae* gen. nov., sp. nov., isolated from the starfish *Patiria pectinifera,* and reclassification of *Ulvibacter marinus* as a member of the genus *Patiriisocius* comb. nov. Int J Syst Evol Microbiol 70:4119–4129. https://doi.org/10.1099/ijsem.0.004254.
111. Kim YS, Kim SE, Kim SJ, Jung HK, Kim KH. 2020. *Pukyongiella litopenaei* gen. nov., sp. nov., a novel bacterium isolated from the gut content of a whiteleg shrimp *Litopenaeus vannamei*. Int J Syst Evol Microbiol 70:4193–4198. https://doi.org/10.1099/ijsem.0.004269.
112. Enciso-Ibarra J, González-Castillo A, Soto-Rodriguez SA, Enciso-Ibarra K, Bolán-Mejia C, Gomez-Gil B. 2020. *Photobacterium lucens* sp. nov., isolated from a cultured shrimp *Penaeus vannamei*. Curr Microbiol 77:1111–1116. https://doi.org/10.1007/s00284-020-01893-9.
113. Le Guern AS, Savin C, Angermeier H, Brémont S, Clermont D, Mühle E, Orozova P, Najdenski H, Pizarro-Cerdá J. 2020. *Yersinia artesiana* sp. nov., *Yersinia proxima* sp. nov., *Yersinia alsatica* sp. nov., *Yersina vastinensis* sp. nov., *Yersinia thracica* sp. nov. and *Yersinia occitanica* sp. nov., isolated from humans and animals. Int J Syst Evol Microbiol 70:5363–5372. https://doi.org/10.1099/ijsem.0.004417.
114. Wang G, Xu S, Dang G, Liu J, Su H, Chen B, Liao Z, Huang W, Liang J, Wang Y, Yu K. 2020. *Poritiphilus flavus* gen. nov., sp. nov., a member of the family *Flavobacteriaceae* isolated from coral *Porites lutea*. Int J Syst Evol Microbiol 70:5620–5626. https://doi.org/10.1099/ijsem.0.004452.
115. Wang G, Dang G, Xu S, Liu J, Su H, Liang J, Huang W, Wang Y, Yu K. 2020. *Aliikangiella coralliicola* sp. nov., a bacterium isolated from coral *Porites lutea*, and proposal of *Pleioneaceae* fam. nov. to accommodate *Pleionea* and *Aliikangiella*. Int J Syst Evol Microbiol 70:5880–5887. https://doi.org/10.1099/ijsem.0.004489.
116. Liao L, Su SY, Zhang YJ, Liu H, Zhang XY, Zhang J, Wen J, Chen B, Yu Y. 2021. *Pseudopuniceibacterium antarcticum* sp. nov., isolated from an Antarctic marine sponge. Int J Syst Evol Microbiol 71:e004605. https://doi.org/10.1099/ijsem.0.004605.
117. Kim H, Yoon SC, Choi KH, Kim ST, Lee JB, Kim DS, Le Han H, Bae KS, Park DS. 2017. *Lacinutrix chionocetis* sp. nov., isolated from gut of a red snow crab. Arch Microbiol 199:597–603. https://doi.org/10.1007/s00203-016-1330-5.
118. Rao Q, Liu Y, Chen C, Lin Q, Ren L, Huang M, Tu J, Luo T. 2019. *Pseudomonas ovata* sp. nov., isolated from the skin of the tail of farmed Murray cod (*Maccullochella peelii peelii*) with a profound ulceration. Curr Microbiol 76:1168–1174. https://doi.org/10.1007/s00284-019-01729-1.
119. Chen S, He M, Lai Q, Xu Y, Shang C. 2019. *Jannaschia marina* sp. nov., isolated from the gut of a gastropod, *Onchidium reevesii*. Int J Syst Evol Microbiol 71:e004756. https://doi.org/10.1099/ijsem.0.004756.
