**The evolution, structure and function of the ray finned fish (Actinopterygii) glucocorticoid receptors.**

Nic R. Bury

King’s College London

Diabetes and Nutritional Sciences Division

Franklin Wilkins Building

150 Stamford Street

London

SE1 9NH

TEL: +44 (0)2078484091

Email: [nic.bury@kcl.ac.uk](mailto:nic.bury@kcl.ac.uk)

University of Suffolk

Faculty of Health adn Science,

James Hehir Building

University Quays

Ipswich,

IP3 0AQ,

Ipswich ,

Suffolk,

United Kingdom

**Abstract**

Basal ray-finned fish (Actinopterygii) possess a single glucocorticoid receptor (GR) and when compared to the lobe-finned vertebrate (Sarcoptergyii) GR possess nine additional amino acids between the zinc-finger of the DNA binding domain. A whole genome duplication event which occurred between 320-350 MYA in the teleost lineage following the split from the basal ray-finned fish resulted in 2 GRs: one GR group, GR1, has retained the 9 amino acids insert whereas the other group, GR2, has not. The exception to this is the zebrafish, that have lost one of the GRs, but they do possess 2 GRs with a splice variant that lacks the C-terminal portion of the GR to form GRβ which acts as a dominant-repressor of the wildtype GR. Another splice variant sees the basal ray-finned GR and teleost GR1 without the 9 amino acids insert. The molecular basis for GRs retention is beginning to be unravelled. In *Pantadon buchholzi*, rainbow trout, carp, marine and Japanese medaka GR2 is more sensitive to glucocorticoids (GC), thus potentially playing a more significant role in regulating gene expression at basal circulatory GC concentrations. However, this division in GC sensitivity is not seen in other species. The few studies to evaluate the significance of the 9 amino acid insert have shown that it affect maximal transactivational activity the extent to which is dependent on the number of glucocorticoid response elements (GREs) present in the reporter plasmid. The retention of these GRs would suggest there was an evolutionary advantage, which saw the development of a complex regulatory process to mediate the actions of the glucocorticoids.

**1. Introduction**

The corticosteroid receptors (CR), which include the glucocorticoid (GR) and mineralocorticoid receptors (MR), belong to the nuclear receptor family of proteins. The genes that encode for these proteins evolved from a common ancestor steroid receptor (SR) present in the chordates, following rounds of whole genome or gene duplication events, with the CRs emerging in the vertebrate lineage approximately 500MYA. A further whole genome duplication event in the teleost lineage between 320 – 350 MYA has given rise to 2 GR isoforms (Figure 1). The majority of functional and structural analysis has been carried out on the tetrapod GRs and these studies have been used to compare and contrast the properties of the basal actinopterygian (ray-finned fish) GRs and the teleost GRs (Arterberry et al 2012, Becker et al 2008, Bury et al 2003, Ducouret et al 1995, Greenwood et al 2003, Kim et al 2011, Li 2012, Miyagawa et al 2014, Oka et al 2015, Stolte et al 2008, Sturm et al 2005, Sturm et al 2010, Sturm et al 2011). This short review will first describe the structure and function of the human GRs, and then briefly describe the evolution of the steroid receptors, that gave rise to the actinopterygian GRs. Finally, the structure and function of the two teleost GRs will be discussed and potential reasons for their retention proposed.

**2. Glucocorticosteroid receptor structure and function**

The gene encoding for the human GR is composed of 9 exons (Oakley and Cidlowski, 2011) and the translated protein is described as having 4 functional regions. The protein contains a highly conserved central DNA-binding domain (DBD) or C-domain, encoded on exon 3 and 4, which contains two zinc-fingers and recognises specific palindromic DNA sequences of the glucocorticoid response element (GRE) upstream of the target genes, and is also a region important for homodimer formation. The hormone binding domain (HBD), or E-domain, and hinge region, or D-domain, are encoded on exons 5 – 9. The C-terminus HBD is also highly conserved between GRs, specifically the 22 amino acids that interact with the glucocorticoid hormones, to form the hydrophobic ligand binding pocket that characterises all GRs (Bledsoe et al 2002). The HBD is also the sight of two transactivation functional sites, named activation function 2 (AF2) and τ2 (Hollenberg and Evans 1988; Kucera et al 2002). The D-domain, located between the DBD and HBD, is the least conserved region and is involved in protein folding. Additionally, one of two nuclear localisation signals, NL1, spans the DBD/hinge region transition; the other, NL2, is present in the HBD (Bamberger et al 1996). The N-terminal transactivation domain (NTD) also known as the A/B domain, is encoded on exon 2; it is also not well conserved between the vertebrate GR, but is the site of the ligand-independent AF1 site (Giguere et al 1986, Oka et al 2015, Sturm et al 2011). Classically, the inactive GRs reside in the cytoplasm as part of a large heteromeric complex which includes HSP90 and immunophilins (Heitzer et al 2007). Following ligand/receptor binding, the GR dissociates and is transferred to the nucleus where it forms homodimers, interacts with GREs and stimulates gene expression. Alternately, the GR-ligand complex may interact with less well defined negative GREs to suppress gene expression. The GRs can also interact with other transcription factors to repress or enhance gene expression (Glass and Rosenfeld, 2000).

However, alternate splice variants, different translation initiation sites, post-translation modifications (e.g. phosphorylation) and single nucleotide polymorphisms result in a diverse array of GR proteins (Oakley and Cidlowski, 2011). In recent years, it has become apparent that the plethora of GR isoforms have different functional properties when compared to the wild-type GR, termed GRα, and can influence GRα function or act independently (Oakley and Cidlowski, 2011). For example, in the human GR there is an acceptor splice site between exon 8 and 9 that results in a splice variant termed GRβ. GRα and β share the first 727 amino acids, thereafter the GRα possesses a further 50 amino acids and GRβ a non-homologous additional 15 amino acids. GRβ lacks the C-terminal helix 12 and the AF2 region, and so is unable to bind cortisol and induce transactivation. It does, however, form heterodimers with GRα to act as a dominant-negative inhibitor of GRα gene expression (Bamberger et al 1995), and has also been shown to directly stimulate or repress a number of genes not regulated by GRα (Kino et al 2009, Lewis-Tuffin et al 2007). A similar variant is present in zebrafish (*Danio rerio*), but the acceptor splice site is absent in exon 8 of other fish species and thus the presence of GRβ may be restricted to the Ostariophysi superorder in the fishes (Schaaf et al 2008). Zebrafish GRβ acts in a similar way as its vertebrate paralogue as a dominant-negative inhibitor of GRα, but similarly has recently been shown to regulate its own suite of genes (Chatzopoulou et al 2015). Another splice variant of the human GRα sees three bases retained from the intron separating exon 3 and 4, which results in an additional amino acid, arginine, inserted between the two zinc fingers of the DBD this has been termed GRγ (Ray et al 1996, Rivers et al 1999). GRγ binds GCs with a similar affinity as GRα, but has an impaired ability to regulated GR transcription (Ray et al 1996), despite this, in various tissues GRγ can regulate a different subset of genes to GRα (Oakley and Cidlowski 2011) and has been associated with GC resistance in a number of cancers (Beger et al 2003). The alternate translation start sites in exon 2 have results in 8 versions of GRα (Oakley and Cidlowski, 2011). One of these, GRα-D, lacks the A/B domain, but is still active, regulating around 1800 genes in response to GCs (Oakley and Cidlowski, 2011). Furthermore, single nucleotide polymorphisms in GRα can also significantly alter function. Such an example is in GRα ER22/23EK polymorphism within exon 2, where a G to A point mutation in codon 22 results in a change of arginine to lysine; in patients with this mutation there is a concurrent silent G to A point mutation in codon 23 (van Rossum et al 2002). The result is a receptor with decreased hormone sensitivity, which is associated with patients with altered metabolism, risk of cardiovascular disease (DeRijk and de Kloet , 2005) and who are susceptible to depression (Panek et al 2014). The list of GR isoforms demonstrates that a wide range of regulatory strategies, including difference protein-ligand, protein-protein and protein-DNA interactions that mediate cellular specific glucocorticoid actions.

**3. Vertebrate steroid receptor evolution**

**3.1 Hypothetical models for gene retention following duplication**

Whole genome duplication (WGD) events play an important role in the evolution of complex organisms. An example would be the teleosts where a WGD event occurred between 320-350MYA (Hoegg et al 2004) which has resulted in the most specious vertebrate group containing around half of all known vertebrates (Glauser and Neuhaus, 2014). A WGD is undoubtedly a dramatic event and a large proportion (80-99%) of duplicated genes are lost (Jaillon et al 2004; Kassahn et al 2009, Woods et al 2005) and hypothetical models have been developed to help explain why certain duplicated genes are retained (Ohno, 1970). In the duplication-degeneration-complementation model, (Force et al 1999) mutation in the encoding region of the duplicated gene may render the gene non-functional leading to its eventual loss from the gene pool. If duplicated genes are retained then they may either partially lose their ancestral function, thus, both are required to maintain full functional activity, a process known as sub-functionalisation, or neo-functionalisation may emerge where one gene retains the original function and the other alters to acquire a new function. A further model to explain retention of genes via sub-functionalisation termed escape from adaptive conflict (DesMarias and Ruahser, 2008) sees adaptive evolution driving changes in the two genes. Thus, in this scenario both paralogues are released from the potential negative effect of each other and both evolve to improve the subfunctional properties they carry out. Following a WGD the relative ratio of genes in a pathway is not altered. However, a disparity in this ratio will occur once mutations in one paralogue lead to altered function. Gene dosage, or maintenance of gene ratios, is thus an alternative mechanism by which duplicate genes may be retained and is hypothetically important for genes encoding proteins that function in gene pathways or networks, such as nuclear steroid receptors (Conant and Wolfe et al 2007).

**3.2. Chordate and early vertebrate steroid receptors**

The ancestral steroid hormone receptor (SR) is proposed to be “estrogen-like” and orthologs of ER genes are present in a number of invertebrate including the gastrapod *Aplysia californica* (Thornton et al 2003) and octapod *Octopus vulgaris* (Keay et al 2006), however, both ERs are constitutively active and do not respond to estrogens. In the cephalochordate, *Branchiostoma floridae*, there are two hormone receptor orthologs termed a steroid receptor (bfSR) and estrogen receptor (bfER) (Bridgham et al. 2008). The hormone transactivational properties of these two receptors have been characterised throught the method of cloning into a mammalian expression vector and assessing the activity of the recombinant proteins following transfection into mammalian cells along with reporter plasmid containing either vertebrate estrogen response elements (ERE) or GRE upstream of the luciferase gene. Estrogen stimulated bfSR transactivation in the presence of the ERE containing plasmid, but not the GRE plasmid, where as GCs did not. In contrast, the bfER was transcriptionally unresponsive. However, the bfER acted as a negative regulator of bfSR, (Bridgham et al 2008) and would appear to play an analogous role to GRβ, which acts as a dominant-inhibitor of GRα gene activity in humans and zebrafish (Schaaf et al 2008).

Extant members of the earliest vertebrates, the agnathans (the hagfish and lamprey), possess 3 steroid hormone receptors that are homologous to the estrogen (ER), progesterone (PR) and corticosteroid receptors (CR) of other vertebrates (Bridgham et al 2006). The ER, PR and CR emerged following the duplication of cephalochordate SR and ER as a consequence of a WGD event early in the vertebrate lineage (Kuraku et al 2009). In transactivation studies the CR of the lamprey (*Petromyzon marinus*) and hagfish (*Myxine glutinosa*) is functional being activated by various corticosteroids such as cortisol, corticosterone, 11-deoxycortisol, 11-deocycorticosteorne, aldosterone and to a lesser extent by progestins, but not the androgens or estrogens (Bridgham et al 2006). In lamprey, 11-deoxycortisol has been shown to be an active glucocorticoid, elevating plasma glucose, and a mineralocorticoid, aiding ionoregulation (Close et al 2010). Computational analysis of the ligand binding pocket of lamprey CR by Baker et al (2011) identified that leucine-220 and methionine-299 made significant interactions between hydroxyl group on C17 of 11-deoxycortisol and the receptor (Close et al 2010), supporting the hypothesis that this steroid is the active corticosteroid in these ancient vertebrates.

The phylogenetic relationship between the lamprey and hagfish is debated (Bury et al 2016, Thomson et al 2014). Original classification suggested paraphyly with the lamprey being more closely related to the jawed fishes. However, recent molecular evidence suggest monophyly, with lampreys and hagfish forming a sister clade (Heimberg et al 2010), however, this has also been questioned (see Bury et al 2016 for further details). If these two groups are monophyletic it would suggest that the ancestral vertebrate was common to both, as well as the gnathostomes. In this scenario it would appear that the lamprey has retained many of the ancestral features that also are present in extant gnathostomes, where as the hagfish has undergone a remarkable loss of these ancestral traits. For example, in the lamprey there is fully functional pituitary-interrenal axis, similar to that seen in the teleosts, which synthesises corticosteroid (Takahashi et al 2013) and produces an increase in circulatory concentrations in response to a stressor. A physiological role has also been identified (Close et al 2010). However, even though the hagfish possess a gene encoding for a CR (Bridgham et al 2006), the site of synthesis of corticosteroids has yet to be properly identified (Idler and Burton, 1976). Elevated circulating levels of corticosteroids equivalent to those measured in other vertebrates have seldom been recorded (Weisbart and Idler, 1970) and a physiological role of corticosteroids has not been identified (Bury et al 2016). Very few studies have tried to identify a role of the corticosteroids in the Myxini. Hagfish, in contrast to all other vertebrates, are osmoconformers in terms of Na+ and Cl-, but do regulate divalent ions and sulphate (Belamy and Jones, 1961). Interperitional administration of known corticosteroids (cortisol, corticosterone or 11-deoxycorticosterone) had little effect on their ability to deal with a sulphate challenge if a sulphate challenge was administered then no changes in plasma 11-deoxycortisol, the active corticosteroid in lamprey, was observed (Clifford et al unpublished results). Similarly, a stress protocol induced a rise in plasma glucose, but had no effect on plasma 11-deoxycortisol (Clifford et al unpublished results) and only after 7 days following administration of 11-deoxycorticosterone was there a minor increase in plasma glucose observed (Bury et al 2016). Consequently, an active corticosteroid system has yet to be clearly identified and characterised in Myxini.

**3.3. Sarcoptygerian glucocorticoid and mineralocorticoid receptors.**

There have been two further whole-genome duplication (WGD) events in the vertebrate lineage, one early on in the split from the chordates (Kuraku et al 2009) and the other in the Teleostei lineage (Hoegg et al 2004). The first of these WGD events resulted in duplicated CRs from which emerged the mineralocorticoid (MR) and glucocorticoid (GR) receptors present in all extant vertebrates. The profile of steroid induced transactivation of the agnathan CR is similar to that of vertebrate MRs and would suggest that the ancestral CR was “MR-like” (Bridgham et al 2006). Sequence alignment and Maximum-Likelihood phylogenetic analysis of all known CRs has allowed for the prediction of the ancestral CRs at important nodes in vertebrate evolution (Bridgham et al 2006; Bridgham et al 2009; Carroll et al 2011). By characterising these predicted ancestral proteins and introducing site-directed mutations to engineer the molecules’ evolutionary trajectories it has been possible to identify the permissive sequence of amino acid mutations in the ligand binding pocket region that conferred GR preferentially binding cortisol or corticosterone over aldosterone in the Osteichthyes (Bridgham et al 2006, Bridgham et al 2009, Harms and Thornton, 2014, Ortlund et al 2007) and the binding to 1β-hydroxycorticosterone in Chondrichthyes (Carroll et al 2008). The divergence in vertebrate GR and MR hormone selectivity is a potential way in which neofunctionalisation emerged. However, for the MRs mineralocorticoid specific action to evolve a further sequences of events was required. There are two 11β-HSD enzyme which catalyse the reaction that converts cortisol to cortisone: 11β-HSD Type 1 catalyses a reversible reaction, whereas 11β-HSD type 2 catalyses an irreversible reaction which reduces cellular cortisol concentrations by converting this hormone to the inactive cortisone. In mineralocorticoid responsive tissue such as epithelium involved in ionoregulation the MR and 11β-HSD type 2 are co-expressed to allow for the specific action of aldosterone (Whorwood et al 1994).

**3.4. The ray-finned fish (Actinopterygii) glucocorticoid receptors**

The genome of the spotted gar (*Lepisosteus oculatus*) possesses 1 GR, and a GR has also been cloned other basal ray-finned fish, a tropical gar (*Atractosteus tropicus*) (Oka et al 2014) and a sterlet (*Acipenser ruthenus*) (Li et al 2012). The sterlet GR shows a 9 amino acid insert between the zinc fingers of the DBD and this is encoded on exon 4 of the spotted gar gene (ENSLOCT00000012909). This insert is not present in the hagfish or lamprey CR (Bridgham et al 2006), Chondrichtyes GR (Carroll et al 2008) or tetrapod GRs (Hollenberg et al 1985). Li et al (2012) and Oka et al (2015) reported only a single transcript of GR in the sterlet and tropical gar, respectively. However, ENSEMBL predicts a splice variant for the spotted gar GR that lacks this insert, thus there may be 2 GR variants in these ancient ray-finned fishes.

The WGD in the teleost lineage 350MYA (Jaillon et al 2004) resulted in further duplications of the GR and MR receptors. Extant teleosts appear to have lost one of the MR duplicates as only one MR is present in those fish whose genomes have been sequenced. Li et al (2012) identified two GRs in an extant member of the basal teleost the Osteoglossimorph, *Pantadon buchholzi* – an order that split from the acipensideridae and was derived following the teleost WGD (Hoegg et al 2004). They identified two isoforms of GR, one termed GR1 containing the 9 amino acid insert between the DBD, previously observed in the basal ray finned fish, and one without termed GR2, in addition a splice variant of GR1 lacking the 9 amino acids was also identified (Li et al 2012). Whole genome sequencing of teleosts and further cloning of full-length fish GRs has revealed that the majority of fish have retained duplicated GRs (Figure 1; Supplementary Material Table and Figure; Bury et al 2003, Greenwood et al 2003, Kim et al 2011, Miyagawa et al 2014, Stolte et al 2007,). The GRs split into two groups; those possessing this 9 amino acids between the zinc fingers of the DBD, GR1, and those that do not, GR2 (Figure 1). Similar to the spotted gar these amino acids are encoded on a separate exon [e.g. exon 5, Stickleback (*Gasterosteus aculeatus*) GR1 (ENSGACT00000027452); exon 3, Fugu (*Takifugu rubripes*) (ENSTRUT00000015714); exon 3 Platyfish (*Xiphophorus maculates*) (ENSXMAT00000001516); exon 3 cavefish (*Astyanax* *mexicanus*) (ENSAMXT00000020636); exon 3, Amazon molly (*Poecilia formosa*) (ENSPFOT00000005871), exon 4 Nile tilapia (*Oreochromis niolticus*) (ENSONIT00000010671); exon 19 Cod (*Gadus morhua*) (ENSGMOT00000019605)]. There are reports of splice variant of the teleost GR1 without these amino acids, thus there are 3 GRs present in teleost fish, a GR1, termed GR1a, and a splice variant of GR1, termed Gr1b and GR2 (Greenwood et al 2003, Li et al 2012, Miyagawa et al 2014, Stolte et al 2008, Takeo et al 1996). The number of genes retained following duplication is disputed, but is estimated to be between 1 and 20% (Aparico et al 2002, Kassahn et al 2009, Woods et al 2005), thus, an assumption would be that the retention of 2 GRs in teleosts following the WGD event 350 MYA (Hoegg et al 2004) offered an evolutionary advantage.

The exception to this is the zebrafish which have one gene encoding a GR, which lacks the 9 amino acid insert, and groups with the teleost GR2 (Schaaf et al 2008). It is not known if the loss of a GR is seen in other fishes or restricted to the zebrafishes. The GRs of only 3 species of the Ostariophysii, to which the zebrafish belong, have been cloned to date and all are in the cyprinidae. Filby and Tyler (2007) report the cloning of 1 GR in fathead minnow, however, in contrast Stotle et al (2007) reports duplicated GRs in the common carp. A further common carp WGD event occurred relatively recently 8MYA (Li et al 2015), which may account for the duplicated GR. However, analysis of 1757 recently duplicated common carp genes identified by Li et al (2015) shows that the paralogues amino acid sequences are 90% similar. By contrast there is only 57% similarity between the amino acids of carp GRs (Stolte et al 2007). In addition, the common carp GR1 possess the extra 9 amino acid insert characteristic of this teleost GR group (Stolte et al 2007) and the other GR groups with the other teleost GR2s (Figure 1). Consequently, the most parsimonious conclusion is that the two GRs in common carp are not from this recent carp lineage WGD and that a loss of the GR only occurs in the lineage of fishes that includes the zebrafish following the split from the common carp.

**3.4.1. Teleost glucocorticoid receptor DNA binding domain**

The significance of this actinopterygian lineage specific 9 amino acid insert in the DBD of GR has been puzzling since its discovery in the rainbow trout GR1 by Ducouret et al (1995). The 9 amino acids generate an additional loop that resides outside of the protein (Wickert and Selbig, 2002) and transactivational activity indicates that this extra loop does not affect recognition of consensus GREs (Ducouret et al 1995). Functional studies on the transactivational properties of the GR1a and GR1b splice variants do show some differences in activity, but this is species specific and depends on the structure of cis-regulatory region. Takeo et al (1996) showed that both rainbow trout GR1 splice variants were active in the presence of cortisol and dexamethasone using a reporter plasmid containing the full-length mouse mammary tumor virus (MMTV) long terminal repeat sequence. Using a different reporter plasmid, but one that also contains the MMTV sequence, Miyagawa et al (2014) found that the transactivational activity EC50 for the Japanese medaka GR1 splice variants increased and there was a decrease in fold induction (Miyagawa et la 2014). The presence of the insert in *Haplochromis burtonii* GR1 results in a reduction in the maximal transcriptional activity in a system using a reporter plasmid containing 3 GREs (Greenwood et al 2003), and in the rainbow trout differences between the splice variants emerge, with reporter plasmids possessing fewer GREs. Lethimonier et al (2012) showed that the splice variant lacking the insert is unable to interact with a single GRE, but function is restored with the reporter plasmid contains two GREs; with the full length GR1 activates both (Lethimonier et al 2002).

There are species within the GR2 group that also possess additional amino acids insertion in the DBD. For example, the first study to clone a second GR in a teleost fish found that the rainbow trout GR2 has an insertion of 5 amino acids, GTGAR, in this region (Bury et al 2003). Subsequent sequencing identified a similar insertion in another salmonid, Atlantic Salmon (Supplementary Material Table). The salmonid lineage has experienced a WGD event approximately 50 – 80 MYA (MacQueen and Johnson, 2014), but this 5 amino acid insertion is not a consequence of this event and is present in other Protacanthopytergii, such as the Esociform, the European Pike (*Esox lucius*) ( Supplementary Material Table). Kim et al (2011) generated a marine medaka GR2 mutant that contained the addition of the 9 amino acids present in GR1 and assessed transactivational activity and ability of the receptors to bind transcription co-regulators, GRIP 1, a co-activator (Avenant et al 2010), and SMILE a co-repressor (Xie et al 2009). The co-transfection of each receptor with plasmids expressing mouse GRIP enhanced activity, whereas mammalian SMILE repressed activity, as expected, however, the GR2 mutant containing the 9 amino acids showed increased transcriptional activity compared to GR2 wild type, demonstrating the significance of the insert in regulating transcriptional activity.

The significance of these variations in the GR DBD is currently not clear, however due to the fact they are present in basal actinopterygians and early teleosts, and have been retained in almost all other extant teleosts it is suggested that they offer an evolutionary advantage. Whether this has enabled the GR isoforms to recognise different response elements and be retained via subfunctionalisation or whether they have co-evolved with changes in the non-coding regulatory regions of genes to control different gene pathways of the ancestral vertebrate GR awaits further study. Interestingly, a recent study by Kiilerich et al (2015) identified that the rainbow trout MR, which is also activated by cortisol and in the absence of defined teleost mineralocorticoid or function for MR (Takahashi and Sakamoto, 2013) could be described as a third teleost GR, is a repressor of both rtGR1 and rtGR2 transcriptional activity (Figure 3). Similar observations have been made with the mammalian GR and MR and the repressor activity is due to GR/MR heterodimerisation that disrupts the self-synergistic interactions between the N-terminal of 2 GRs when bound as a homodimer (Liu et al 1995). However, point mutations in the DBD of the MR suggests that in trout the dominant-negative effect of rtMR on the rtGRs is associated with DNA recognition. This effect was more prominent in the rtGR2 and if plasmids containing 1 or 2 GREs were used (Kiilerich et al 2015).If GR1a and b, GR2, MR co-localise then there is the potential for 6 different heterodimers that could dampen or enhance the transcriptional activity of one or other of the receptors (Figure 3). Nuclear receptor heterodimer formations is a common mechanism of transcription regulation in other receptors (RXR, VDR, PPAR and TR (Gronemeyer et al 2004) and thus may also be an important regulatory mechanism to mediate the action of GCs via GR1 and GR2.

**3.4.2. Teleost glucocorticoid receptor hormone sensitivity**

The first GR2 to be cloned and characterised was from the Rainbow trout, and showed distinct differences in functionality between itself and rtGR1 - rtGR2 had a greater increase in hormone transcriptional activity at equimolar hormone concentrations and increased sensitivity (Bury et al 2003). The ability to repress NFκB transcriptional activity also occurred at lower dexamethasone concentrations with GR2 (Bury and Sturm 2007) and the movement of GR2 from the cytoplasm to the nucleus also occurred at lower hormone concentrations (Becker et al 2008). In this initial study (Bury et al 2003) a cell free expression system was used to assess receptor hormone binding and found no difference in affinity for dexamethasone between the two GRs. However, a subsequent study using a cell line expression system found rtGR2 to have an increased hormone binding affinity (Sturm et al 2011). This difference in sensitivity is not restricted to the salmoniformes (Table 1) and a similar transactivation activity pattern is seen with the two GRs from the basal teleost *P. buchholzi* (Li et al 2012), carp (Stolte et al 2007), marine medaka (*Oryzias dacena*) (Kim et al 2011), and the Japanese medaka (*Oryzias latipes*) GRs show a remarkable 10 000 fold difference in the cortisol EC50 for transactivational activity (Miyagawa et al 2014). Focusing on the rainbow trout GRs, two papers by Sturm et al (2010, 2011) aimed to identify the molecular signatures that conferred the difference in the rtGR transcriptional sensitivity to glucocorticoids. Deletion of the NTD reduced transactivational activity to 2% of the wild type (Sturm et al 2010), as is seen with mammalian GRs (Giguere et al 1986), but did not alter the sensitivity, suggesting that the HBD plays a significant role. This was confirmed with chimeric constructs where by the HBD of the two receptors where exchanged and the chimera that contained the HBD of either GR1 or GR2 resembled the sensitivity of the respective wild type (Sturm et al 2011). When 3 sub-regions of the HBD were exchanged it was apparent that each contributed to the differences in sensitivity. However, the C-terminal extremity of GR1 differs to GR2, with Ala and Leu (AL) replacing the consensus C-terminus sequence GluLys (QK) (Supplementary Material Figure) and also containing an additional 6 amino acids. When these 6 amino acids are deleted and AL converted to QK the mutant GR1 increases its hypersensitivity by 4.1 fold (Sturm et al 2011). Using the crystal structure of the dexamethasone bound GR hormone binding domain Bledsoe et al (2002) indentified that a β strand situated after the AF2 located in helix 11 and 12 at the C-terminal region interacted with a β-strand located between Helix 8 and 9 in the HBD to stabilise the active AF2 configuration. Thus, these additional amino acids of rtGR1 may have the potential to affect the stability of the active receptor. Other protacanthopytergian GR1, including the salmonids, Atlantic salmon (*Salmo salar*) and Brown trout (*Salmo trutta*), the coregonid, Marena whitefish (C*oregonus maraena*) andescoid, European pike (*Esox lucius*) also possess additional amino acids at the C-terminus (see Supplementary Material Figure). Interestingly, the hyposensitive GR1 of *P. buchholzi* possesses the conserved QK, but an additional 21 amino acids. However, there is always an exception and the Japanese medaka GR1 possess no additional amino acids in this region but do have the amino acids SS at the N-terminus as opposed to the consensus QK (Supplementary Material Table).

These differences led to a hypothesis that the two teleost GRs had been retained due to a difference in their hormone sensitivity, with the hypersensitive GR playing a more prominent role in regulating gene pathways during periods of basal circulatory concentrations of hormone (unstressed), with the hyposensitive GR becoming more prominent during stressful stimuli when plasma hormone concentrations are elevated (Bury et al 2003). The observation of hypo and hyper-sensitive GRs in an extant member of one of the first teleost groups to emerge following the teleost lineage WGD would support this hypothesise. However, Greenwood et al (2003) reports no significant difference in EC50 for cortisol for the two *Haplochromis burtonii* GRs (Table 1).

**4. Conclusion**

The teleost WGD event resulted in the duplication of the vertebrate GR and MR and two GRs have been retained in the majority of teleost fish studied so far. The molecular basis for this retention has yet to be fully understood. The cloning of the first GR2 and functional characteristic analysis of subsequent GR2 suggested that there is one mechanism for differential regulation of gene networks maybe via differences in the transcriptional activity sensitivity of the 2 GRs, (Bury et al 2003). This maybe the case in the rainbow trout (Bury et al 2003), carp (Stolte et al 2007) and beloniforms (Kim et al 2011, Miyagawa et al 2014), but was not observed in a cichlidae (Greenwood et al 2003) and thus is not a universal explanation for the retention of the two GRs. The only common feature is the 9 amino acid insert in the teleost GR1 group. Very little work has been carried out to assess the significance of this insertion, but those studies that have suggest that the insertion does indeed affect transcriptional responses, however, this is dependent on species and the number of GRE upstream of reporter genes (Lethiomonier et al 2002, Greenwood et al 2003, Miyagawa et al 2014). An interesting observation is the effect of heterodimer formation in regulation of receptor function. In the earliest active SR reported from a cephalochordate, its transcriptional activity is repressed in the presences of a non-active ER (Figure 3A., Bridgham et al 2008). The ability to repress GR activity also appears to be of importance in vertebrates. In humans, a splice variant GRβ, which lacks the C-terminal region, is a negative-dominant repressor of GRα (Figure 3B, Bamberger et al 1996). In zebrafish, which have lost the second GR found in other teleost fishes, convergent evolution sees the emergence of a similar GRβ to that in humans that also acts as a repressor of zebrafish GRα activity (Figure 3B, Schaaf et al 2008). To date, the zebrafish are the only fish species known to have “human-like” GRβ, but GR activity repression may occurs via a different route in other fish species, with Kiilerich et al (2015) showing that in rainbow trout the MR, which also binds cortisol and can activate GREs in vitro (Sturm et al 2005), can act to repress GR1 and GR2 transactivation

The retention of teleost GRs suggests some evolutionary advantage that saw the development of a more complex regulatory process to mediate the actions of glucocorticoids. This may be due to either difference between the GRs in their sensitivity to hormones, their DBD recognising different GREs, or heterodimer formation altering the functional properties and in doing so altering the ability to activate genes. However, the regulation of tissue specific GC actions maybe even more complex, due to the fact that a number of vertebrate GR proteins have been identified that lack portions of the NTD due to different translation initiation sites and post-translational modifications will affect functionality (Oakley and Cidlowski, 2011).

**References**

Aparicio S.,, Chapman, J., Stupka, E., Putnam, N., Chia, J.M., Dehal, P., Christoffels, A., Rash, S., Hoon, S., Smit, A., Gelpke, M.D., Roach, J., Oh, T., Ho, I.Y., Wong, M., Detter, C., Verhoef, F., Predki, P., Tay, A., Lucas, S., Richardson, P., Smith, S.F., Clark, M.S., Edwards, Y.J., Doggett, N., Zharkikh, A., Tavtigian, S.V., Pruss, D., Barnstead, M., Evans, C., Baden, H., Powell, J., Glusman, G., Rowen, L., Hood, L., Tan, Y.H., Elgar, G., Hawkins, T., Venkatesh, B., Rokhsar, D., Brenner, S., 2002. Whole-genome shotgun assembly and analysis of the genome of *Fugu rubripes.* Science 297, 1301-1310.

Arterbery, A.S., Fergus, D.J., Fogarty, E.A., Mayberry, J., Deitcher, D.L., Kraus, W.L., Bass, A.H., 2011. Evolution of ligand specificity in vertebrate corticosteroid receptors, BMC Evol. Biol. 11, 14.

Avenant, C., Kotitschke, A., Hapgood, J.P., 2010. Glucocorticoid receptor phosphorylation modulates transcription efficacy through GRIP-1 recruitment. Biochemistry 49, 972 – 985.

Baker, M.E., Uh. K.Y., Asnaashari, P., 2011. 3D models of lamprey corticoid receptor complexed with 11-deoxycortisol and deoxycorticosterone. Steroids 76, 1451-1457.

Bamberger, C.M., Bamberger, A.M., de Castro, M., Chrousos, G.P., 1995. Glucocorticoid receptor beta, a potential endogenous inhibitor of glucocorticoid action in humans, J. Clin. Invest. 95, 2435-2441.

Bamberger C.M., Schulte, H.M., Chrousos, G.P., 1996. Molecular determinants of glucocorticoid receptor function and tissue sensitivity to glucocorticoids. Endocr. Rev. 17, 245-261.

Becker, H., Sturm, A., Bron, J.E., Schirmer, K., Bury, N.R., 2008. The A/B domain of the teleost glucocorticoid receptors influences partial nuclear localization in the absence of hormone. Endocrinol. 149, 4567-4576.

Beger, C., Gerdes, K., Lauten, M., Tissing, W.J.E., Fernandez-Munoz, I., Schrappe, Welte, M.K., 2003. Expression and structural analysis of glucocorticoid receptor isoforms gamma in human leukaemia cells using an isoform-specific real-time polymerase chain reaction approach. Brit. J. Haematol. 122, 245-252.

Bellamy, D., Jones, I.C., 1961. Studies on *Myxine glutinosa*—I. The chemical composition of the tissues, Comp. Biochem. Physiol. 3A, 175–183.

Bledsoe, R.K., Montana, V.G., Stanley, T.B., Delves, C.J., Apolito, C.J., McKee, D.D., Consler, T.G., Parks, D.J., Stewart, E.L., Willson, T.M., Lambert, M.H., Moore, J.T., Pearce, K.H., Xu, H.E., 2002. Crystal structure of the glucocorticoid receptor ligand binding domain reveals a novel mode of receptor dimerization and coactivator recognition. Cell 110, 93-105.

Bridgham, J.T., Carroll, S.M., Thornton, J.W., 2006. Evolution of hormone-receptor complexity by molecular exploitation. Science 312, 97–101.

# Bridgham, J.T., Brown, J.E., Rodríguez-Marí, A., Catchen, J.M., [Thornton](http://www.ncbi.nlm.nih.gov/pubmed/?term=Thornton%20JW%5BAuthor%5D&cauthor=true&cauthor_uid=18787702), J.W., 2008. Evolution of a new function by degenerative mutation in cephalochordate steroid receptors. PLoS Genet. 12, e1000191.

Bridgham, J.T., Ortlund, E.A., Thornton, J.W., 2009. An epistatic ratchet constrains the direction of glucocorticoid receptor evolution. Nature 461, 515–519.

Bury, N.R., Sturm, A., Le Rouzic, P., Lethimonier, C., Ducouret, B., Guigen, Y., Robinson-Rechavi, M., Laudet, V., Prunet, P., 2003. Evidence for two distinct functional glucocorticoid receptors in teleost fish, J. Mol. Endocrinol. 31, 141-156.

Bury, N.R., Sturm, A., 2007. Evolution of the corticosteroid receptor signalling pathway in fish, Gen. Comp. Endocrinol. 153, 47-56.

Bury, N.R. , A.M. Cliford, Goss, G.G., 2016. Corticosteroid signalling pathways in hagfish, in: Edwards, S., Goss, G. (Eds), Hagfish Biology, CRC pres, Taylor & Francis Group, London, UK, pp 257-275.

Carroll,  S.M., Bridgham, J.T., Thornton, J.W., 2008. Evolution of hormone signaling in elasmobranchs by exploitation of promiscuous receptors. Mol. Biol. Evol. 25, 2643-2645.

Carroll, S.M., Ortlund, E.A., Thornton, J.W., 2011. Mechanisms for the evolution of a derived function in the ancestral glucocorticoid receptor. PLOS Genet. 7, e1002117.

Chatzopoulou, A., Roy, U., Meijer, A.H., Alia, A., Spaink, H.P. Schaaf, M.J.M., 2015. Transcriptional and metabolic effects of glucocorticoid receptor α and β signalling in zebrafish. Endocrinol. 156, 1757-1769.

Close, D.A., S.S. Yun, S.D. McCormick, A.J. Wildbill, Li, W., 2010. 11-deoxycortisol is a corticosteroid hormone in the lamprey. Proc Natl Acad Sci U S A. 107, 13942-13947.

Conant, G.C., Wolfe, K.H., 2007. Increased glycolytic flux as an outcome of a whole-genome duplication in yeast. Mol. Syst. Biol. 3, 129.

DeRijk, R., de Kloet, R.R., 2005. Corticosteroid receptor polymorphisms and stress responsitivity. Endocrine 28, 263-269.

DesMarias, D.L., Ruahser, M.D., 2008. Escape from adaptive conflict after duplication in an anthocyanin pathway gene. Nature 454, 762-765.

Ducouret, B., Tujague, M., Ashraf, J., Mouchel, N., Servel, N., Valotaire, Y., Thompson, E.B., 1995. Cloning of a teleost fish glucocorticoid receptor shows that it contains a deoxyribonucleic acid-binding domain different from that of mammals. Endocrinol. 136, 3774-3783.