120. Xu S, Li A, Zhang MX, Yao Q, Zhu H. 2019. *Lysobacter penaei* sp. nov., isolated from intestinal content of a Pacific white shrimp (*Penaeus vannamei*). Int J Syst Evol Microbiol 71:e004593. https://doi.org/10.1099/ijsem.0.004593.
121. Jeong YS, Kang W, Lee JY, Sung H, Kim HS, Han JE, Tak EJ, Lee SY, Lee JY, Kim PS, Hyun DW, Jung MJ, Bae JW. 2019. *Pseudorhodobacter turbinis* sp. nov., isolated from the gut of the Korean turban shell, *Turbo cornutus*. Int J Syst Evol Microbiol 71:e004711.

122. Duman M, Mulet M, Altun S, Saticioglu IB, Gomila M, Lalucat J, Garcia-Valdes E. 2019. *Pseudomonas piscium* sp. nov., *Pseudomonas pisciculturae* sp. nov., *Pseudomonas mucoides* sp. nov. and *Pseudomonas neuropathica* sp. nov. isolated from rainbow trout. Int J Syst Evol Microbiol 71:e004714. https://doi.org/10.1099/ijsem.0.004714.
123. Li F, Huang Y, Hu W, Li Z, Wang Q, Huang S, Yu L, Liu S, Sun C, Pan X. 2021. *Mesobaculum littorinae* gen. nov., sp. nov., a novel bacterium isolated from a sea snail *Littorina scabra*. Int J Syst Evol Microbiol 71:e004821.
124. Mulet M, Duman M, Altun S, Saticioglu IB, Gomila M, Matthijs S, Lalucat J, García-Valdés E. 2021. *Pseudomonas arcuscaelestis* sp. nov., isolated from rainbow trout and water. Int J Syst Evol Microbiol 71:e004860. https://doi.org/10.1099/ijsem.0.004860.
125. Choi JW, Lee JY, Hyun DW, Lee JY, Kim PS, Han JE, Jeong YS, Lee SY, Sung H, Tak EJ, Kim HS, Bae JW. 2021. *Chitinibacter bivalviorum* sp. nov., isolated from the gut of the freshwater mussel *Anodonta arcaeformis*. Int J Syst Evol Microbiol 71:e004909.
126. Shin SK, Kim E, Choi S, Yi H. 2016. *Cochleicola gelatinilyticus* gen. nov., sp. nov., isolated from a marine gastropod, *Reichia luteostoma*. J Microbiol Biotechnol 26:1439–1445. https://doi.org/10.4014/jmb.1604.04083.
127. Macián MC, Lucena T, Arahal DR, Ruvira MA, Aznar R, Pujalte MJ. 2021. *Pseudidiomarina piscicola* sp. nov., isolated from cultured European seabass, *Dicenthrarchus labrax*. Arch Microbiol 203:1293–1298. https://doi.org/10.1007/s00203-020-02131-3.
128. Duman M, Mulet M, Altun S, Burcin Saticioglu I, Gomila M, Lalucat J, García-Valdés E. 2021. *Pseudomonas anatoliensis* sp. nov and *Pseudomonas iridis* sp. nov. isolated from fish. Syst Appl Microbiol 44:126198. https://doi.org/10.1016/j.syapm.2021.126198.
129. Zhuang L, Pang H, Xu L, Chen D. 2021. *Marixanthomonas spongiae* sp. nov., isolated from marine sponge. Int J Syst Evol Microbiol 71:e004968.
130. Liang J, Yin Q, Zheng X, Wang Y, Song ZM, Zhang Y, Hao L, Xu Y. 2021. *Muricauda onchidii* sp. nov., isolated from a marine invertebrate from South China Sea, and transfers of *Flagellimonas algicola*, *Flagellimonas pacifica* and *Flagellimonas maritima* to *Muricauda algicola* comb. nov., *Muricauda parva* nom. nov. and *Muricauda aurantiaca* nom. nov., respectively, and emended description of the genus *Muricauda*. Int J Syst Evol Microbiol 71:e004982.