Filby, A.L., Tyler, C.R., 2007. Cloning and characterization of cDNAs for hormones and/or receptors of growth hormone, insulin-like growth factor-1, thyroid hormone and corticosteroid and the gender-, tissue-, and developmental-specific expression of their mRNA transcript in fathead minnow (*Pimephales promelas*). Gen. Comp. Endocrinol. 150, 151-163.

Force, A., Lynch, M., Pickett, F.B., Amores, A., Yan, Y.L., Postlethwait, J., 1999. Preservation of duplicate genes by complementary, degenerative mutations. Genetics 151, 1531-1545.

Giguere, V., Hollenberg, S.M., Rosenfeld, M.G., Evans, R.M. 1986. Functional domains of the human glucocorticoid receptor. Cell 46, 645-652.

Glass C.K.,  Rosenfeld, M.G., 2000. The coregulator exchange in transcriptional functions of nuclear receptors. Genes Dev. 14, 121-141.

Glasauer, S.M.K. Nuehaus, S.C.F., 2014. Whole-genome duplication in teleost fishes and its evolutionary consequences, Mol. Genet. Genomics 289, 1045 – 1060.

Greenwood, A.K., Butler, P.C., White, R.B., DeMarco, Pearce, D., Fernald, R.D., 2003. Multiple cortioicosteroid receptors in a teleost fish: distinct sequences, expression patterns, and transcriptional activities. Endocrinol. 144, 4226-4236.

Gronemeyer, H., Gustafsson, J-Å., Laudet, V., 2004. Principles for modulation of teh nuclear receptor superfamily. Nature Rev. Drug Discov. 3, 950-964.

Harms, M.J., Thornton, J.W. 2014. Historical contingency and its biophysical basis in glucocorticoid receptor evolution. Nature 512, 203-207.

Heimberg, A.M., Cowper, Sal-lari, R., Sémon, M., Donoghue, P.C.J., Peterson, K.J., 2010. microRNAs reveal the interrelationships of hagfish, lampreys and gnathostomes and the nature of the ancestral vertebrate. Proc. Natl. Acad. Sci. USA 107, 19379-19383.

Hoegg S, Brinkmann H, Taylor JS, Meyer, A., 2004. Phylogenetic timing of the fish-specific genome duplication correlates with the diversification of teleost fish. J. Mol. Evol. 59,190-203.

Heitzer, M.D., Wolf, I.M., Sanchez, E.R., Witchel, S.F., DeFranco, D.B., 2007, Glucocorticoid receptor physiology. Rev. Endocr. Metab. Disord. 8, 321-330.

Hollenberg, S.M., Weinberger, C., Ong, E.S., Cerelli, G., Oro, A., Lebo, R., Thompson, E.B., Rosenfeld, M.G., Evans, R.M., 1985. Primary structure and expression of a functional human glucocorticoid receptor cDNA. Nature 318, 635-641.

Hollenberg S.M., Evans, R.M., 1988. Multiple and cooperative trans-activation domains of the human glucocorticoid receptor. Cell 55, 899-906.

Jaillon, O., Aury, J.M., Brunet, F., Petit, J.L., Stange-Thomann, N., Mauceli, E., Bouneau, L., Fischer, C., Ozouf-Costaz, C., Bernot, A., Nicaud, S., Jaffe, D., Fisher, S., Lutfalla, G., Dossat, C., Segurens, B., Dasilva, C., Salanoubat, M., Levy, M., Boudet, N., Castellano, S., Anthouard, V., Jubin, C., Castelli, V., Katinka, M., Vacherie, B., Biemont, C., Skalli, Z., Cattolico, L., Poulain, J., De Berardinis, V., Cruaud, C., Duprat, S., Brottier, P., Coutanceau, J.P., Gouzy, J., Parra, G., Lardier, G., Chapple, C., McKernan, K.J., McEwan, P., Bosak, S., Kellis, M., Volff, J.N., Guigo, R., Zody, M.C., Mesirov, J., Lindblad-Toh, K., Birren, B., Nusbaum, C., Kahn, D., Robinson-Rechavi, M., Laudet, V., Schachter, V., Quetier, F., Saurin, W., Scarpelli, C., Wincker, P., Lander, E.S., Weissenbach, J., Roest Crollius, H., 2005. Genome duplication in the teleost fish *Tetraodon nigroviridis* reveals the early vertebrate proto-karyotype. Nature 431, 946-957.

Idler, D.R., M.P.M. Burton, The pronephroi as the site of presumptive interregnal cells in the hagfish *Myxine glutinosa* L., Comp. Biochem. Physiol. 53A (1976) 73-77.

Kassahn, K.S., Dang, V.T., Wilkins, S.J. Perkins, A.C., Ragan, M.A., 2009. Evolution of gene function and regulatory control after whole-genome duplication: comparative analysis in vertebrates. Genome Res. 19, 1404-1418.

Keay J., Bridgham, J.T., Thornton, J.W., 2006. The *Octopus vulgaris* estrogen receptor is a constitutive transcriptional activator: evolutionary and functional implications. Endocrinol. 147, 3861-3869.

Kiilerich, P. Triqueneaux, G., Christensen, N.M., Trayer, V., Terrien, Lombes, M., Prunet, P., 2015. Interaction between the trout mineralocorticoid and glucocorticoid receptors *in vitro.* J. Mol. Endocrinol, 55, 55-68.

Kim, M.A., Kim, D.S., Sohn, Y.C. 2011. Characterization of two functional glucocorticoid receptors in the marine madake *Oryzias dancena*. Gen. Comp. Endocrinol. 171, 341-349.

Kino, T., Manoli, I., Kelkar, S., Wang, Y., Su, Y.A., Chrousos, G.P. 2009. Glucocorticoid receptor (GR) beta has intrinsic, GRalpha-independent transcriptional activity. Biochem. Biophys. Res. Commun. 381, 671-675.

Kucera, T., Waltner-Law, M., Scott, D.K., Prasad, R., Granner, D.K., 2002. A point mutation of the AF2 transactivation domain of the glucocorticoid receptor disrupts its interaction with steroid receptor coactivator 1. J. Biol. Chem. 277, 26098-26102.

Kuraku, S, Meyer, A., Kuratani, S., 2009.Timing of genome duplications relative to the origin of the vertebrates: did cyclostomes diverge before or after? Mol. Biol. Evol. 26, 47-59.

Lethimonier, C., Tujague, M., Kern, L., Ducouret, B., 2002. Peptide insertion in the DNA-binding domain of fish glucocorticoid receptor is encoded by an additional exon and confers particular functional properties. Mol. Cell. Endocrinol. 194, 107-116.

Lewis-Tuffin, L.J., Jewell, C.M., Bienstock, R.J., Collins, J.B., Cidlowski, J.A., 2007. Human glucocorticoid receptor β binds RU-486 and is transcriptionally active. Mol. Cell. Biol. 27, 2266-2282.

Li, Y., Sturm, A., Cunningham, P., Bury, N.R., 2012. Evidence for a divergence in function between two glucocorticoid receptors from a basal teleost. BMC Evol. Biol. 12, 137.

Li, J-T., Hou, G-Y., Kong, X-F., Li, C-Y., Zeng, J-M., Li, H-D., Xiao, G-B., Li, X-M. Sun, X-W., 2015. The fate of recent duplicated genes following a fourth-round whole genome duplication in a tetraploid fish. Common carp (*Cyprinus carpio*), Sci. Report 5, 8199.

Liu, W., Wang, J., Sauter, N.K., Pearce, D., 1995. Steroid receptor heterodimerization demonstrated *in vitro* and *in vivo*, Proc. Natl. Acad. Sci. 92, 12480-12484.

Macqueen, D.J., Johnston, I.A., 2014. A well-constrained estimate for the timing of the salmonid whole genome duplication reveals major decoupling from species diversification. Proc. Biol. Sci. 281, 20132881.

Miyagawa, S., Lange, A., Tohyama, S., Ogino, Y., Mizutani, T., Kobayashi, Tatarazako, N., Tyler, C.R., Iguchi, T., 2015. Characterization of *Oryzias latipes* glucocorticoid receptors and their unique response to progestins. J. Appl. Toxicol. 35, 302-309.

Oakley, R.H., Cidlowski, J.A. 2011. Cellular processing of the glucocorticoid receptor gene and protein: new mechanisms for generating tissue-specific actions of glucocorticoids, J. Biol. Chem. 286, 3177-3184.

Ohno, S.,Evolution by Gene Duplication. (1970). George Allen & Unwin, London, UK.

Oka, K., Hoang, A., Okada, D., Iguchi, T., Baker, M.E., Katsu, Y., 2015. Allosteric role of the amino-terminal A/B domain on corticosteroid transactivation of gar and human glucocorticoid receptors. J. Steroid Biochem. Mol. Biol. 154, 112-119.

Ortlund, E.A., Bridgham, J.T., Redinbo, M.R., Thornton, J.W., 2007. Crystal structure of an ancient protein: evolution by conformational epistasis. Science 317, 1544-1548.

Panek M., Pietras T., Szemraj J., Kuna, P., 2014. Association analysis of the glucocorticoid receptor gene (NR3C1) haplotypes (ER22/23EK, N363S, BclI) with mood and anxiety disorders in patients with asthma. Exp. Ther. Med.  8, 662-670.

Ray, D.W., Davis, J.R.E., White, A., Clark, A.J.L. 1996. Glucocorticoid receptor structure and function in glucocorticoid resistant small cell lung carcinoma cells. Cancer Res. 56, 3276-3280.

Rivers, C., Levy, A., Hancock, J., Lightman, S., Norman, M., 1999. Insertion of an amino acid in the DNA-binding domain of the glucocorticoid receptor as a result of alternative splicing. J. Clin. Endocrinol. Metabol. 84, 4283-4286.

Schaaf, M.J., Champagne, D., van Laanen, I.H.C., van Wijk, D.C.W.A., Meijer, A.H., Meijer, O.C., Spaink, H.P., Richardson, M.K., 2008. Discovery of a functional glucocorticoid receptor β-isoform in zebrafish. Endocrinol. 149, 1591-1599.

Stolte, E.H., de Mazon, A.F., Leon-Koosterziel, K.M., Jesiak, M., Bury, N.R., Sturm, A., Savelkoul, H.F.J., Verburg van Kemenade, B.M.L., Flik, G., 2007. Corticosteroid receptors involved in stress regulation in common carp, *Cyprinus carpio*. J. Endocrinol. 198, 403-417.

Stolte, E.H., Nabuurs, S.B., Bury, N.R., Sturm, A., Flik, G., Savelkoul, H.F.J., Verburg van Kemenade, B.M.L., 2008. Stress and innate immunity in carp: Corticosteroid receptors and pro-inflammatory cytokines. Mol. Immunol. 46, 70-79.

Sturm, A., Bury, N.R., Dengreville, L., Fagart, J., Flouriot, G., Rafestin-Oblin, M.E., Prunet, P., 2005. 11-deoxycorticosterone is a potent agonist of the rainbow trout (*Oncorhynchus mykiss*) mineralocorticoid receptor. Endocrinol. 146, 47-55.

Sturm A., J.E. Bron, D.M. Green, Bury, N.R., 2010. Mapping of AF1 transactivation domains in duplicated rainbow trout glucocorticoid receptors. J. Mol. Endocrinol 45, 391-404.

Sturm, A., Colliar, L., Leaver, M.J., Bury, N.R., 2011. Molecular determinants of hormone sensitivity in rainbow trout glucocorticoid receptors 1 and 2. Mol. Cell. Endocrinol. 333, 181-189.

Takahashi, A., Kobayashi, Y., Mizusawa, K., 2013. The pituitary-interrenal axis of fish: a review focusing on the lamprey and flounder. Gen. Comp. Endocrinol. 188, 54-59.

Takahashi, H., Sakamoto, T., 2013. The role of “mineralocorticoids” in teleost fish: relative importance of glucocorticoid signalling in the osmoregulation and “central” actions of mineralocorticoid receptor. Gen. Comp. Endocrinol. 181, 223-228.

Takeo, J., Hata, J-I., Segawa, C., Toyohara, H., Yamashita, S., 1996. Fish glucocortioicd receptor with splicing variants in the DNA binding domain, FEBS Letters 389, 244-248.

Tamura, K., Stecher, G., Peterson, D., Filipski, A., Kumar, S., 2013. MEGA6: Molecular evolutionary genetics analysis version 6.0. Mol. Biol. Evol 30, 2725-2729.

Thomson, R.C., Plachetzki, D.C., Mahler, D.L., Moore, B.R., 2014. A critical appraisal of the use of microRNA data in phylogenetics. Proc. Natl. Acad. Sci. USA. 111, 3659-3668.

Thornton, J.W., Need, E., Crews, D., 2003. Resurrecting the ancestral steroid receptor: ancient origin of estrogen signalling. Science 301, 1714-1717.

van Rossum, E.F.C., Koper, J.W., Huizenga, N.A.T.M., Uitterlinden, A.G., Janssen, J.A.M.J.L., Brinkmann, A.O., Grobbee, D.E., de Jong, F.H., van Duyn, C.M., Pols, H.A.P., Lamberts, S.W.J., 2002. A polymorphism in the glucorticosteroid receptor gene, which decreases sensitivity to glucocorticoids in vivo, is associated with low insulin and cholesterol. Diabetes 51, 3128 – 3134.

Weisbart M., Idler, D.R., 1970. Re-examination of the presence of corticosteroids in two cyclostomes, the Atlantic hagfish (*Myxine glutinosa* L.) and the sea lamprey (*Petromyzon marinus* L.). J Endocrinol 46, 29-43.

# Whorwood, C.B., Ricketts, M.L., Stewart, P.M., 1994. Epithelial cell localization of type 2 11 beta-hydroxysteroid dehydrogenase in rat and human colon. Endocrinol. 135, 2533-2541.

Wickert, L., Selbig, J., 2002. Structural analysis of the DNA-binding domain of alternatively spiced steroid receptors. J. Endocrinol. 173, 429-436.

Woods, I.G., Wilson, C., Friedlander, B., Chang, P., Reyes, D.K., Nix, R., Kelly, P.D., Chu, F., Postelthwait, J.H., Talbot, W.S., 2005. The zebrafish gene map defines ancestral vertebrate chromosomes. Genome Res. 15, 1307-1314.

Xie, Y.B., Nedumaran, B., Chopi, H.S., 2009. Molecular characterization of SMILE a novel corepressor of nuclear receptors. Nucleic Acid Res. 37, 4100-4115.

**Figure 1.** Phylogenetic tree using 75 full length actinoptergyian GRs and hagfish CR. Tree was constructed with the Maximum-Likelihood methods in MEGA6 (Tamura et al 2013) using the Jones-Taylor Thornton model and nearest-neighbour interchange. Bootstrap values are reported based on 800 replicates. The tree shows clearer the two GR1 and GR2 groups with GRs from orders of fish clustering. The hagfish CR is separate and the basal actinotperygian GRs (*Acipenser ruthenus*, *Lepisosteus oculatus* and *Atractoseus tropicus*) group together between the teleost GR1 and GR2.

**Figure 2**. The consensus amino acid sequence spanning the two zinc fingers of the teleost GR. A. Represents the 5 additional amino acid insert of GR2 observed in Salmoniformes and Escoiformes. B. Represents the 9 amino acid insert seen in the GR1 group (also see Supplementary Material Figure), splice variants of GR1 exist where these 9 amino acids are absent.

**Figure 3.** Evidence for repression of steroid receptor function due to heterodimer formation. A. The situation in the cephalochordate where a steroid receptor (SR) is transactivationally active (represented by a solid arrow) in the presence of estrogens in contrast the estrogen (ER) is inactive (represented by an arrow with a cross), but acts a repressor (represented by a dashed arrow) of SR activity. B. In humans and zebrafish a spice variant in exon 8 forms a truncated glucocorticoid receptor (GR), termed GRβ, that acts as a repressor of GRα activity. There is also evidence of MR/GR heterodimer formation repressing GR activity. C. In teleost fish, the situation is more complex, the mineralocorticoid receptor (MR) has been shown to be transcriptionally active, but represses the actions of GR1 and GR2. It is unclear (represented by a dashed arrow with a question mark) how the various isoforms of GR in fishes influenced each others, either via repression or enhancement, function.

**Table 1** Transactivation EC50 values for full length actinopterygii GRs.

|  |  |  |  |
| --- | --- | --- | --- |
| **Species** | **EC50** | | **Reference** |
|  | **GR1** | **GR2** |  |
|  |  |  |  |
| Rainbow trout (*Oncorhynchus mykiss*) | 46 ± 12nMa  4.4 nMb | 0.72 ± 0.87nMa  0.6nMb | Bury et al (2003)  Sturm et al 2011 |
|  |  |  |  |
| Common Carp  (*Cyprinus carpio*) | 7.1 ± 2.9nMa  2.4 ± 3.8nMb | 2.4 ± 0.4nMa  0.7 ± 1.4nMb | Stolte et al (2007) |
|  |  |  |  |
| Marine medaka (*Oryzias dancena*) | 21.8 ±1.1nMa | 9.9 ± 2.5nMa | Kim et al (2011) |
|  |  |  |  |
| Japanese medaka (O*ryzias latipes*) | 57nMa | 0.00085nMa | Miyagawa et al 2014 |
|  |  |  |  |
| *Haplochromis burtoni* | 5.4nMa | 3.6nMa | Greenwood et al (2003) |
|  |  |  |  |
| *Pantadon buchholzi* | 10.4 ±1.4nMa,1  12.0 ± 1.3nMb,1 | 2.7 ±0.6nMa  1.5 ± 0.4nMb | Li et al (2012) |
|  |  |  |  |
|  | **GR** | |  |
| Zebrafish (*Danio rerio*) | 10.1nMa; 0.37nMb | | Schaaf et al 2008 |
|  |  | |  |
| Tropical gar (*Atractosterus tropicus*) | 1.3nMa, 0.15nMb | | Oka et al (2015) |
|  |  | |  |
| Sterlet (*Acipenser ruthenus*) | 21.6 ± 3.1nMa, 2.2 ± 0.7nMb | | Li et al (2012) |
|  |  | |  |

a – cortisol, b – dexamethasone. 1 – EC50 for GR1b which lacks the 9amino acid insert.