131. Cao WR, Shang DD, Liu BT, Hu YH, Sun XK, Sun YY, Jiang MY, Du ZJ. 2021. *Ruegeria haliotis* sp. nov., isolated from the gut of the abalone *Haliotis rubra*. Curr Microbiol 78:2151–2159. https://doi.org/10.1007/s00284-021-02450-8.
132. Cao WR, Liu BT, Sun XK, Sun YY, Jiang MY, Du ZJ. 2021. *Tamlana haliotis* sp. nov., isolated from the gut of the abalone *Haliotis rubra*. Arch Microbiol 203:2357–2364. https://doi.org/10.1007/s00203-021-02216-7.
133. Yin Q, Liang J, Zheng X, Wang Y, Song ZM, Zhang Y, Xu Y. 2021. *Algibacter onchidii* sp. nov., a symbiotic bacterium isolated from a marine invertebrate. Int J Syst Evol Microbiol 71:e005102. https://doi.org/10.1099/ijsem.0.005102.
134. Cuny H, Offret C, Boukerb AM, Parizadeh L, Lesouhaitier O, L, Chevalier P, Jégou C, Bazire A, Brillet B, Fleury Y. 2021. *Pseudoalteromonas ostreae* sp. nov., a new bacterial species harboured by the flat oyster *Ostrea edulis*. Int J Syst Evol Microbiol 71:e005070. https://doi.org/10.1099/ijsem.0.005070.
135. Kim YO, Noh JK, Kim DG, Park IS, Park S, Yoon JH. 2021. *Paenihalocynthiibacter styelae* gen. nov., sp. nov., isolated from stalked sea squirt *Styela clava*. Int J Syst Evol Microbiol 71:e005085.
136. Tanaka R, Cleenwerck I, Mizutani Y, Iehata S, Bossier P, Vandamme P. 2017. *Arcobacter haliotis* sp. nov., isolated from abalone species *Haliotis gigantea*. Int J Syst Evol Microbiol 67:3050–3056. https://doi.org/10.1099/ijsem.0.002080.
137. Kim MJ, Baek MG, Shin SK, Yi H. 2021. *Poseidonibacter parvus* sp. nov., isolated from a squid. Int J Syst Evol Microbiol 71:e004590. https://doi.org/10.1099/ijsem.0.004590.
138. Altamia MA, Shipway JR, Stein D, Betcher MA, Fung JM, Jospin G, Eisen J, Haygood MG, Distel DL. 2021. *Teredinibacter haidensis* sp. nov., *Teredinibacter purpureus* sp. nov. and *Teredinibacter franksiae* sp. nov., marine, cellulolytic endosymbiotic bacteria isolated from the gills of the wood-boring mollusc *Bankia setacea* (Bivalvia: Teredinidae) and emended description of the genus *Teredinibacter*. Int J Syst Evol Microbiol 71:e004627. https://doi.org/10.1099/ijsem.0.004627.
139. Goldberg SR, Haltli BA, Correa H, Kerr RG. 2021. *Curvivirga aplysinae* gen. nov., sp. nov., a marine bacterium isolated from the sea sponge *Aplysina fistularis*. Int J Syst Evol Microbiol 71:e004873. https://doi.org/10.1099/ijsem.0.004873.
140. Moon YL, Park JS. 2021. *Vibrio ulleungensis* sp. nov., isolated from *Mytilus coruscus*. Int J Syst Evol Microbiol 71:e005136. https://doi.org/10.1099/ijsem.0.005136.
141. Kohn T, Wiegand S, Boedeker C, Rast P, Heuer A, Jetten MSM, Schüler M, Becker S, Rohde C, Müller RW, Brümmer F, Rohde M, Engelhardt H, Jogler M, Jogler C. 2020. *Planctopirus ephydatiae*, a novel Planctomycete isolated from a freshwater sponge. Syst Appl Microbiol 43:126022. https://doi.org/10.1016/j.syapm.2019.126022.
142. Kallscheuer N, Wiegand S, Boedeker C, Peeters SH, Jogler M, Rast P, Heuer A, Jetten MSM, Rohde M, Jogler C. 2020. *Aureliella helgolandensis* gen. nov., sp. nov., a novel Planctomycete isolated from a jellyfish at the shore of the island Helgoland. Antonie Van Leeuwenhoek 113:1839–1849. https://doi.org/10.1007/s10482-020-01403-8.
143. Kallscheuer N, Wiegand S, Kohn T, Boedeker C, Jeske O, Rast P, Müller RW, Brümmer F, Heuer A, Jetten MSM, Rohde M, Jogler M, Jogler C. 2020. Cultivation-independent analysis of the bacterial community associated with the calcareous sponge *Clathrina clathrus* and isolation of *Poriferisphaera corsica* gen. nov., sp. nov., belonging to the barely studied class *Phycisphaerae* in the phylum *Planctomycetes*. Front Microbiol 11:602250. https://doi.org/10.3389/fmicb.2020.602250.
144. Oren A, Garrity GM. 2020. List of new names and new combinations that have appeared in effective publications outside of the IJSEM and are submitted for valid publication. Int J Syst Evol Microbiol 70:4844–4847. https://doi.org/10.1099/ijsem.0.004366.
145. Oren A, Garrity GM. 2021. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 71:e005096.
146. Oren A, Garrity GM. 2018. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 68:2130–2133. https://doi.org/10.1099/ijsem.0.002831.
147. Oren A, Garrity GM. 2018. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 68:2707–2709. https://doi.org/10.1099/ijsem.0.002945.
148. Oren A, Garrity GM. 2019. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 69:5–9. https://doi.org/10.1099/ijsem.0.003174.
149. Oren A, Garrity GM. 2019. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 69:1247–1250. https://doi.org/10.1099/ijsem.0.003357.
150. Oren A, Garrity GM. 2020. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 70:1–5. https://doi.org/10.1099/ijsem.0.003881.
151. Oren A, Garrity GM. 2020. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 70:1443–1446. https://doi.org/10.1099/ijsem.0.003991.
152. Oren A, Garrity GM. 2020. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 70:2960–2966. https://doi.org/10.1099/ijsem.0.004156.
153. Oren A, Garrity GM. 2020. List of new names and new combinations that have appeared in effective publications outside of the IJSEM and are submitted for valid publication. Int J Syst Evol Microbiol 70:5596–5600. https://doi.org/10.1099/ijsem.0.004484.
154. Oren A, Garrity GM. 2021. List of new names and new combinations that have appeared in effective publications outside of the IJSEM and are submitted for valid publication. Int J Syst Evol Microbiol 71:e004688.
155. Oren A, Garrity GM. 2021. Valid publication of new names and new combinations effectively published outside the IJSEM. Int J Syst Evol Microbiol 71:e004846.
156. Oren A, Garrity GM. 2021. Valid publication of new names and new combinations effectively published outside the IJSEM. Int J Syst Evol Microbiol 71:e004773.
157. Supong K, Suriyachadkun C, Suwanborirux K, Pittayakhajonwut P, Thawai C. 2013. *Verrucosispora andamanensis* sp. nov., isolated from a marine sponge. Int J Syst Evol Microbiol 63:3970–3974. https://doi.org/10.1099/ijs.0.050906-0.
158. Nouioui I, Carro L, Garcia-Lopez M, Meier-Kolthoff JP, Woyke T, Kyrpides NC, Pukall R, Klenk HP, Goodfellow M, Goker M. 2018. Genome-based taxonomic classification of the phylum *Actinobacteria*. Front Microbiol 9:2007. https://doi.org/10.3389/fmicb.2018.02007.