*Lepisosteus* *oculatus* Lepisosteidae Lepisosteiformes

*Acipenser ruthenus* Acipenseridae Acipenseriformes

*Oncorhynchus mykiss* Salmonidae Salmoniformes

*Esox lucius* Esocidae Esociformes

*Salmo salar* Salmonidae Salmoniformes

*Astatotilapia burtoni* Cichlidae Perciformes

*Poecilia formosa* Peociliidae Cyprinodontiformes

*Poecilia formosa* Peociliidae Cyprinodontiformes

*Astatotilapia burtoni* Cichlidae Perciformes

*Esox lucius* Esocidae Esociformes

*Oncorhynchus mykiss* Salmonidae Salmoniformes

*Salmo salar* Salmonidae Salmoniformes

*Salmo trutta* Salmonidae Salmoniformes

*Atractosteus tropicus* Lepisosteidae Lepisosteiformes

*Coregonus marena* Salmonidae Salmoniformes

*Myxine glutinosa* Myxinidae Myxiniformes

*Pantadon buchholzi*  Pantodontidae Osteoglossiformes

*Clupea harengus* Clupeidae Clupeiformes

*Oryzias latipes*  Adrianichthyidae Beloniformes

*Oryzias dancena* Adrianichthyidae Beloniformes

*Pundamilia nyererei* Cichlidae Cichliformes

*Oreochromis mossambicus* Cichlidae Perciformes

*Neolamprologus brichardi* Cichlidae Perciformes

*Maylandia zebra* Cichlidae Perciformes

*Oreochromis niloticus*  Cichlidae Perciformes

*Acanthopagrus schlegelii Sparidae Perciformes*

*Sparus aurata* Sparidae Perciformes

*Perca fluviatilis* Percidae Perciformes

*Larimichthys crocea* Scianenidae Perciformes

*Tautogolabrus adspersus* Labridae Perciformes

*Notothenia coriiceps* Nototheniidae Perciformes

*Stegastes partitus* Pomacetridae Perciformes

*Dicentrarchus labrax* Moronidae Perciformes

*Danio rerio* Cyprinidae Cypriniformes

*Pimephales promelas* Cyprinidae Cypriniformes

*Cyprinus carpio* Cyprinidae Cypriniformes

*Cynoglossus semilaevis* Cynoglossidae Pleuronectifomres

*Fundulus heteroclitus* Fundulidae Cyprinodontiformes

*Austrofundulus limnaeus* Rivulidae Cyprinodontiformes

*Poecilia reticulate* Peociliidae Cyprinodontiformes

*Xiphophorus maculates* Peociliidae Cyprinodontiformes

*Astyanax mexicanus* Characacidae Characiformes

*Gadus morhua* Gadidae Gadiformes

*Gasterosteus aculeatus* Gasterosteidae Gasterosteiformes

*Tetraodon nigroviridis* Tetradontidae Tetraodontiformes

*Takifugu rubripes*  Tetradontidae Tetraodontiformes

Species

Family

Order

*Xiphophorus maculates* Peociliidae Cyprinodontiformes

*Poecilia reticulate* Peociliidae Cyprinodontiformes

*Fundulus heteroclitus* Fundulidae Cyprinodontiformes

*Austrofundulus limnaeus* Rivulidae Cyprinodontiformes

*Oryzias latipes*  Adrianichthyidae Beloniformes

*Oryzias dancena* Adrianichthyidae Beloniformes

*Oreochromis niloticus*  Cichlidae Perciformes

*Maylandia zebra* Cichlidae Perciformes

*Neolamprologus brichardi* Cichlidae Perciformes

*Pundamilia nyererei* Cichlidae Cichliformes

*Stegastes partitus* Pomacnetridae Perciformes

*Perca fluviatilis* Percidae Perciformes

*Gasterosteus aculeatus* Gasterosteidae Gasterosteiformes

*Takifugu rubripes*  Tetradontidae Tetraodontiformes

*Tetraodon nigroviridis* Tetradontidae Tetraodontiformes

*Dicentrarchus labrax* Moronidae Perciformes

*Larimichthys crocea* Scianenidae Perciformes

*Gadus morhua* Gadidae Gadiformes

*Clupea harengus* Clupeidae Clupeiformes

*Astyanax mexicanus* Characacidae Characiformes

*Cyprinus carpio* Cyprinidae Cypriniformes

*Pantadon buchholzi*  Pantodontidae Osteoglossiformes

*Coilia nasus Engraulidae* Clupeiformes

*Anguilla japonica* Anguillidae Anguilliformes

*Hippocampus abdominalis* Syngnathidae Syngnathiformes

*Cynoglossus semilaevis* Cynoglossidae Pluronectiformes

*Paralichthys olivaceus* Pluronectidae Pluronectiformes

*Paralichthys flesus* Pluronectidae Pluronectiformes

*Sciaenops ocellatud* Sciaenidae Perciformes

**GR2**

**GR1**

Figure 1

Figure 2

**Zn**

**Zn**

**A.**

**B.**

**G/L**

A.

SR ER

x

B.

GRα

GRβ

MR

x

?

C.

GR1a

GR1b

MR

?

GR2

?

?

Figure 3

**Supplementary Material**

**Table – A list of full length actinopterygian and hagfish glucocorticoid receptor amino acid sequences used for the phylogenetic analysis.**

**Figure – Alignment of the full length actinopterygian and hagfish glucocorticoid receptors using Clustal Omega 1.2.1. Species abbreviation can be found in Table S1.**

**Table S1**: A list of the species glucocorticoid receptor sequences used for phylogeny and the PubMed or ENSEMBL accession numbers.

|  |  |  |
| --- | --- | --- |
| Classification | Common Name | Accession Number\* (name abbreviation) |
| Class: Pteraspidomorphi  Subclass: Pteraspidomorpha  Order: Myxiniformes  Family: Myxinidae  Genus: *Myxine*  Species: *M. glutinosa* | Atlantic hagfish | ABD46742.1 (Myxine) |
|  |  |  |
| Class: Actinopterygii  Order: Lepisosteiformes  Family: Lepisosteidae  Genus: *Lepisosteus*  Species: *L. oculatus* | Spotted gar | ENSLOCT00000012909 (Gar) |
|  |  |  |
| Class: Actinopterygii  Order: Lepisosteiformes  Family: Lepisosteidae  Genus: *Atractosteus*  Species: *A. tropicus* | Tropical gar | BAR64351.1 (Tgar) |
|  |  |  |
| Class: Actinopterygii  Order: Acipenseriformes  Family: Acipenseridae  Genus: *Acipenser*  Species: *A. ruthenus* | Sterlet | AFK14015.1 (Sterlet) |
|  |  |  |
| Class: Actinopterygii  Order: Osteoglossiformes  Family: Pantodontidae  Genus: *Pantodon*  Species: *P. buchholzi* | Freshwater butterflyfish | JQ791099.1 (ButterGR1) JQ781069.1 (ButterGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Anguilliformes  Family: Anguillidae  Genus: *Anguilla*  Species: *A. japonica* | Japanese eel | AB506765.1 (JeelGR1) |
|  |  |  |
| Class: Actinopterygii  Order: Clupeiformes  Family: Engraulidae  Genus: *Coilia*  Species: *C. nasus* | Japanese grenadier anchovy | KJ747634.1 (AnchGR1) |
|  |  |  |
| Class: Actinopterygii  Order: Clupeiformes  Family: Clupeidae  Genus: *Clupea*  Species: *C. harengus* | Atlantic herring | XM\_012837767.1 (HerrGR1) XM\_012831682.1 (HerrGR2) |
|  |  |  |
| Class: Actinopterygii  Superorder: Protacanthopterygii Order: Salmoniformes  Family: Salmonidae  Genus: *Oncorhynchus*  Species: *O. Mykiss* | Rainbow trout | Z54210.1 (RTrouGR1) AY495372.1 (RTrouGR2) |
|  |  |  |
| Class: Actinopterygii  Superorder: Protacanthopterygii  Order: Esociformes  Family: Esocidae  Genus: *Esox*  Species: *E. lucius* | Northern pike | XP\_010869409.1 (PikeGR1)  XM\_010871111.2 (PikeGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Salmoniformes  Family: Salmonidae  Genus: *Salmo*  Species: *S. salar* | Atlantic salmon | XP\_014053534.1 (ASalmGR1)  XP\_014054152.1(AaalmGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Salmoniformes  Family: Salmonidae  Genus: *Salmo*  Species: *S. trutta* | Brown trout | AY863149.1 (BtrouGR1) |
|  |  |  |
| Class: Actinopterygii  Order: Salmoniformes  Family: Salmonidae  Genus: *Coregonus*  Species: *C. maraena* | Maraena whitefish | CEP28034.1 (WhiteGR1) |
|  |  |  |
| Class: Actinopterygii  Order: Beloniformes  Family: Adrianichthyidae  Genus: *Oryzias*  Species: *O. Latipes* | Japanese medaka | XM\_011483198.1 (MedakaGR1)  NM\_001163133.1 (MedakaGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Beloniformes  Family: Adrianichthyidae  Genus: *Oryzias*  Species: *O. dancena* | Marine medaka | HM598068.1 (OdancGR1)  HM598069.1 (OdancGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Cichlidae  Genus: *Astatotilapia*  Species: *A. burtoni* | Burton's mouthbrooder | NM\_001286292.1 (BurtonGR1)  AF263738.1 (BurtonGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Cichlidae  Genus: *Pundamilia*  Species: *P. nyererei* | *Pundamilia nyererei* | XM\_013909490.1 (PundGR1) XP\_005719827.1 (PundGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Cichlidae  Genus: *Oreochromis*  Species: *O. mossambicus* | Mozambique tilapia | AB771724.1 (TilMGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Cichlidae  Genus: *Neolamprologus*  Species: *N. brichardi* | Princess cichlid | XP\_006785025.1 (NeolGR1)  XP\_006781607.1 (NeolGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Cichlidae  Genus: *Maylandia*  Species: *M. zebra* | Zebra mbuna | XP\_004550398.1 (MzebraGR1)  XP\_004541006.1 (MzebraGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Cichlidae  Genus: *Oreochromis*  Species: *O. niloticus* | Nile Tilapia | ENSONIT00000010671 (TilGR1)  ENSONIT00000022590 (TilGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Sparidae  Genus: *Acanthopagrus*  Species: *A. schlegelii* | Black porgy | AY921612.2 (PorgyGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Sparidae  Genus: *Sparus*  Species: *S. aurata* | Gilthead seabream | DQ486890.1 (BreamGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Percidae  Genus: *Perca*  Species: *P. fluviatilis* | European perch | EU861040.1 (PerchGR1) KC847473.1 (PerchGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Sciaenidae  Genus: *Larimichthys*  Species: *L. crocea* | Large yellow croaker | XM\_010729315.1 (CroakerGR1) XM\_010754714.1 (CroakerGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Sciaenidae  Genus: *Sciaenops*  Species: *S. ocellatus* | Red drum | ADI48099.1 (RdrumGR1) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Labridae  Genus: *Tautogolabrus*  Species: *T. adspersus* | Cunner | GU596482.1 (CunnerGR1) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Nototheniidae  Genus: *Notothenia*  Species: *N. coriiceps* | Black rockcod | XM\_010776182.1 (RCodGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Pomacentridae  Genus: *Stegastes*  Species: *S. partitus* | Bicolor damselfish | XP\_008292826.1 (BicolorGR1)  XP\_008282587.1 (BicolorGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Perciformes  Family: Moronidae  Genus: *Dicentrarchus*  Species: *D. labrax* | European seabass | AY549305.1 (SBassGR1)  AY619996.1 (SBassGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Cypriniformes  Family: Cyprinidae  Genus: *Danio*  Species: *D. rerio* | Zebrafish | NM\_001020711.3 (zebra) |
|  |  |  |
| Class: Actinopterygii  Order: Cypriniformes  Family: Cyprinidae  Genus: *Pimephales*  Species: *P. promelas* | Fathead minnow | AY533141.1 (MinnowGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Cypriniformes  Family: Cyprinidae  Genus: *Cyprinus*  Species: *C. carpio* | Common carp | CAI51316.3 (CarpGR1) AM183668.2 (CarpGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Pleuronectiformes  Family: Pleuronectidae  Genus: *Platichthys*  Species: *P. Flesus* | European flounder | JF951960.1 (EflouGR1) |
|  |  |  |
| Class: Actinopterygii  Order: Pleuronectiformes  Family: Pleuronectidae  Genus: *Platichthys*  Species: *P. olivaceus* | Japanese flounder | AB013444.1 (JFlouGR1) |
|  |  |  |
| Class: Actinopterygii  Order: Pleuronectiformes  Family: Cynoglossidae  Genus: *Cynoglossus*  Species: *C. semilaevis* | Tongue sole | XP\_008330515.1 (TsoleGR1)  XP\_008325580.1 (TsoleGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Cyprinodontiformes  Family: Fundulidae  Genus: *Fundulus*  Species: *F. heteroclitus* | Mummichog | XM\_012876202.1 (MummGR1) XP\_012711750.1 (MummGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Cyprinodontiformes  Family: Rivulidae  Genus: *Austrofundulus*  Species: *A. limnaeus* | *Austrofundulus limnaeus* | XP\_013872304.1 (AlimGR1) XP\_013886492.1 (AlimGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Cyprinodontiformes  Family: Poeciliidae  Genus: *Poecilia*  Species: *P. reticulate* | Guppy | XM\_008426940.1 (GuppyGR1)  XM\_008420058.1 (GuppyGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Cyprinodontiformes  Family: Poeciliidae  Genus: *Poecilia*  Species: *P. formosa* | Amazon molly | ENSPFOT00000005871 (MollyGR1) ENSPFOT00000010427 (MollyGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Cyprinodontiformes  Family: Poeciliidae  Genus: *Xiphophorus*  Species: *X. maculates* | Platyfish | ENSXMAT00000001516 + ENSXMAT00000019313 (PlatyGR1)  ENSXMAT00000009210 (PlatyGR2A) |
|  |  |  |
| Class: Actinopterygii  Order: Syngnathiformes  Family: Syngnathidae  Genus: *Hippocampus*  Species: *H. Abdominalis* | Big-belly seahorse | KJ756323.1(SeaHGR1) |
|  |  |  |
| Class: Actinopterygii  Order: Characiformes  Family: Characidae  Genus: *Astyanax*  Species: *A. Mexicanus* | Cavefish | ENSAMXT00000020636 (CaveGR2)  ENSAMXT00000011973 (CaveGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Gadiformes  Family: Gadidae  Genus: *Gadus*  Species: *G. morhua* | Cod | ENSGMOT00000019605 (CodGR1)  ENSGMOT00000006200 (CodGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Gasterosteiformes  Family: Gasterosteidae  Genus: *Gasterosteus*  Species: *G. aculeatus* | Stickleback | ENSGACT00000027452 (StickleGR1)ENSGACT00000024121 (StickleGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Tetraodontiformes  Family: Tetraodontidae  Genus: *Tetraodon*  Species: *T. Nigroviridis* | Green pufferfish | ENSTNIT00000021610 (TdonGR1)  ENSTNIT00000011990 (TdonGR2) |
|  |  |  |
| Class: Actinopterygii  Order: Tetraodontiformes  Family: Tetraodontidae  Genus: *Takifugu*  Species: *T. rubripes* | Fugu | ENSTRUT00000015714 (FuguGR1) ENSTRUT00000018490 (FuguGR2) |
|  |  |  |

Myxine ------------------------------------------------------------

**Figure S1.** Alignment of GR amino acid sequences

FuguGR1 -------------MDQGGLKRNGNRDG-SLTFGETGGRLGG-----DMGDPAGSLLQP--

TdonGR1 -------------MDQGGLKRSGNRDG-CLTFGEAGGRLGG-----D---PAGSLLQP--

CodGR1 -------------MDQGGLRRSGNRDD-GLTFRPT-------------------------

SeaHGR1 -------------MDQGILKCNSNQDD-SLTFIELGTRECK-----EAADTTASLLCA--

AlimGR1 ----MFFSLQNEEMDQGGPKHNGNQNN-NLTFGEIAPELGR-----DTS---A-LLLQ--

MedakaGR1 -------------MDQGELKLNGNQGG-SLSYGEIRPEACR-----DTGDSSDLLFQ---

OdancGR1 -------------MDQGELKLNGNQGG-SLSFGEIGPEACG-----DTGDSSDLLFQ---

BicolorGR1 -------------MDQGGLKRNGNRDD-SLTFGEIGAEVAR-----DTGDTPSSLLQ---

TSoleGR1 -------------MDQGGRERNSNRDD-SLTFGEVGVRLSS-----NAGDTTSSLLL---

MummGR1 -------------MDQGGPKHNGNQND-NLTFAGIGPEVGR-----DTVGPSDLLLQ---

GuppyGR1 -------------MDQGGPKHNGNRND-KLTFAGIRPEVGR-----DSVSTSGLLLQ---

MollyGR1 -------------MDQGGPKHNGNRND-NLTFAGIRPEVGR-----DSVNTSGLLLQ---

PlatyGR1 -------------MDQGGPKHNGNRND-NLTFAGIRPEVGR-----DSVSTSGLLLQ---

PundGR1 -------------MDQGGLKRNGNRDD-GLTFAEIE----------GTGDTPGSLFQ---

TilGR1 -------------MDQGGLKRNGNRDD-GLTFAEIG----------GTGDTPGSLFQ---

NeolGR1 -------------MDQSGLKRNGNRDD-GLTFAEIG----------GTGDTPGSLFQ---

BurtonGR1 -------------MDQGGLKRNGNRDD-GLTFAEIE----------GTGDTPGSLFQ---

MzebraGR1 -------------MDQGGLKRNGNRDD-GLTFAEIE----------GTGDTPGSLFQ---

StickleGR1 -------------MDQGELKRTGNRDD-SLTFGETLA----------AGDTAGPALQ---

CroakerGR1 -------------MDQHGLKRNGNRDD-SLTFGEAVAGGGS-----DTGDTADSMLE---

RdrumGR1 -------------MDQGGLKRNGNRDD-SLTFGEAVAGVGS-----DTGDTAGSMLQ---

PerchGR1 -------------MDQGGLKRNGNQDD-SLTFGVTGAGVGR-----DTDDTTGSRLQ---

SbassGR1 -------------MDQGGLKRSAFFEMRSDIWGGRSWSRQS-----IQADTAGSLLQ---

JflouGR1 -------------MDQGGLKRNCNRDD-SLTFGETAVGVGS-----DTGDTAGSLLQP--

EflouGR1 -------------MDQGGLKRNGNRDD-SLTFGETAV--GS-----DTGDTAGSLLEP--

ButterGR1 MTQLFRVQTQEQEMERRGLKVSS-NQYECLTLG-HTETLGQGKL--------RGITPLPS

FuguGR2 -------------MDKDGVKKVTYRRDDPLRKLVYTESPEEGGLLKVAPHGAMSITSA--

TdonGR2 -------------MDKGGVKKVTYRKDDLLSKLVYTESPEEGGLLKVAPHGAMSLTSA--

CodGR2 -------------MDKGRVKKIRNNRDDHLSKLFYTESPVDGTPLKVAPHSAMSITSA--

TsoleGR2 -------------MDKGGVKKITYRRDDHLTKLVYTESPEVGGLLKVAPHTAMPISSA--

AlimGR2 -------------MDQGGVKKITYRGNDHLSKLVYTESPEEGGLLKVAPHSAVSLASA--

MummGR2 -------------MDQGGVKKIAYRRNDHLSKLVYTESPEEGGLLKVAPHSAMSITSP--

PlatyGR2 -------------MDQGGVKKIAYRRNDHLSKLVYTESPEEGGLLKVAPHSAMSITSP--

MollyGR2 -------------MDQGGVKKIAYRRNDHLSKLVYTESPEEGGLLKVAPHSAMSITSP--

GuppyGR2 -------------MDQGGVKKIAYRRNDHLSKLVYTESPEEGGLLKVAPHSAMSITSP--

MedakaGR2 -------------MDQGGVKKITYRRDDHLSKLVYTESPEEGGLLKVAPHSATSINSA--

OdancGR2 -------------MDQGGVKKITYRRDDHLSKLVYTESPEEGGLLKVAPHSAMSINSA--

SbassGR2 -------------MDKGGVKKITYRRDDHLSKLVYTESPEEGGLLKVAPHSAMSIASA--

NeolGR2 --------MFFLEMDKGGVKKIAYRRDDHLSKLVYTESPEEGGLLRVAPHSAMSVTSP--

BurtonGR2 -------------MDKGGVKKIAYRRDDHLSKLVYTESPEEGGLLRVAPHSAMSVTSP--

MzebraGR2 -------------MDKGGVKKIAYRRDDHLSKLVYTESPEEGGLLRVAPHSAMSVTSP--

PundGR2 -------------MDKGGVKKIAYRRDDHLSKLLYTESPEEGGLLRVAPHSAMSVTSP--

TilGR2 -------------MDKGGVKKIAYRRDDHLSKLVYTESPEEGGLLRVAPHSAMSVTSP--

TilMGR2 -------------MDKGGVKKIAYRRDDHLSKLVYTESPEEGGLLRVAPHSAMSVTSP--

CroakerGR2 -------------MDKGGVKKITHRRDDHLSKLVYTESPEEGGLLKVAPHSAVSITTP--

StickleGR2 -------------MDNGGVKKITYRRDDHLSKLVYTESPENGGLLKVAPHSAMSISSA--

CunnerGR2 -------------MDTGGVKKIIYRRDDHLSKLVYTESPEEGGLLKVAPHSAMSIASA--

RCodGR2 ----------------------------------------------------------MS

PorgyGR2 -------------MDQGGLKKITYRRDDHSSKLVYTESAEEGGLLKVAPQSAMSITSA--

BreamGR2 -------------MDQGGLKKITYRRDDHSSKLVYTESTEEGGLLKVTPQSAMSITSA--

BicolorGR2 -------------MDKGGVKKIAYRRDDHLSKLVYTESPEEGGLLKVAPRSAMSITSATS

PerchGR2 -------------MDKGGVKKILYRRDDHLSTLVYSESPEEGGLLKVAPHSAMSITSA--

ButterGR2 -------------MDQKGVKRSN-NQDDRLTLTDYVEKE-GGAF-RS-GVTTMSVAS---

PikeGR2 -------------------------------------------------MSVSSATT---

RtroutGR2 ------------------------------------------------------------

AsalmGR2 ------------------------------------------------------------

HerrGR2 ---------MHQEMDQGGVKNST-KRDEHLIKLDFNESPADGAL-RNGGLGAMSLAP---

CaveGR2 -------------MDKGGLKEVM-KRDERLITLNYSDSPAEGVL-QNGTRSTMSIAS---

zebra -------------MDQGGLENGK-KRDERLNTLDYNKRATEGIL-PRRIQSTMSVAP---

MinnGR2 -------------MDQGGLKNGA-KRDERLNILDYSNSPVEGIL-RSGIQSAMSVAP---

CarpGR2 -------------MDQGGLTNGA-KRDDHLNTLDYSNSPVEGIL-RSGIQSAMPVAP---

Sterlet ---------------MDERVQSF-NGDESLKLARFCDRGGD----TASRGGVSTM-STST

Gar ----MLLNEQGQDMEQGGLHQSN-NRDESVKFVEYSGRGEG-----AFGGGGSTM-AAST

Tgar -------------MEQGGLQQSN-NRDESVKFVEYSGRGEG-----AFGGGGSTM-AAST

HerrGR1 -------------MDRGGLKHNP-RDNSFVFSEQAGEVGFV----NDIGKSAR-------

AnchGR1 -------------MDQSGLRRNP-RNNG----KQAGEGGFV----SDIGSSGMQVPATTT

JeelGR1 ------------------------------------------------------------

PikeGR1 -------------MDQSGLKRSR-NQDNSSPFSDSPERGVQ----KNLSGDAGGSKSTAA

WhiteGR1 -------------MDPGGLKHSN-NQDKGLAFGKLSESCVE----GSFSGEAGGSKSTTS

RtrouGR1 -------------MDPGGLKHS---KDKGLAFGKLSESSVE----GSFSGDTGGSKSTTS

AsalmGR1 -------------MDPGGLKHSI-NKDKGLAFGKLSESGVE----GSFSGDAGGSKSTTS

BtrouGR1 -------------MDPGGLKHSH-NKDNGLAFGKLSESGVE----GSFSGDAGGSKSTTS

CaveGR1 --------------MDCGLKRSN-NQDENLTLGDRTMRGLS----TDINSTNMSSSPT--

CarpGR1 --------------MDSGQKRSS-NNGENLTLGDCIERGFV----PDIGVNVS---AL--

Myxine ------------------------------------------------------------

FuguGR1 --DMHLPGI-GSLPSSAVSSTEQGGSK-DPVEL-----------GSF-FLSDM-------

TdonGR1 APAVHLPGL-GSLPPTTVSSAGQGGSQ-NHLEF-----------GGF-FPSDT-------

CodGR1 ------------------------------------------------------------

SeaHGR1 ---LH-----------PISPN-GGGTK-DQLEP-----------GIL-LDSHQQR-----

AlimGR1 -STMHLPGP-GNQTQSTLAPNGQGGTK-DQGNF-----------GGI-FESPH-L-----

MedakaGR1 -SAMHLPGS-S-----SVAPNGQGGTK-GQGEV-----------GGF-FEPPE-H-----

OdancGR1 -SAMHLPGS-G-----SVAPNGQGGTK-GQGEV-----------GGF-FEPPE-S-----

BicolorGR1 -STMHLPGP-GPLPQPTVAPNGRVGTK-DQGEL-----------GGL-FESPQ-H-----

TSoleGR1 -STMHLPGP-GSLPHLTVPPNAE--RK-EQGEY-----------GAI-FKSPH-P-----

MummGR1 -SAMHLPSP-GSMNQSTVAPNGQGGTK-DQGEL-----------GGL-FESDK-------

GuppyGR1 -PAMHLPSP-GSVNQSTVAPNGQGGTK-DQGEL-----------GGL-FESDK-------

MollyGR1 -PTMHLPSP-GSANQSTVAPNGQGGTK-DQGEL-----------GGL-FESDK-------

PlatyGR1 -PTMHLPSP-GSVNQSTVAPNGQGGTK-DQGEL-----------GGL-FESDK-------

PundGR1 -TAMHL--P-GSLPPATVAPNRQGGTN-GQGEL-----------GGL-FESHQ-H-----

TilGR1 -SAMHL--P-GSLPPATVAPNRQGGTN-GQGEL-----------GGL-FESHQ-H-----

NeolGR1 -TAMHL--P-GSLPPATVAPNRQGGTN-GQGEL-----------GGL-FESHQ-H-----

BurtonGR1 -TAMHL--P-GSPPPATVAPNRQGGTN-GQGEL-----------GGL-FESHQ-H-----

MZebraGR1 -TAMHL--P-GSLPPATVAPNRQGGTN-GQGEL-----------GGL-FESHQ-H-----

StickleGR1 -SAADRPGQ-GPLPQPAAGLNGRCGNK-NRGEP-----------GGL-FDSPQ-H-----

CroakerGR1 -SAMHLPGP-GSLPQPMMPPNGQGGTK-DQ------------------------------

RdrumGR1 -PAMHLPGP-GSLPQPTMPPNGQGGTK-DQVEL-----------GGL-FEPAQ-H-----

PerchGR1 -SATHLSGP-GSLPQPTVAPNGQGETK-DQGEL-----------GGL-FESPQ-H-----

SbassGR1 -SAMHLPGP-GSVPQPTVCTNGQGGTK-DQGEL-----------GGL-FESPQ-H-----

JflouGR1 -AAMHLPSP-SSLPQLTVAPNGGAGTK-DQGEF-----------GGL-FESPR-G-----

EflouGR1 -AAMHLPSP-GSLAQLTVTPNGRAATK-DQGEF-----------GGL-FESPR-G-----

ButterGR1 AQS-------VTQPKEGEAV-GTR----------------IIPVSPV-------------

FuguGR2 ------TPSQLLQP--GQVSNGLGNSS-FPEELAP--G--TANVSHL-SENPEI------

TdonGR2 -TSVALPPSQLMQP--GQASNGLSSSP-LPEERTS--L--AANVGQL-LENPEI------

CodGR2 -TAVVLPSSPLMQP--GDVPNSLSNSP-LPEELTSASG--TASFGLI-LEDSEP------

TsoleGR2 -ATIALPPSPLMQP--GQIPNGLSNSP-LPQELSPITA--NATLGPL-LTK---------

AlimGR2 -TSVVLPTSPLMQP--GQVTNGLSNSP-LPDEHTSASA--PATIGSL-IEIPEP------

MummGR2 -PSVVLPSSPLMQP--GQVTNGLSNSP-LPEEL--ASA--PATLGSL-VECPET------

PlatyGR2 -PSVVLPSSPLMQP--GQVTNGLSNSP-LPEEL--ASA--PATIGSS-VDSSET------

MollyGR2 -PSVVLPSSPLMQP--GQVTNGLSNSP-LPEEL--ASA--PATIGSS-VDSSET------

GuppyGR2 -PSVVLPSSPLMQP--GQVTNGLSNSP-LPEEL--ASA--PATIGSS-VDSSET------

MedakaGR2 -TSVVLPSSPLMQP--GQVTNGLSSSP-LPEELTP--A--PTSIGFL-LDTQEP------

OdancGR2 -TSVVLPSSPLMQP--GQVTNGLSSSP-LPEELTP--A--PTSIGFL-LDTQEP------

SbassGR2 -TSVNLPSSPLMQP--GQVPNGLSNSP-LPEELTS--V--TATVGSL-LEDHES------

NeolGR2 -ASVVLPSSSLMQP--GQVPNGLNNST-LPEELTSASV--TATVGSL-IDSPQP------

BurtonGR2 -ASVVLPSSSLMQP--GQVPNGLNNST-LPEELTSASV--TATVGSL-IDSPQP------

MZebraGR2 -ASVVLPSSSLMQP--GQVPNGLNNNT-LPEELTSASV--TATVGSL-IDSPQP------

PundGR2 -ASVVLPSSSLMQP--GQVPNGLNNNT-LPEELTSASV--TATVGSL-IDSPQP------

TilGR2 -ASVVLPSSSLMQP--GQVPNGLNNSP-LPEELTSASV--IATVGSL-IDGPEP------

TilMGR2 -ASVVLPSSSLMQP--GQVPNGLNNSP-LPEELTSASV--IATVGSL-IDGPEP------

CroakerGR2 ATSVVLPSSPFMQP--GQVPNGLSNSP-LPEELTS--V--TAIVGPF-LEDQES------

StickleGR2 -TSLLLPSSPLMQP--GQVPYGLSNSP-LPEELTS--A--TATVGPL-LEDQES------

CunnerGR2 -TSIVLPSSPLMQP--GQAPNGLSNSP-LPEELTY--V--TATVGTL-LEDPES------

RCodGR2 ITSVVLPSTPLMQP--GQVPNGLSNSH-LT-ELSSASV--TSTVGPL-LEDPEP------

PorgyGR2 -TSVVLPSSPLMQP--GQVPNGLSDSP-FPEELTS--I--TATVGPV-FEDSES------

BreamGR2 -ASVVLPSSPLMQP--GQVPNGLSDSP-FPEELTS--I--TATVGPL-LEVPES------

BicolorGR2 VTSVVLPSSPLMQP--GQVPNGLSNTP-LPEELTSTSL--TATLGSL-LDGPET------

PerchGR2 -TSVILPSSPLMQP--GQVPNGLSKSP-LPEELTS--V--TATVGLL-PEDPEP------

ButterGR2 -SMVVAPPNSRRPVAPGDVSNGLGGVS-QDQ------LALSVPLGLL-TEEATS------

PikeGR2 -TSVFLPSSPLMQP--GDVPNGLSNPP-SREDVTSASITATASGGLY-LEDPETPNIETP

RtroutGR2 ------------------------------------------------------------

AsalmGR2 ------------------------------------------------------------

HerrGR2 -TSLVPPSSPLMQPVSGDVPNGLCNSP-LPEEYTTAV---TTSLGFY-GEEADH------

CaveGR2 -TSLVPPPSPLMQPVTGDLPNGLSSSP-TPEELTTPA-----TLDLY-MEDLDM------

Zebra -TSMVPQAGPMMQPVSGDIPNGLSNSP-TLEEHTSSV---SS---IF-GDDSEL------

MinnGR2 -TSMVPQPSPLMQPVSADLPNGLSNSP-TLEEHTTS------TLGFF-MEDSEL-----Q

CarpGR2 -TSLVPQPNPLMQPVSGDVPNGLSNSP-TLEEHTTSV---SSTLGIF-GEDSEL------

Sterlet ESTVAQAST-SLHTVATDISNGVGS-HAPQRELMTAV---STSMGLY-MEDTDS------

Gar TSTVAQPSP-RIPPVPGDITNGLGT-SAPQQELTTAV---SASMGLY-MEETDS------

Tgar TSTVAQPSP-RIPPVPGDITNGVGT-SAPQQELTTAV---SASMGLY-MEETDS------

HerrGR1 ----------VQVPPTDDSSNGLNS-SNLQRDRAAIG---LGPRGRRAVEGTHV------

AnchGR1 G-L-VQPMLRSPAPRADGPFGGLHS-SSLQRDLALMG---LGPRGQGALQGLHI------

JeelGR1 -------------------------------------------MGLY-TEDPDA------

PikeGR1 ASRMHLPGS-RAPPSATDSSNGLN-VFMAQGEFDMPG---TAST----VKVAEM------

WhiteGR1 TSLMHLPGP-RTQPPARDSSNGLN-VTKTQGELSAPG---TASMGLT-IEEAEV------

RtrouGR1 TSLMHLPGS-RPQPPARDSANGLN-VTTTQMELST--------GGLT-IEEAEV------

AsalmGR1 TSLMHLPGS-RPQPPARDSANGLN-VTTTQMELST--------GGLT-IEESEV------

BtrouGR1 TSLMHLPGS-RPQPPARDSANGLN-VTTTQMELST--------GGLT-IEESEV------

CaveGR1 -------------SASSDILNGLSSSMSAQRELPMAG---PTMVGHG-TQENSA------

CarpGR1 -------------NTSKDFSNGQ-SGSDAQRNLSLAD---PSLLGRN-TQEPAV------

Myxine ------------------------------------------------------------

FuguGR1 ---------KE----GK-GRMQK------------QQDIDQFSME-SNL--LKQS-----

TdonGR1 ----------K----GK-AAMQK------------QQDVDLFSLE-AP------------

CodGR1 ---------GE----GKALGVQK-----------QQQGIDVFNME-GNLSFLEQSIADLD

SeaHGR1 QALFEGSNTND----QKMVRIEKR----Q-------QDVGVFNIE-EDLALLSQNIADLD

AlimGR1 HAPCEGSDKE-----AKRIRMQK-------------QEQDIFSIG-DNLSLLNQNISDLN

MedakaGR1 TIPCEGSEAQG----DKLIRMQK-------------SEQNVFSMG-ENLTLVSESISDPK

OdancGR1 ------SEVKG----DKLIRMQK-------------SEQNVFSMG-ESLPLVSESISDPK

BicolorGR1 HVLCDRSDMKE----GKMIRMQKP----Q----QQQQDIDIFNMG-DSLPLLNQNISDLD