159. Chen JH, Tian XR, Ruan Y, Yang LL, He ZQ, Tang SK, Li WJ, Shi H, Chen YG. 2015. *Bacillus crassostreae* sp. nov., isolated from an oyster (*Crassostrea hongkongensis*). Int J Syst Evol Microbiol 65:1561–1566. https://doi.org/10.1099/ijs.0.000139.

160. Patel S, Gupta RS. 2020. A phylogenomic and comparative genomic framework for resolving the polyphyly of the genus *Bacillus*: proposal for six new genera of *Bacillus* species, *Peribacillus* gen. nov., *Cytobacillus* gen. nov., *Mesobacillus* gen. nov., *Neobacillus* gen. nov., *Metabacillus* gen. nov. and *Alkalihalobacillus* gen. nov. Int J Syst Evol Microbiol 70:406–438. https://doi.org/10.1099/ijsem.0.003775.
161. Balcázar JL, Pintado J, Planas M. 2010. *Bacillus galliciensis* sp. nov., isolated from faeces of wild seahorses (*Hippocampus guttulatus*). Int J Syst Evol Microbiol 60:892–895. https://doi.org/10.1099/ijs.0.011817-0.
162. Chen YG, Zhang YQ, He JW, Klenk HP, Xiao JQ, Zhu HY, Tang SK, Li WJ. 2011. *Bacillus hemicentroti* sp. nov., a moderate halophile isolated from a sea urchin. Int J Syst Evol Microbiol 61:2950–2955. https://doi.org/10.1099/ijs.0.026732-0.
163. Yoon JH, Kim IG, Kang KH, Oh TK, Park YH. 2003. *Bacillus marisflavi* sp. nov. and *Bacillus aquimaris* sp. nov., isolated from sea water of a tidal flat of the Yellow Sea in Korea. Int J Syst Evol Microbiol 53:1297–1303. https://doi.org/10.1099/ijs.0.02365-0.
164. Ngo HT, Nguyen TT, Nguyen QM, Tran AV, Do HT, Nguyen AH, Phan TN, Nguyen AT. 2016. Screening of pigmented *Bacillus aquimaris* SH6 from the intestinal tracts of shrimp to develop a novel feed supplement for shrimp. J Appl Microbiol 121:1357–1372. https://doi.org/10.1111/jam.13274.
165. Gupta RS, Patel S, Saini N, Chen S. 2020. Robust demarcation of 17 distinct *Bacillus* species clades, proposed as novel *Bacillaceae* genera, by phylogenomics and comparative genomic analyses: description of *Robertmurraya kyonggiensis* sp. nov. and proposal for an emended genus *Bacillus* limiting it only to the members of the Subtilis and Cereus clades of species. Int J Syst Evol Microbiol 70:5753–5798. https://doi.org/10.1099/ijsem.0.004475.
166. Teo WFA, Tan GYA, Li WJ. 2021. Taxonomic note on the family *Pseudonocardiaceae* based on phylogenomic analysis and descriptions of *Allosaccharopolyspora* gen. nov. and *Halosaccharopolyspora* gen. nov. Int J Syst Evol Microbiol 71:e005075.
167. Pei J, Wu Y, Gao Y, Li S, Fang J, Wei Y. 2021. *Hanstruepera crassostreae* He et al. 2018 is a later heterotypic synonym of *Pseudobizionia ponticola* Park et al. 2018. Int J Syst Evol Microbiol 71:5074.
168. Chen MH, Sheu SY, Chen CA, Wang JT, Chen WM. 2012. *Idiomarina aquimaris* sp. nov., isolated from the reef-building coral *Isopora palifera*. Int J Syst Evol Microbiol 62:1536–1542. https://doi.org/10.1099/ijs.0.035592-0.