TSoleGR1 Q--CEGPHMKE----GKIVRMEKQ----Q-----QQQDVGMFNIK-GSEPFLNPNFSDPD

MummGR1 ----------E----GKMSRMHK-------------QDQDIFMYG-DSLPLLNQSISDLD

GuppyGR1 ----------E----GKMSRMHK-------------QEQDIFSYG-DSLPLLNQSTSDLD

MollyGR1 ----------E----GKISRMHK-------------QEQDIFSYG-DSLPLLNQSTSDVD

PlatyGR1 ----------E----GKMSRMHK-------------QEQDIFSYG-DSLSLLNQSTSDLD

PundGR1 HVLGEGADMKE----GKMIRMQKQ----QQQ--QQQQDIGIFGMG-DSLPLFNQCISD--

TilGR1 HVLGEGTDMKE----SKMIRMQKQ----QQ---QQQQDIGIFGMG-DSLPLFNQCISD--

NeolGR1 HVLGEGTDMKE----GKMIRMQKQ----QQ---QQQQDIGIFGMG-DSLPLFNQCISD--

BurtonGR1 HVLGEGTDMKE----GKMIRMQKQ----QQQ--QQQQDIGIFGMG-DSLPLFNQCISD--

MZebraGR1 HVLGEGTDMKE----GKMIRMQKQ----QQQ--QQQQDIGIFGMG-DSLPLFNQCISD--

StickleGR1 RVLFEGSDPEE----GKVVSMQK-----------QHQGIVRFNAD-GTGPPLKRGISDLE

CroakerGR1 E--------------GIMVRVLKP------PQQQHNPDIDLINME-DDLLLKQRA----D

RdrumGR1 E--------------GIMIRVQKP----P-PQQQHNPDIDLFNME-DNLSLA-VS----D

PerchGR1 HVLCEGSDVEE----GKIIKMQK-----------QHQDIGVFNME-DNLPLLKQSISDLN

SbassGR1 H--V-MSDMKE----GEIIRMQKQ----QQQQQQQHQDMDIFNME-DSLPLLKQSISDLN

JflouGR1 Q--CEGSEMKE----GKIIRLQKR---------KHHLDIGMFNME-DNLSLLNQNISDLN

EflouGR1 Q--CEGSDMKE----AKILRLQKR---------QHRPDIAMFNME-DNMPLLNQSISDLE

ButterGR1 KVNGS------------NMRAAQ----------ETSLS-----QG-GCSPFLDFGVADLN

FuguGR2 KGPTK------------DQKLQEQ-QLCFL---HTSTSLGGQILR-ESLPQLEANTIDGT

TdonGR2 KGLTK------------DQKLQEQ-QLCLL---HTTASLGGQILR-DSL-QLEASTIDGT

CodGR2 RGASK------------DQRAQQ--QLFQP---QTTASLGRYTFG-DNLSRLEASIADLT

TsoleGR2 -----------------DPRIQR-QQSRPI---QTSTTFGLQTLS-HTLPQFEGSIVDIT

AlimGR2 RGLTK------------DQRPQQP-QQFQM---HTSNVFGHQ-----SLPQLEASIVDIT

MummGR2 RGLTK------------DQRPEEL-QLYQT---QTSNTFGHQ-----VLPQLDASMADIT

PlatyGR2 RGLTK------------DQRPEEL-QLFQT---QTFNTFGHQ-----VLPQLDASMADIT

MollyGR2 RGLTK------------DQRPEEL-HLFQT---QTFNTFGHQ-----VLPQLDASMADIT

GuppyGR2 RGLTK------------DQRPEEL-QLFQT---QTFNTFGHQ-----VLPQLDASMADIT

MedakaGR2 KDTTK------------AQRPQ---QAFQT---QTSNRFGQQ-----HLPQLETSIADST

OdancGR2 KDTTK------------DQRPQ---QAFPT---QTSNTFGQQ-----HLPQLETSIADST

SbassGR2 RGLTR------------DQKLQQ--QLLQT---QTSTTFGRQTLR-ENLPHLEASIADIT

NeolGR2 RGLTK------------DQRPQHQ-QLLQT---Q--TTFGHQTLS-ENLSQLDASMADIT

BurtonGR2 RGLTK------------DQRPQHQ-QLLQT---Q--TTFGHQTLS-ENLSQLDASMADIT

MZebraGR2 RGLTK------------DQRPQHQ-QLLQT---Q--TTFGHQTLS-ENLSQLDASMADIT

PundGR2 RGLTK------------DQRPQHQ-QLLQT---Q--TTFGHQTLS-ENLSQLDASMADIT

TilGR2 RGLTK------------DQRPQHQQQLLQT---Q--TTFGHQTLS-ENLSQLDASMADIT

TilMGR2 RGLTK------------DQR--HQQQLLQT---Q--TTFGHQTLS-ENLSQLDASMADIT

CroakerGR2 RSLTK------------DQKLQQ--QLLQT------HTFGHQTLR-GNLPQLEA------

StickleGR2 RCLSR------------DQKLHQQQQLLQT---QTSTSFGRQTLR-ENFPQLEASVADIS

CunnerGR2 RSLSK------------DQKPQQ-QQLFQA---PTSTLFGRQ-----TLPQLEASITDLA

RCodGR2 RGLIK------------IQKLHQ-QHFLQT---QTSTTFGRQHFR-ESLPQLEASTADIN

PorgyGR2 RGLTK------------DQRVQQ--QFLQT---HTSSAFGRQILR-EHLPQLEASIADIN

BreamGR2 RGLTK------------DQRVQQ--QFLQT---HTSTTFGRQILR-EHLPQLEASIADIN

BicolorGR2 RGLTK------------DQRLQQ-QQLLQT---QTSTNFGRQNLA-ENLPQLEASITDIT

PerchGR2 RGLTK------------DQKLQQ-QQLLQT---QTSTTFGRQNLR-ENLPQLEASIADNT

ButterGR2 KGMAH------------EQKVQQS----------PQHLPGLYTVG-ESFSRLEASIADFN

PikeGR2 KVSTK------------DQRAQAQNLVFPPQQTNTSLGLGLFTLG-ETFSCLEASIADLN

RtroutGR2 ------------------------------------------------------------

AsalmGR2 ------------------------------------------------------------

HerrGR2 KVAGK------------DQRAQQG--------L-QHQPLGLYTTG-ETFSHLEASIADLN

CaveGR2 KTVGR------------DPRAQQA--------FQQQSSLGYCGVG-DSLSRLEASIADLS

Zebra KLLGK------------EQRA------------LQQQTLVPFTLG-DSLSGLEASIADLN

MinnGR2 KAVGK------------EQRA------------QQQQALCSFTLG-DSFSGLEASIADIN

CarpGR2 KMVGK------------EQRA------------HQHQTLGAFTLG-DSFSSLEASIADLN

Sterlet KVLGS------------NLGIQ------------QPQTPGSLTLGETNFTLLEESIANLN

Gar KVAGN------------DLKLQ------------QQQTPSSFMLGETNFSLLEESIANLN

Tgar KVAGN------------DLKLQ------------Q-QTPSSFILGETNFSLLEESIANLN

HerrGR1 KEIGK------------LLRIQSM--------QSHQDALGPMNIG-DSFSLLDETLADLN

AnchGR1 KEFDK------------PLRIQHM--------QSHPDTLGPMNVG-DSFSLLDETLADLT

JeelGR1 KALGVGGSPQLQKQQPPPQQQQQQ-----QQQQQQQHALGSFSLG-ENFSLGENFFPAGG

PikeGR1 KVGGK------------VLRESH---------TDKQNPQ--QQLF-ENFAMLEESIADLN

WhiteGR1 KVMEK------------ALRMQL---------PQKPQQN--QQLF-ENFALLEASIADLN

RtrouGR1 KVMEK------------AIRMQQ---------PQKPQQN--QQLF-ENFALLEASIADLN

AsalmGR1 KVMEK------------ALRMQQ---------PQKPQQN--QQLF-ENFALLEASIADLN

BtrouGR1 KVMEK------------ALRMQQ---------PQKPQQN--QQLF-ENFALLEASIADLN

CaveGR1 KLFAK------------PYRMQH---------QQRQKESLGLSVG-DNFALLDESIADLN

CarpGR1 KAF-K------------PFRMQH---------QQKVKEP--LNIG-ENFSLLDESIADLN

Myxine --------------------------------------------------MELNDAGGSR

FuguGR1 --IPDS----------IITTSDTSILGNLPLPDLFP-QHIKQQETFSL-DKDLETYNTNT

TdonGR1 --DSTS----------IITTSDTSVLGNFPLPDLFP-QHIKQEETFSL-EKDLKTYGLNA

CodGR1 RMSASH----------VISTSSSSILGNLPLPNLFSMQHVKQEVDFGL-EKDLATYCGPL

SeaHGR1 NVSS-S----------VIST---SVLGNLPLPDLFP-QHIKQEVDFSL-DKELGSYGGLP

AlimGR1 QTST-S----------IITTSESSVLGNLPLPDLFP-QQIKQERVFSM-DKDLGNYCGQT

MedakaGR1 QAPT-C----------VISASDRSVLGNLPLPDLFS-QHIKQEGMFYM-DKDFGAYSG--

OdancGR1 QAPP-C----------VISASDRSVLGGLPLPDLFS-QHIKQEGMFYM-DKDLGAYSGQT

BicolorGR1 RTST-S----------VISTSDTSV---LPMPDLFS-QHIKQEGIFSL-DKEMGTYSGHT

TSoleGR1 QTST-C----------VINTSVSSVHGSLPISDLFP-QQIKQEEPFSL-ERDLGNCSGLT

MummGR1 QTST-S----------VINTSEASILGNLPLPDLFS-QQIKQEGIFSL-DKELGNFGGQT

GuppyGR1 QTST-S----------VINTSETSVLGNLPLPDLFP-QQIKQEGIFSL-DKELGNYGGQA

MollyGR1 QTST-S----------VINTSETSVLGNLPLPDLFP-QQIKQEGIFSL-DKELGNYGGQA

PlatyGR1 QTST-S----------VINTSETSVLGNLPLPDLFP-QQIKQEGIFSL-DKELGTYGGQA

PundGR1 -TPT-S----------VINTSDTSVLGNLPLPDLFS-HPIKTESILSL-DKDLGTYSGHT

TilGR1 -TPT-S----------VINTSDTSVLGNLPLPDLFS-HPIKTESILSL-DKDLGTYSGHT

NeolGR1 -TPT-S----------VINTSDTSVLGNLPLPDLFS-HPIKTESILSL-DKDLGTYSGHT

BurtonGR1 -TPT-S----------VINTSDTSVLGNLPLPDLFS-HPIKTESILSL-DKDLGTYSGHT

MZebraGR1 -TPT-S----------VINTSDTSVLGNLPLPDLFS-HPIKTESILSL-DKDLGTYSGHT

StickleGR1 QTAA-S----------VISASVSSILGNLPLPDLFP-QHIKQEANFSP-DEDLETYCGHT

CroakerGR1 LSST-S----------VISTSDVSVFGNLPLPDLFP-QHIKQEGTYSL-DKHLETYSEHT

RdrumGR1 LSST-S----------VISTSNTSVLGNLPLPDLFP-QHIKQEGTYSL-DKDLETYSGHA

PerchGR1 QMST-S----------VISTSVSSILGNLPLPNLFS-QHIKQEGDFSL-DKDLETYSGHT

SbassGR1 QKST-S----------VISTSDTSVLGNLPLPDLFP-QHIKQEGNFSL-DKDMETYSGHI

JflouGR1 RTST-S----------VISTSDTSVLGKLPLPNLFP-QHIKQEGGFSL-EKELGTYGGHT

EflouGR1 RTSS-S----------VISLSHTSVLGNLPLPNLFP-QHIKQEGGFSL-EKDLGTYGGHT

ButterGR1 ----------------CSTASVDSLI--GSYPNALPV---KVE-DYSFVDQ--NKLSSEQ

FuguGR2 ----------------Q-S-SMDSLI-GGSDPNFFPM---KTD-DFSMDNGDQDPIEIDP

TdonGR2 ----------------Q-S-SMDTLI-GGSDPNFFPM---KTD-DFSMDKRDQDPIDIDP

CodGR2 ----------------HSS-SMDSLI-GGSDPNLFPL---RTD-DFSMDKVDHHSMDLDH

TsoleGR2 ----------------Q-S-SMDSLI-GGSDPNFFPM---RTE-DFSMDKGDQDMID---

AlimGR2 ----------------Q-S-SMDSLI-GGSDPNLFAM---KTE-DFSLDKGEQDSTDFDN

MummGR2 ----------------Q-S-SMDSLI-GGSDPNLFAV---KTE-DFSMDKGEQDPNDLDH

PlatyGR2 ----------------Q-S-SMDSLI-GGSDPNLFAV---KTE-DFSMDKSEQDPNDLDH

MollyGR2 ----------------Q-S-SMDSLI-GGSDPNLFAV---KTE-DFSMDKGEQDPNDLDH

GuppyGR2 ----------------Q-S-SMDSLI-GGSDPNLFAV---KTE-DFSMDKGEQDPNBLDH

MedakaGR2 ----------------E-S-PMDSLI-GGSDPNFFAM---KTE-DFSMDKVEQDPIDLDN

OdancGR2 ----------------E-S-PMDSLI-GGSDPNFFAM---KTE-DFSMDKVEQDPIDLDN

SbassGR2 --------------------SMDSLI-GGSDPNFFPM---KTE-DFSMDEGDQEPIDLDH

NeolGR2 ----------------Q-S-SMDSLI-GGSDPNFFPL---KTE-DFSLDKGEQDPIDLDN

BurtonGR2 ----------------Q-S-SMDSLI-GGSDPNFFPL---KTE-DFSLDKGEQDPIDLDN

MZebraGR2 ----------------Q-S-SMDSLI-GGSDPNFFPL---KTE-DFSLDKGEQDPIDLDN

PundGR2 ----------------Q-S-SMDSLI-GGSDPNFFPL---KTE-DFSLDKGEQDPIDLDN

TilGR2 ----------------Q-S-SMDSLI-GGSDPNFFHL---KTE-DFSLDKGEQDPIDLDN

TilMGR2 ----------------Q-S-SMDSLI-GGSDPNFFHL---KTE-DFSLDKGEQDPIDLDN

CroakerGR2 ---------------------MDSLI-GGSDPNFFPM---KTE-DFSMDKGDQEPIDLDH

StickleGR2 ----------------Q-S-CMDSLI-GGSDPNFFHT---KTE-DFSMDLGEQDPIDLDN

CunnerGR2 ----------------Q-S-SMDSLI-GGSDPNFFSI---KTG-DFSMDKGDQDPIDLDT

RCodGR2 ----------------Q-S-CMDSLI-GGSDPNFFHT---KTE-DFSMDRGDQDPIDLDH

PorgyGR2 ----------------Q-S-SMDSLI-GGSDPNFFPM---KTE-DFSMDKGDQDPIDLDH

BreamGR2 ----------------Q-S-SMDSLI-GGSDPNFFPM---KTE-DFSMDKGDQDPIDLDH

BicolorGR2 ----------------Q-S-SMDSLI-GGSDPNFFPM---KTE-DFSMDKGEQDPIDLDH

PerchGR2 ----------------Q-S-CMDSLI-GGSDPNFFHM---KTE-DFSMDKGDQDPTDLDH

ButterGR2 ----------------RS--NIDSLI-GGTDPDLFPL---KSE-DLSPMGK--DDIDLDQ

PikeGR2 ----------------RSSPSMDSLI-GGSDPNLFPM---STR-TETDFNR--DQDPMDL

RtroutGR2 ---------------------MDSLI-GDSDPNLFPM---SMR-TETAFSR--DQNPMDM

AsalmGR2 ---------------------MDSLI-GDSDPNLFPM---SMR-TETAFSR--DQDPMDM

HerrGR2 ----------------RSSASMDSLI-GGADPSLFHL---KTE-DFSPMDK--GDMDMDQ

CaveGR2 ----------------SSSPSVDSLI-GGVDPSLFTL---KHE-DFSPMGK--GDIDVEP

Zebra ----------------NPSPSMDSLI-GGVDPNLFPL---KTE-DFSPMIK--GDMDLDQ

MinnGR2 ----------------SSSPSIDSMI-GGVDPNLFPL---KTE-QFSPMDK--CDIDLDQ

CarpGR2 ----------------STSPSVDSLI-GGMDPNLFPL---KTE-EYSLMDK--GDMDLDQ

Sterlet ----------------RSSGGID--S-LSAGSDPFTL---KSE-DYLPMDK--SVLALDQ

Gar ----------------RSSTSAD--A-LPSGSDPFSL---KAE-DFTAMDK--SELDLEQ

Tgar ----------------RSSTAAD--A-LPSGSDPFSL---KAE-DFTAMDK--SELDLEQ

HerrGR1 ----------------SSST-SGT-S-NTRELDPFHI---KTE-DLSPAID--KDR----

AnchGR1 ----------------SSSTSTGT-S-AVRELDPFTI---KTE-DFSVAID--KDR----

JeelGR1 QHREPEPLFHHRGPTDRPRGGLGR-G-RGRRFGAFPA---EDG-GFSPAGK--DRLDMEP

PikeGR1 ----------------RSNTLGSS-V-LGH-HDLFSF---KNE-DLSSMDK--DMLDTGR

WhiteGR1 ----------------RSNTPGSS-V-LGRPHDLFSL---KAE-NFSPMDK--DRLDMGS

RtrouGR1 ----------------RSNTPGSS-V-LGRPHDLFSL---KTE-NFSPMDK--DRLDMGS

AsalmGR1 ----------------RSNTPGSS-V-LERPHDLFSL---KTE-------K--DRLDMGS

BtrouGR1 ----------------RSNTPGSS-V-LERPHDLFSL---KTE-------K--DRLDMGS

CaveGR1 ----------------RTSTSVNS-S--GQAPETFAF---KME-EFSPLDK--ISYDFG-

CarpGR1 ----------------RGS------S--IQAPDTFTM---KME-QFSPMEK--DRLDFP-

Myxine E---------------QW-----DSDLQH-DEVTSAVGEQGNESVPEQLFRAVAESMGVY

FuguGR1 V---VGQSVLESNSNLLL-E---DAVIWKDLELSCSL--------P--------EISDFE

TdonGR1 A---VGPGDLDSTSNQLLDD---DTAIWKDLDLPCSL--------P--------EISDFE

CodGR1 GQMGLGSQLDSGDGSPLI-E---DSQIWNDLELTSSL--------P--------DISDFE

SeaHGR1 S---ATSCDLTGG-TRLI-E---DSELWKDLDLPGSL--------P--------EISDFE

AlimGR1 G---AGSSNLDGS-SQLI-D---DSEIWQDLDLSSSL--------P--------EISDFE

MedakaGR1 ------QCDLDSNSTPLI-D---DAEIWRDLDLTSSL--------D--------EINALE

OdancGR1 G---SGLCDLDSNSTPLI-D---DAEIWRDLDLTSSL--------E--------EISALE

BicolorGR1 G---TGQCDLDGNSNRLI-E---DTEIWQTLDLPSSL--------P--------VISAFE

TSoleGR1 A---SGPCLLD-NSTRLI-E---ETDIWQALDLPSSL--------P--------EISGLE

MummGR1 G---AGACNLDSRSASLI-D---DADIWQDLDLPNSL--------P--------EISAFE

GuppyGR1 G---VGSCSLDGSTAQLI-D---DADIWQDLDLPNSL--------P--------EISAFE

MollyGR1 G---VGSCSLDGSTAQLI-D---DADIWQDLDLPNSL--------P--------EISAFE

PlatyGR1 G---VGSCSLDGSTSQLI-D---DADIWQDLDLPNSL--------P--------EISAFE

PundGR1 G---TGPCDLDGNSGRLI-E---DTEIWQDLDLPSSL--------P--------EISAFE

TilGR1 G---TGLCDLDGNSGRLI-E---DTEIWQDLDLPSSL--------P--------EISAFE

NeolGR1 G---TGPCDLDGNSGRLI-E---DTEIWQDLDLPSSL--------P--------EISAFE

BurtonGR1 G---TGPCDLDGNSGRLI-E---DTEIWQDLDLPSSL--------P--------EISAFE

MZebraGR1 G---TGPCDLDGNSGRLI-E---DTEIWQDLDLPSSL--------P--------EISAFE

StickleGR1 G---PGSGDLDGNGSRQI-E---DLEIWQDLDLPNTL--------P--------EISDFD

CroakerGR1 G---TGPNDLDAKSARLM-E---DTEIWQDLDLPSSL--------P--------EISDFE

RdrumGR1 G---TGPNDLDAKSARLM-D---DTEIWQDLDLPSSL--------P--------EISDFE

PerchGR1 V---TVPCDLDGNSSGLI-E---DSEIWQDLDLSNSL--------P--------EISDFE

SbassGR1 G---AGPCDMDGNSGRLI-E---DTEIWQDLDLPSSL--------P--------EISDFE

JflouGR1 G---GGPCDLDGNSGHLI-E---DTEIWQDLDLPNSL--------P--------EISDFE

EflouGR1 G---GGPCDLDGNNGRLL-E---DTEIWQDLDLPNSL--------P--------EISDFE

ButterGR1 --DSFLGKDFEVN-QRLFGD--NTMDILHGLETSGDL-------------------EEIY

FuguGR2 -SFEPIRKDGDVH-QKLFSD--NTLDLLQDFELIGSP-------------------SDFY

TdonGR2 -SFEAIEKDGDVH-QKLFGD--NTLDLLQDFELIGSP-------------------SDFY

CodGR2 DSFGHVGKDEEMN-TKLFND--NTLDLLPDFELAGSP-------------------SDYY

TsoleGR2 --------PLEVS-QKLFSE--NALDLLQDFDLTGSP-------------------SDFY

AlimGR2 -AFDSIGKDVDMT-QKLFND--TSLDLLQEFDLTGSP-------------------SDFY

MummGR2 -AFDHMGKDVDMN-QKLFNE--TSLDLLQEFDLTASP-------------------SDFY

PlatyGR2 -AFDHIGKDVDMN-QKLFNE--TSLDLLQEFDLTASP-------------------SDFY

MollyGR2 -AFDHIGKDVDMN-QKLFNE--TSLDLLQEFDLTASP-------------------SDFY

GuppyGR2 -AFDHIGKDVDMN-QKLFNE--TSLDLLQEFDLTASP-------------------SDFY

MedakaGR2 -AFDNIGKDVELN-QKLFND--TTLDLLQDFDLSGSP-------------------SDFY

OdancGR2 -AFDNIGKDVELN-QKLFND--TTLDLLQDFDLSASP-------------------SDFY

SbassGR2 -AFEHIGKDVDVH-QKLFSD--NALDLLQDFELTGSP-------------------SDFY

NeolGR2 -AFEPIGKDMDVN-QKLFSD--NTLDLLQDFDLAGSP-------------------SDFY

BurtonGR2 -AFEPIGKDMDVN-QKLFSD--NTLDLLQDFDLSGSP-------------------SDFY

MZebraGR2 -AFEPIGKDMDVN-QKLFSD--NTLDLLQDFDLSGSP-------------------SDFY

PundGR2 -AFEPIGKDMDVN-QKLFSD--NTLDLLQDFDLSGSP-------------------SDFY

TilGR2 -AFEPIGKDMDVN-QKLFSD--NTLDLLQDFDLTGSP-------------------SDFY

TilMGR2 -AFEPIGKDMDVN-QKLFSD--NTLDLLQDFDLTGSP-------------------SDFY

CroakerGR2 -AFEHIGKDVDVQ-QKLFSD--NALDLLQDFELIGSP-------------------SDFY

StickleGR2 -AFGHIGKDVDMS-QKFFTD--NTLELLQDFELTGSP-------------------SDFY

CunnerGR2 -AFEHIGKDVDVH-QKLFSD--NTLDLLHDFELTGSP-------------------SDFY

RCodGR2 -AFDHIGKDVDVT-QKFFTD--NTLDLLQDFELTGSP-------------------SDFY

PorgyGR2 -AFEHIGKDVDMH-QKLFSD--NALDLLQDFELTGSP-------------------SEFY

BreamGR2 -AFEHIGKDVDVH-QKLFSD--NALDLLQDFELTGSP-------------------SEFY

BicolorGR2 -PFG-IGKDVDVN-QKLFSD--NALDLLQDFDLTGSP-------------------SDFY

PerchGR2 -AFDHIGKDVDVN-QKFFSD--NTMDLLQDLELAGSP-------------------SDFY

ButterGR2 EPFGQVGKDS----DKIFSE--NTLDILQDFDLTGSP-------------------SEFY

PikeGR2 DQDGYIGKD-----QKLFND--NTMDLLQDFELTGSP-------------------SDFN

RtroutGR2 DQEGYIGKD-----QKLFSD--NTLDLLQDFELTGSP-------------------SDFY

AsalmGR2 DQEGYIGKD-----QKLFSD--NTLDLLQDFELTGSP-------------------SDFY

HerrGR2 DSFGPMGKDIDIGNHKLFND--NTLDLLQDFELTGSP-------------------SDFY

CaveGR2 DPFGPIGKDMDSSTPKLFSE--NTLDLLNDFEIETSP--------------------DFY

Zebra DSFGHIGKDVDVGNHKLFSD--NTLDLLQDFELDGSP-------------------SDFY

MinnGR2 DSFGPMGKDVDVGNHKLFSD--NTLDLLQDFELDGSP-------------------SDFY

CarpGR2 DSFGPIGKDGDVDNHKLFSD--NTLDLLQDFELDGSP-------------------SDFY

Sterlet DSFAQVGKDSSVS-PRFFNDDQNTLDLLQEYDLPVSPKGEMNGSPW--------NLNAFY

Gar DSFGQGEKDSDIN-PRLFGEDQNTLDILQELDLPGSPKGEMNGSPW--------NFTEFY

Tgar DSFGQGEKDSDIN-PRLFGEDQNTLDILQELDLPGSPKGEMNGSPW--------NFTEFY

HerrGR1 --Q----EGLVEK-DSDLGE--ATLDILRHLDLPGSL--------T--------ELSELY

AnchGR1 --HGGPQLGLVEK-DSDLGD--PTLDFLRDLDLPGSL--------T--------ELNDLY

JeelGR1 EPFGQAGKEQDLN-ARLFTE--NSLDILRDLELPGSL--------T--------DLNEFY

PikeGR1 VSFEQSQKDLDLS-DRLLGD--NTMDILQDLDLPGSL--------S--------DLNEFY

WhiteGR1 VSFGQSQKDLDVN-ERLLGD--NTLDILRDLDLPGSL--------S--------DLNEFY

RtrouGR1 VSFGQSQKDLDVN-ERLLGD--NTMDILQDLDLPGSL--------S--------DLNEFY

AsalmGR1 VSFGQSQKDLDVN-ERLLGD--NTMDILQDLDLPGSL--------S--------DLNEFY

BtrouGR1 VSFGQSQKDLDVN-DRLLGD--NTMDILQDLDLPGSL--------S--------DLNEFY

CaveGR1 -PYGQPGRDVDGN-EKLLDE--NTLDILHDLDLPSSP--------S--------ELNEFY

CarpGR1 -SYGHMDKELDSN-ERVIGD--NTIDILKDLDLPDSL--------S--------DLNELY

Myxine MSEDMLDLLEPLVPGDDAGNTVG-MTSLETDVSPPYP-------------------ELCQ

FuguGR1 LDTEVA-HLDNILHQCRSSR--APISPFPNDIRSALD-----------------RGNNCP

TdonGR1 LDTEVA-HLDNILHECRSGG--APVGAFPKDIKPGSD-----------------DGMNCL

CodGR1 LEGEVA-HLDNVLQEGSDVA-SWVL-----------------------------------

SeaHGR1 LDSEVA-HLDNILHDDGRL-----AGGLPKAMQVLTG-----------------NGGNCY

AlimGR1 LDSEVA-HLDNILQENSLGG--GSIIGLPKETKPLLG-----------------NGENCT

MedakaGR1 LDSEVA-QLDTFLQDSKCAS-VDSPSGLLKETKSLMG-----------------NGANFT

OdancGR1 LDSEVA-HLDNILQDSNGAG-VDSSSGLLKETKSLMG-----------------NGANFT

BicolorGR1 LDSEVA-NLDNLLHESSRGG------GLVKETKSLMG-----------------NGENCT

TSoleGR1 LDSEME-HLQNILHHGDVGG---PDSSLLKEPK--MG-----------------NRGNCT

MummGR1 LDSEVA-HLDTILQESGGGP--E---------KSLLG-----------------NGANCI

GuppyGR1 LDSEVA-HLDTILQESSSGG--E---------KSLLG-----------------NGANCI

MollyGR1 LDSEVA-HLDTILQESGSGG--E---------KSLLG-----------------NGANCI

PlatyGR1 LDSEVA-HLDTILQESSSGG--E---------KSLLG-----------------NGANCI

PundGR1 LDSEVA-HLDNILQESTGGG--CPVGGLPKEIKPLMG-----------------NGENCT

TilGR1 LDSEVA-HLDNILQESAGGG--CPVSGLPKEIKPLMG-----------------NGENCT

NeolGR1 LDSEVA-HLDNILQESTGGG--CPVSGLPKEIKPLMG-----------------NGENCT

BurtonGR1 LDSEVA-HLDNILQESTGGG--CPVGGLPKEIKPLMG-----------------NGENCT

MZebraGR1 LDSEVA-HLDNILQESTGGG--CPVGGLPKEIKPLMG-----------------NGENCT

StickleGR1 LDSEVA-HLDNILHDSRGGS----VSGLLNEPKPLTG-----------------KELNST

CroakerGR1 LDSEVA-HLGNILLDSRGGD--G----LLKETKSLVG-----------------NGINRT

RdrumGR1 LDSEVA-HLDNILHDSRGGD--S----LLRETKSLVG-----------------NGINRT

PerchGR1 LDSEVA-HLDNILKLQQGWW--WFGQWLAKGKQSLSW----------------VMGVNCT

SbassGR1 LDSKVA-HLNNILHDSMGGS--GPVSGLLKETKVPTW----------------VTGVNCT

JflouGR1 LDSEVA-HLDNILHDSSGGC--GPDGSLLKETKVLVG-----------------NGGNCT

EflouGR1 LDSEVA-HLDNILHDSSGSG--SPADGLLKETKALMG-----------------NGGNCT

ButterGR1 SGDEAA-FLSCLDVVDSLLGEV----SAQKGMNSNKSNNT--------------------

FuguGR2 VGD-DA-LLY-SLAEDSLLGDA----SSEKDLNG---------------ALS--------

TdonGR2 VGD-DA-LLY-SLADDSLLGDV----SSEKDLKPAVVDSV-----IGSGALS--------

CodGR2 VGD-DA-FLS-TLGDDSLLGDI----SSEKESKLTL--ST-----NGGEPSS-------T

TsoleGR2 VGD-DA-FLS-TLADDSLLGDV----GSDRDIKPAMLESN-----IGSSSVS-------V

AlimGR2 VGD-DA-FLT-TLADDSLL--GDMRGTLERDIKPALVESI-----NTTGALT-------A

MummGR2 VGD-DA-FLS-TLADDSLLADGEMRGMSERDLKTPTVESV-----NTSGALD-------G

PlatyGR2 VGDDDA-FLS-TLADDSLLADGEMRGTTERDVKPSVVESV-----GTT-----------R

MollyGR2 VGDDDA-FLS-TLADDSLLADG----ATERDVKPSVVESV-----GTTGALA-------S

GuppyGR2 VGDDDA-FLS-TLADDSLLADG----ATERDVKPSVVESV-----GTTR--A-------S

MedakaGR2 VGH-DA-FLS-PMENDPFLVDGDIRGTSERDVKPSVAESN-----AAIGAVS-------L

OdancGR2 VGH-DA-FLS-PMDNDPFLVDGDIRGTSERDIKPMVVESN-----AAIGAVS-------L

SbassGR2 VGD-DA-FLS-SLADDSLLGDV----SSERDIKPAVVESM-----NGCGAVS-------V

NeolGR2 VGD-DA-FLS-SLADDSLLG-V----TSDRDIKPAVVDSS-----NTTRAVP-------V

BurtonGR2 VGD-DA-FLS-SLADDSLLG-V----TSERDIKPAVVDSS-----NTTGAVP-------V

MZebraGR2 VGD-DA-FLS-SLADDSLLG-V----TSERDIKPAVVDSS-----NTTGAVP-------V

PundGR2 VGD-DA-FLS-SLADDSLLG-V----TSERDIKPAVVDSS-----NTTGAVP-------V

TilGR2 VGD-DA-FLS-TLADDSLLG-V----TSERDIKPAVVDSS-----NTTGAVP-------V

TilMGR2 VGD-DA-FLS-TLADDSLLG-V----TSERDIKPAVVDSS-----NTTGAVP-------V

CroakerGR2 VGD-DA-FLT-SLADDSLLEDV----SSEKDLKTAAADSI-----ISSGAIS-------V

StickleGR2 VGD-DA-FLS-TLADDSLLGDV----GSERDPKPVVVEGI-----NS----A-------V

CunnerGR2 VGD-DA-FLS-SLADDSLLGDV----SSERDMKAAAVESV-----NGSGQTS-------A

RCodGR2 VGD-DA-FLS-TLAADTLLGDV----SSERDIKPSLVESI-----NSSGAVS-------V

PorgyGR2 VGD-DA-FLS-SLADDSLLGDV----GSEGDTKSAVAESI-----NGSGAVF-------V

BreamGR2 VGD-DA-FLS-SLADDSLLGDV----GSERDTKSAVAESI-----NGSGAVF-------V

BicolorGR2 VGD-DA-FLS-TLTDDSLLGDV----SSERDMKPAVVESI-----NTTGGVT-------V

PerchGR2 VGD-DA-FLS-TLANDSLLGDV----GSERDIKPTMVERI-----NGSGTVS-------V

ButterGR2 VGDDAA-FLTSLTADDSLLGDI----VPTKETKPLSGASG---HSNGGNRTSLS------

PikeGR2 VGDDEF--LY-SLADGSLLGDD----SQDRGIPNPSSKQTTTTNIG-GGILSGSN---ST

RtroutGR2 VGDDAF--LS-SLADDTLLGDE----SQDRGVSNSTSKPAATM-TN-SGSFSGSN---TT

AsalmGR2 VGEDAF--LS-SLAEDSLLGDE----SQDRGVSNSTSKPAATM-TN-SGSFSGSN---TT

HerrGR2 VADDAF--LS-SLAEDSLLSDV----STDRETKLASSLGPGSGSGGGGGNTPASSTSGSL

CaveGR2 VVDEDF---P-PLGEDSLLGVI----GPERDLKPAASVSDINGTSNSSNNIS--------

Zebra VADDAF--LS-TIGEDALLSEL----PTNLDRDSKAAVSGSNTL----------------

MinnGR2 VADDAF--LS-TIGEDAMLGDL----STNAERDSKASISVNSTL----------------

CarpGR2 GADDPF--LS-TISEDALLGDL----PTITERDSKVAVNGATTT----------------

Sterlet GEDDDS-LLSPLVTEDPFLADI----TKD--TKPTIIN--------------NS-SLITN

Gar DGDEAA-LLTSLATDETFLMDV----NTSKDTKPVVNN---------------S-N--CT

Tgar DGDEAA-LLTSLATDETFLMDV----NTSKDTKPVVNS---------------S-N--CT

HerrGR1 VADEAA-FLSSLAVDDAMLGDS----LV-KEKKSGDGGVGGGCVGNGSGGVGCN-GGGCA

AnchGR1 VQDEAA-FLNTLAVDDALIGEG----LG-KESNPGAC---------GSVGDGCN-GGSCV

JeelGR1 VGDEAA-FLSSLSVDEALMGDV----GPLKETKPVVS------------GNGGI-AGLCG

PikeGR1 VADEVA-FLSSLSGDDALPGES----NV--ESKPVVS------------SNGGK----RA

WhiteGR1 VADEAA-FLSSLSVEDALLEDG----NM--ETKPIDR------------SNGGN----CT

RtrouGR1 VSDEAA-FLSSLSVEDVLLEDG----NM--ETKPIDC------------SNGGN----CT

AsalmGR1 VSDEAA-FLSSLSVEDVLLEDG----NM--ETKPIDC------------SNGGN----CT

BtrouGR1 VSDEAA-FLSSLSVEDVLLEDG----NM--ETKPIDC------------SNGGN----CT

CaveGR1 TQEETA-FLSSLAVEDALLGEA----VMLKDTKPVVT------------GNDGT----CK

CarpGR1 VADEAA-FLSSLAVDDALLGES----NFLKDTSPVVT------------GNSAA----CA

Myxine SISSSSPSQLINLK-----------E-ESADRGTITSCANSC--QGLAMPQSTR-AGVTS

FuguGR1 SLNGTDNSVQKL-----------------------------------SQQQQQQPGPLLS

TdonGR1 NLNGTKHPVQ------------------------------------------HLPGPLLS

CodGR1 --NGAGQNATSP----H--------------------------------PFPPPNAAPLP

SeaHGR1 A-NGTGQQHHNVLHP------------PHQQHHLLQHQVH---------PQHQQPASLLS

AlimGR1 SVNGMEQQRRHP------------MQQQQPPQHLVQHQQHALQ--------PQQSPTMIS

MedakaGR1 SVNGTEQQQHPQVH-------------QQPPLHLAQHQQPQTH--------HQQLQPILS

OdancGR1 SVSGTEQQQH--RH-------------QQPPLHLAQ------H--------HQQLQPILS

BicolorGR1 SVNGSEQQHHPI-------QH-HHPHQQQQHHHLVRHQQHQLHH------QHQQPSTLLS

TSoleGR1 SLNGADQQHPMH------------HTQHLQSGHLLQHQQH----------PHHQSSLLLS

MummGR1 ALNGTEQQQ-----------------QQQPPPHLVQHQQH----------QLQQPPAMLT

GuppyGR1 GLNGTEQQQ------------------------LVQQHQL----------QQQQPPGMLS

MollyGR1 GLNGTEQQQ------------------------LVQQHQL----------QQQQPPGMLS

PlatyGR1 GLNGTEQQQ------------------------LVQQHQL----------QQQQPPGMLS

PundGR1 SVNGTKQQHHAL--------HPHQQQ--QQHHQLIHHQQH--------QPQHHQPQALLS

TilGR1 SVNGTEQQHHAL--------HPHQQQQQQQHHQLIHHQQH--------QPQHHQPQALLS

NeolGR1 SVNGTEQQHHAL--------HPHQQQ-QQQHHQLIHHQQH--------QPQHHQPQALLS

BurtonGR1 SVNGTKQQHHAL--------HPHQQQ--QQHHQLIHHQQH--------QPQHHQPQALLS

MZebraGR1 SVNGTKQQHHAL--------HPHQQQ--QQHHQLIHHQQH--------QPQHHQPQALLS

StickleGR1 NGNGS--------------------------------------------DPHHHPASLLS

CroakerGR1 N----------VNGSEHPIQHHSHQQ-QQQHHHLLQHQQHQLHQQ-----QQQQPASLLS

RdrumGR1 N----------VNGTEHPIQHHSHQQ-QQQHHHLLQHQQHQLHHQQQQQQQQQQPASILS

PerchGR1 NVNGTGQHHPPITQQHR----------------LLQHQQHQLHH-------QQQPASLLS

SbassGR1 NGKDGGHGTTPISGIHHPIQHHSH---QQKPHHLLQHQHQQHQL------QHQQPGSLLS

JflouGR1 DVNG--------TDQQHPLQHHQH--QQQQHRHLLQHQQHQLHH------QHQQPPSLLS

EflouGR1 NVNG--------TDRQHQLQQQQHQQQQQQHRQLLQHQQHQLQH------QHQQPPSLLS

ButterGR1 -TNSF--------------------------------------------------SLQLP

FuguGR2 ALNGSNILS-----------------------------PDQS-SIS--TT-ASLMPSPAL

TdonGR2 ALNGND-TS-----------------------------PDQS-SIS--TTATSLSSSPSL