169. Liu Y, Lai Q, Shao Z. 2018. Genome-based analysis reveals the taxonomy and diversity of the family *Idiomarinaceae*. Front Microbiol 9:2453. https://doi.org/10.3389/fmicb.2018.02453.
170. Lu DC, Zhao JX, Wang FQ, Xie ZH, Du ZJ. 2017. *Labilibacter aurantiacus* gen. nov., sp. nov., isolated from sea squirt (*Styela clava*) and reclassification of *Saccharicrinis marinus* as *Labilibacter marinus* comb. nov. Int J Syst Evol Microbiol 67:441–446. https://doi.org/10.1099/ijsem.0.001649.
171. García-López M, Meier-Kolthoff JP, Tindall BJ, Gronow S, Woyke T, Kyrpides NC, Hahnke RL, Göker M. 2019. Analysis of 1,000 type-strain genomes improves taxonomic classification of *Bacteroidetes*. Front Microbiol 10:2083. https://doi.org/10.3389/fmicb.2019.02083.
172. Yoon BJ, Oh DC. 2011. *Formosa spongicola* sp. nov., isolated from the marine sponge *Hymeniacidon flavia*. Int J Syst Evol Microbiol 61:330–333. https://doi.org/10.1099/ijs.0.023499-0.
173. Pujalte MJ, Macián MC, Arahal DR, Garay E. 2005. *Stappia alba* sp. nov., isolated from Mediterranean oysters. Syst Appl Microbiol 28:672–678. https://doi.org/10.1016/j.syapm.2005.05.010.
174. Euzeby JP. 2006. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 56:1–6.
175. Biebl H, Pukall R, Lünsdorf H, Schulz S, Allgaier M, Tindall BJ, Wagner-Döbler I. 2007. Description of *Labrenzia alexandrii* gen. nov., sp. nov., a novel alphaproteobacterium containing bacteriochlorophyll a, and a proposal for reclassification of *Stappia aggregata* as *Labrenzia aggregata* comb. nov., of *Stappia marina* as *Labrenzia marina* comb. nov. and of *Stappia alba* as *Labrenzia alba* comb. nov., and emended descriptions of the genera *Pannonibacter*, *Stappia* and *Roseibium*, and of the species *Roseibium denhamense* and *Roseibium hamelinense*. Int J Syst Evol Microbiol 57:1095–1107. https://doi.org/10.1099/ijs.0.64821-0.
176. Nedashkovskaya OI, Cho SH, Joung Y, Joh K, Kim MN, Shin KS, Oh HW, Bae KS, Mikhailov VV, Kim SB. 2013. *Altererythrobacter troitsensis* sp. nov., isolated from the sea urchin *Strongylocentrotus intermedius*. Int J Syst Evol Microbiol 63:93–97. https://doi.org/10.1099/ijs.0.038836-0.
177. Xu L, Sun C, Fang C, Oren A, Xu XW. 2020. Genomic-based taxonomic classification of the family *Erythrobacteraceae*. Int J Syst Evol Microbiol 70:4470–4495. https://doi.org/10.1099/ijsem.0.004293.
178. Lu HB, Cai ZP, Yang YG, Xu MY. 2020. *Duganella rivus* sp. nov., *Duganella fentianensis* sp. nov., *Duganella qianjiadongensis* sp. nov. and *Massilia guangdongensis* sp. nov., isolated from subtropical streams in China and reclassification of all species within genus *Pseudoduganella*. Antonie Van Leeuwenhoek 113:1155–1165. https://doi.org/10.1007/s10482-020-01422-5.
179. Kämpfer P, Irgang R, Busse HJ, Poblete-Morales M, Kleinhagauer T, Glaeser SP, Avendaño-Herrera R. 2016. *Pseudoduganella danionis* sp. nov., isolated from zebrafish (*Danio rerio*). Int J Syst Evol Microbiol 66:4671–4675. https://doi.org/10.1099/ijsem.0.001408.
180. Romanenko LA, Uchino M, Falsen E, Frolova GM, Zhukova NV, Mikhailov VV. 2005. *Pseudomonas pachastrellae* sp. nov., isolated from a marine sponge. Int J Syst Evol Microbiol 55:919–924. https://doi.org/10.1099/ijs.0.63176-0.
181. Rudra B, Gupta RS. 2021. Phylogenomic and comparative genomic analyses of species of the family *Pseudomonadaceae*: proposals for the genera *Halopseudomonas* gen. nov. and *Atopomonas* gen. nov., merger of the genus *Oblitimonas* with the genus *Thiopseudomonas*, and transfer of some misclassified species of the genus *Pseudomonas* into other genera. Int J Syst Evol Microbiol 71:e005011. https://doi.org/10.1099/ijsem.0.005011.
182. Zhang S, Zhou H, Sun C, Hu Z, Wang H. 2020. *Aequorivita lutea* sp. nov., a novel bacterium isolated from the estuarine sediment of the Pearl River in China, and transfer of *Vitellibacter todarodis* and *Vitellibacter aquimaris* to the genus *Aequorivita* as *Aequorivita todarodis* comb. nov. and *Aequorivita aquimaris* comb. nov. Int J Syst Evol Microbiol 70:3117–3122. https://doi.org/10.1099/ijsem.0.004139.
183. Dieguez AL, Perez-Cataluna A, Figueras MJ, Romalde JL. 2018. *Arcobacter haliotis* Tanaka et al. 2017 is a later heterotypic synonym of *Arcobacter lekithochrous* Dieguez et al. 2017. Int J Syst Evol Microbiol 68:2851–2854. https://doi.org/10.1099/ijsem.0.002909.
184. Tison DL, Seidler RJ. 1983. *Vibrio aestuarianus*: a new species from estuarine waters and shellfish. Int J Syst Bacteriol 33:699–702. https://doi.org/10.1099/00207713-33-4-699.
185. On SLW, Miller WG, Biggs PJ, Cornelius AJ, Vandamme P. 2021. *Aliarcobacter*, *Halarcobacter*, *Malaciobacter*, *Pseudarcobacter* and *Poseidonibacter* are later synonyms of Arcobacter: transfer of *Poseidonibacter parvus*, *Poseidonibacter antarcticus*, '*Halarcobacter arenosus*', and '*Aliarcobacter vitoriensis*' to *Arcobacter* as *Arcobacter parvus* comb. nov., Arcobacter antarcticus comb. nov., Arcobacter arenosus comb. nov. and Arcobacter vitoriensis comb. nov. Int J Syst Evol Microbiol 71:e005133. https://doi.org/10.1099/ijsem.0.005133.
186. Lee HW, Roh SW, Shin NR, Lee J, Whon TW, Jung MJ, Yun JH, Kim MS, Hyun DW, Kim D, Bae JW. 2013. *Blastopirellula cremea* sp. nov., isolated from a dead ark clam. Int J Syst Evol Microbiol 63:2314–2319. https://doi.org/10.1099/ijs.0.044099-0.
187. Rensink S, Wiegand S, Kallscheuer N, Rast P, Peeters SH, Heuer A, Boedeker C, Jetten MSM, Rohde M, Jogler M, Jogler C. 2020. Description of the novel planctomycetal genus *Bremerella*, containing *Bremerella volcania* sp. nov., isolated from an active volcanic site, and reclassification of *Blastopirellula cremea* as *Bremerella cremea* comb. nov. Antonie Van Leeuwenhoek 113:1823–1837. https://doi.org/10.1007/s10482-019-01378-1.
188. Oren A, Garrity GM. 2018. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 68:3379–3393. https://doi.org/10.1099/ijsem.0.003071.
189. Oren A, Garrity GM. 2020. List of new names and new combinations previously effectively, but not validly, published. Int J Syst Evol Microbiol 70:4043–4049. https://doi.org/10.1099/ijsem.0.004244.