CodGR2 TLNGSGLAD-----------------------------L--S-SSSPATPASLTPTT--P

TsoleGR2 AISGSIMSS-----------------------------PVQS-STSLSTNTSPTTFPTIL

AlimGR2 TPDGSSVTS-----------------------------PRES-SSGLSTTSCSTPPTT-L

MummGR2 G----KATS-----------------------------PLGS-STGSSRSASLTPTAA-F

PlatyGR2 VCDSSKASS-----------------------------PLE----SKSKTPSLTPTTT-F

MollyGR2 VCNSSKASS-----------------------------PLE----SKSKSPSLTPTTT-F

GuppyGR2 ACNSSKASS-----------------------------PLE----SKSKSPSLTPTTT-F

MedakaGR2 ASNGASLTS-----------------------------PEQC-SPSLSTAASLASSNT-L

OdancGR2 SSNGASLTS-----------------------------PEQC-SPGLSTAASLASSNT-L

SbassGR2 SLNGNNMTS-----------------------------PDQS-CSSISTTASLTPTTT-L

NeolGR2 ALNGSSVTS-----------------------------PDLS-SPTISTTTSLSPTTT-L

BurtonGR2 ALNGSSVTS-----------------------------PDLS-SPTISTTTSLSPTTT-L

MZebraGR2 ALNGNSVTS-----------------------------PDLS-SPTISTTTSLSPTTT-L

PundGR2 ALNGSSVTS-----------------------------PDLS-SPTISTTTSLSPTTT-L

TilGR2 ALNGSSVTN-----------------------------PAQS-SPTISTTTSLSPETT-L

TilMGR2 ALNGSSVTN-----------------------------PAQS-SPTISTTTSLSPATT-L

CroakerGR2 AVNGSTMTS-----------------------------PDLS-CSSISTTASLTPTTT-L

StickleGR2 SLNGSSVSS-----------------------------PEQS-GASRCTSASLIPTTTAP

CunnerGR2 ALNGINMTS-----------------------------PDQP-S-SISTTASLTPTTT-L

RCodGR2 SLNGSSMTS-----------------------------PGQS-SPSISTTSSLTPTAT-L

PorgyGR2 ALNGSNMTS-----------------------------PDQS-CPSISPSASLTRTTT-L

BreamGR2 ALNGSNMTS-----------------------------PDQS-CPSISPSASLTPTTT-L

BicolorGR2 ALNGSNMTS-----------------------------PDQS-SSSISTTASLTSTTT-L

PerchGR2 ALNGSYMAS-----------------------------PDQS-NAGISTTGSSTPTTT-L

ButterGR2 ------------------------------------------------SPEQQVLEPSAT

PikeGR2 TLNGSLLTR-----------------------------QDES-SSGTPATGNNPATPSAT

RtroutGR2 TLNGSSLLA----------------------------CQDES-NSS------TSMTTTAT

AsalmGR2 TLNGSSLLA----------------------------CQDES-NSS------TSTTTTAT

HerrGR2 VVNGARPEPLFTSPP------------------SSSPAGASC-SSSSSGIGSASSTPAIS

CaveGR2 -S-----------NN------------------VGSKSATSC--------ASTGLTTASA

Zebra -------------------------------------NGTAS--------SSLSTANTSI

MinnGR2 -------------------------------------NGMST--------SS---TTTTS

CarpGR2 -------------------------------------PSTSG--------IN---TVTVS

Sterlet NKNGGDQQLLN-----------------------------------------------PP

Gar GVNGTDQQMLDQS---------------------------------------------TP

Tgar GVNGTDQQMLDQS---------------------------------------------TP

HerrGR1 GVNGADTRPQHRPPG--------------------Q-QP--------Q---PLMQSPSMN

AnchGR1 GMNGSETQSRHQPPL--------------------PPQP--------QPLQNMAQPASMS

JeelGR1 GVNGSEQQQQQQ------------------------------------QAAQEAAAAAGL

PikeGR1 NVKFVEQ--QE-----------------------------------------------LL

WhiteGR1 NVDSADQ--QQQ------------------------------------LL-----EPGIS

RtrouGR1 NVDSADQ--QKQ------------------------------------LL-----EAGVS

AsalmGR1 NVDSADQ--QKQ------------------------------------LL-----EPGIS

BtrouGR1 DVDSADQ--QKQ------------------------------------LL-----EPGIS

CaveGR1 NVNGNGKQHPQQ------------------------------------ML-----EPGVN

CarpGR1 NVNGMGKRQ--Q------------------------------------MV-----EASVN

Myxine MPRQECAKE--QPECELRILTPAAIKMERND----PGYGHH-------------------

FuguGR1 SVTIKEEKD--PVPSFIHIRTPEVVKQEKGD---GDTFCDAACLQSAVSSRYE---GRTM

TdonGR1 SIMIKEEKD--PDLSFVHIQTPGVVKQEKGS---GDPFCQTLCLQSGISSGHG---GGAM

CodGR1 SMVIKEEKDVGEEDSFVRLCTPGVVKQEKVD---AGERCQVSCLQSRLGPLHR---GGPT

SeaHGR1 SVIIKE-ED--RDNPFAHIRTPSMVKQEKQE----PVFCQAQCLQGGMGSVHL---GA--

AlimGR1 GVVIKEEKD--PD--FIHLSTPGVVKLERQD---SAGYCQSQCLQGGMGSLHG---GG-A

MedakaGR1 SVVIKEEKD--PD--FIHIRTPGVVKQEKQD-----SYCQSQCLQSGMSSLHG---GEGG

OdancGR1 SVVIKEEKD--PD--FIHIRTPGVVKQEKQD-----SYCQSQCLQSGMSSLHG---GAGG

BicolorGR1 SVIIKE-ED--PDDSFIHIRTPGVVKQEELD---SAGCCQSQCLQNSMSSLHG---GGGG

TSoleGR1 TVMVKEEEK--DQDDFIQIQTPGVVKLEKKG---SSGLCQSQCLLSSMNPLQT---GG-P

MummGR1 NVVIKEEKD--PD--FIHIRTPGVVKQEKQD---GSSYCQSQCLQSGMSPLQG---VG-T

GuppyGR1 SVVIKEEKD--PD--FIHIRTPGVVKQEKQD---GASYCQSQCLQSGMSPLHG---VG-T

MollyGR1 SVVIKEEKD--PD--FIHIRTPGVVKQEKQD---SVSYCQSQCLQSGMSPLHG---VG-T

PlatyGR1 SVVIKVEKD--PD--FIHIRTPGVVKQEKQD---GASYCQSQCLQSGMNPLHG---VG-T

PundGR1 TIIIKEEKD--PDESFIQICTPGVIKQEKQD----NGFCQPQCLQSGISSLHG---GG-P

TilGR1 TVIIKEEKD--PDESFIQICTPGVIKQEKQD----SAFCQPQCLQSSISSLQG---GG-P

NeolGR1 TVIIKEEKD--PDESFLQICTPGVIKQEKQD----NGFCQPQCLQSGISSLHG---GG-P

BurtonGR1 TIIIKEEKD--PDESFIQICTPGVIKQEKQD----NGFCQPQCLQSGISSLHG---GG-P

MZebraGR1 TIIIKEEKD--PDESFIQICTPGVIKQEKQD----NGFCQPQCLQSGISSLHG---GG-P

StickleGR1 SVMIKEEKD--PDDSFIHIRTPGVVKQEKQD---SAGFCQAQCLQSSMSSHHG---GG-P

CroakerGR1 SVMIKEEKD--PGDPLIHIRTPGVVKQEKQD---TPGFCQAQCLQSGMSSLHG---GG-P

RdrumGR1 TVMIKEEKD--PDDPLIHIRTPGVVKQEKQD---TPGFCQAQCLQSGMSSLHG---GG-P

PerchGR1 SVMIKEEKD--PGDSFTHIRTPGVVKLEKQD---SAGCCQSQCLQSSMSSLHG---GG-A

SbassGR1 SVMIKEEKD--PDDSFIHISTPGVVKQEKQE---GAGFCQAQCLQS---SLHG---GG-P

JflouGR1 SVMIKEEKD--HDNSFIHIRTPGVVKQEKQE---NGSFCQSQCLQSSMSSLHG---GG-P

EflouGR1 SVMIKEEKD--HDSSFIHIRTPGVVKQEKQE---NGSFCQAQCLQSTMGSLQG---GG-P

ButterGR1 DSSLFTEKD-----ECIHMSTLGVVKQENNN----QGYCHISSSQSF-------------

FuguGR2 SVVVKKEKD----ADFIQLHTPGVIKEEKTS--PGQNYCQMSSA-SS-P-------EM-L

TdonGR2 SVVVKKEKD----ADFLQLCTPGAIKEEKSS--PGQSYCQVQSATSA-P-------EM-L

CodGR2 LAAIKKESD----SAFIRLCTPGVVKQEKAT--CGRGFCPMSSASSSSS-------DMSC

TsoleGR2 SPFVKEEKD----PDIIQLCTPGVIKQEKTS--TGQSHCQISG-----------------

AlimGR2 PAVVKKEKD----TGFIQLCTPGVIKQEKTS--GG--YCQMGA-----------------

MummGR2 PAVVKKEKD----AGFIQLCTPGVIKQEKTS--AG--YCQMGG-----------------

PlatyGR2 PAVVKKEKD----TGFIQLCTPGVIKKEKTS--SG--YCQMSG-----------------

MollyGR2 PAVVKKEKD----TDFIQLCTPGVIKKEKTS--SG--YCQMSG-----------------

GuppyGR2 PAVVKKEKD----TGFIQLCTPGVIKKEKTS--SG--YCQMSG-----------------

MedakaGR2 PALVKKEKD----SDFIQLCTPGVIKQEKAS--AGHSYCQVSRTS-S---------DTPG

OdancGR2 PALVKKEKD----SDFIQLCTPGVIKQEKAS--AGHSYCQVSGTS-S---------DTPG

SbassGR2 SALVKKEKD----AGFIQLCTSGVIKQEKSS--AGQSYCQMSGTS-S-T-------DMPN

NeolGR2 SAMVKKEKD----ADFIQLCTPGVVKQEKTP--GGQSYCQISGTA-S-G-------DMAG

BurtonGR2 FAMVKKEKD----ADFIQLCTPGVVKQEKTS--GGQSYCQISGTA-S-R-------DMAG

MZebraGR2 SAMVKKEKD----ADFIQLCTPGVVKQEKTS--GGQSYCQISGTA-S-G-------DMAG

PundGR2 SAMVKKEKD----ADFIQLCTPGVVKQEKTS--GGQSYCQISGTA-S-G-------DMAG

TilGR2 SAMVKKEKD----ANFIQLCTPGVVKQEK-T--GGQSYCQISGTA-S-G-------DMAG

TilMGR2 SAMVKKEKD----ANFIQLCTPGVVKQEK-T--GGQSYCQISGAA-S-G-------DMAG

CroakerGR2 SVLVKKEKD----GGFIQLCTPGVIKQEKSS--ADQSYCQISGTS-S-T-------DMPS

StickleGR2 SALVKKEKD----VCFVQLCTQGVIKQEKTS--AGQSYCQLSGTS-A-T-------DMPG

CunnerGR2 SALVKKEKD----SGFIQLCTPGVIKQEKTS--AGQSYCQMSGTT-S-T-------DMPS

RCodGR2 SAKVKKEKD----AGFIQLCTQGGIKQEKTS--AGQSYCQISGAA-STA-------SMST

PorgyGR2 PALVKKEKD----ASFIQLCTQGVIKQEKMS--AGQSYCQMSGTS-S-T-------DMPS

BreamGR2 PALVKKEKD----ASFIQLCTQGVIKQEKTS--AGQSYCQMSGTS-S-T-------DMPS

BicolorGR2 SALVKKEKD----ASFIQLCTPGVIKQEKTS--AGHSYCQMSGSS-S-A-------DVPG

PerchGR2 SALVKKGKD----AGFIQLCTQGVIKQEKTS--AGQSYCQMSGMS-S-T-------DMPS

ButterGR2 SPVVKMEKE-----AYIQLCTPGVIKQENN----PMSYCSI------------------S

PikeGR2 FPIVKMEKD----TGFIQLCTPGVIKQEKNSTSH-SYSCHMTSGTGGSASSS----GLSS

RtroutGR2 FPMVKMEKE----SGFIQLCTPGVIKQENTSAMR-SSSCQMSGSTGGSTSSSPSELSSSS

AsalmGR2 FPMV---KE----AGFIQLCTPGVIKQEKTSAMP-SYSCQMSGSTGGSTSSSPSELSSAS

HerrGR2 PALVKVEKD-----SVLTLSTPGVIKQEKASGVAGRSYCQMGGTVG-----------LAT

CaveGR2 PLVVKVEKD-----PVLQLCTQGVIKQENT---GGRSFCQMAGNELSS---------PLT

Zebra LPNIKVEKD-----SIIQLCTPGVIKQENT----GASYCQGG----------------LH

MinnGR2 LANVKVEKD-----SIIQLCTPGVIKKENV---GGTNYCQMG----------------LH

CarpGR2 LPTVKVEKD-----SIIQLCTPGVIKQENN---GGTKYCQAS----------------LH

Sterlet VPTIKLEK-----ESFIELSTPGVVKQENAS----RSYCQMSGSSSD--------MSSPL

Gar LASVKMEK-----ESYIQLCTPGVIKQETAD----RKYCQMSGAVPD--------LPGPV

Tgar LASVKMEK-----ESYIQLCTPGVIKQETAD----RKYCQMSGAVPD--------LPGPV

HerrGR1 MPVIKTEKD----AGYIQLCTPGVIKMENEN----RSYCQMSGL--D--------MGSSH

AnchGR1 MPIIKTEKD----ASYIQLCTPGVIKMENES----RSYCQM-----D--------LGGSH

JeelGR1 LPVIKKEK-----DSFIQLCTPGVIKQEKES----RSYCQMGGA--D--------LSSPL

PikeGR1 EPVIKTEMD--TDSSFIQLCTPGVIKQESES----RRYCQMPNL--D--------MPGTH

WhiteGR1 MPVIKTEED--ADTSFIQLCTPGVIKQENDR----RSYCQLSSL--D--------MPGTH

RtrouGR1 MPVIKTEED--ADTSFIQLCTPGVIKQENDR----RSFCQISSL--D--------LPSTH

AsalmGR1 MPVIKTEED--ADTSFIQLCTPGVIKQENDR----RSYCQISSL--D--------LPSTH

BtrouGR1 MPVIKTEED--ADTSFIQLCTPGVIKQENDR----RSYCQISSL--D--------LPSTH

CaveGR1 MPVIKTEKD----TEFIQLCTPGVIKQENER----RSYCQMSGM--P----------AAH

CarpGR1 ---IKTEKD----ADFIQLCTPGVIKQETER----RSYCQMSGM--G----------GPH

Myxine --LHNSMGVSPHSA----------------------------------SPFNHTFIPT--

FuguGR1 --ASLPVGLGPSSDYNYTA---NLASVV-------------DL-Q-DQKP-FSLYPNL-P

TdonGR1 --ASLPMGVSPRPGYDYRA---NPASAV-------------GL-Q-DQKP-FCSYPTL-P

CodGR1 PAPPAPRGGARAPAFDYSEAGATSSSAG-------------VL-Q-DQKP-FDMYADL-P

SeaHGR1 -PMSSSMSVD-AAGYRCRT---NAPSTM-------------GQ-Q-PRKP-FAMHSNL-S

AlimGR1 GSMSSPMGVGAGPSYSYGA---SQPSTV-------------NL-P-DQKP-FGAFSTL-P

MedakaGR1 GSLSSPVCMGAGSGYPYRA---SPPSTV-------------TL-Q-DQKP-FGIYPN---

OdancGR1 GALSSSVCLGAGSGYPYRA---SPSSTV-------------TL-Q-DQKP-FGIYPNQ-P

BicolorGR1 GPMSSSMGIGAGPSCHYRA---NPPSTV-------------GL-Q-DQKP-FGMYSDL-S

TSoleGR1 --LTPTMSMGVGHGYQYKA---NQPSSL-------------DL----PDP-YGMYPNL-P

MummGR1 --MLSPLDVGAGTGYHYRA---NPG-TA-------------GL-Q-DQKP-FSTYTNL-P

GuppyGR1 --MPSAMNVATGSGYHYRG---NPG-TV-------------GL-Q-DQKP-FGTYSNL-S

MollyGR1 --IPSAMNVATGSGYHYRG---NPG-TA-------------GL-Q-DQKP-FGTYSNL-S

PlatyGR1 --IPSAMGLATGTGYHYRG---NPE-TA-------------GL-Q-DQKP-FGTYSNL-P

PundGR1 RPMSSAVSVSAVPGYHYTA---NLSSTM-------------DI-Q-DQKP-FDMYSNM-P

TilGR1 GPMSSPVGVGAVPGYHYRA---NPSSTM-------------GI-Q-DQKP-FDMYSNM-P

NeolGR1 RPMSSPVSVSAVPGYHYRA---NPSSTM-------------DI-Q-DQKP-FDMYSNM-P

BurtonGR1 RPMSSPVSVGAVPGYHYTA---NLSSTM-------------DI-Q-DQKP-FDMYSNM-P

MZebraGR1 RPMSSPVSVGAVPGYHYTA---NLSSTM-------------DI-Q-DQKP-FDMYSNM-P

StickleGR1 --MSSPLGLGVGSSYHYRA---SPSTAV-------------GP-A-DQEP-YALYPNL-P

CroakerGR1 --MPSPMGVRAGPGYHYRG---NQFSTV-------------GL-Q-DQKP-IGMYSNL-P

RdrumGR1 --MPSPMGVGAGSGYHYRA---NQFSTV-------------GL-Q-DQKP-FGMYSNL-P

PerchGR1 --MPSSMALSAGPSYHYRA---NPSSTV-------------SR-Q-DQEP-FGNYPNL-P

SbassGR1 --MSSPMGVGAGPGYHYRA---NPSPTV-------------GL-Q-DQKP-FGMYSNL-P

JflouGR1 --MSSTMGAGAVPGYHYKA---SPSSTV-------------GL-Q-DQKP-FGIFSNL-P

EflouGR1 --MSSATGVGTGPGYHYKA---SPSSAV-------------GL-Q-DQKP-FGMFANL-P

ButterGR1 LVPFAV-------GTNC--LEANSL-------------PKLENAQLDQKPVLTPYRQL-A

FuguGR2 SSIISVCGVSTSGGQSYH-FGVSPSSGEA-----------QQQRNQNQKPVSNQYLPV-T

TdonGR2 GSIVSICGVSTSGGQSYH-FGVGPSSGEA-----------RQQK--HPKPVSNQYLPV-T

CodGR2 ASPISICGVSTSGGQSYH-FGVNPSGTPT----STTSPGGGQQQKDQKPPVFSLYPPL-T

TsoleGR2 SNPVSICGVSTSGGPSYH-FGVSPSSSD------------AQQHKD-QKPVSKFILPV-T

AlimGR2 TSPISICGVSTSGGQSFH-FGINSRNNE------------TLEQKD-QKPVPGLFLPV-T

MummGR2 SSPISICGVSTSGGQSFH-FGVNARNSD------------ALQEKE-QKPVSGLFLPV-T

PlatyGR2 SSPISICGVSTSGGQSFH-FGINARNND------------ALQEKD-QKPVSGLFLPV-T

MollyGR2 SSPISICGVSTSGGQSFH-FGINARNSD------------ALQEKD-QKPVSGLFLPV-T

GuppyGR2 SSPISICGVSTSGGQSFH-FGINARNSD------------ALQEKD-QKPVSGLFLPV-T

MedakaGR2 TTPISICGVSTSGGQSYH-FGVNPRKTE------------AQ-QND-QKPVTGLYLPI-T

OdancGR2 TTPISICGVSTSGGQSYH-FGVNPRKNE------------AQ-QKD-QKPVTGLYLPI-T

SbassGR2 SNPISICGVSTSGGQGYR-FGVNPTSNE------------AQQHKD-QKLVSSIYLPV-T

NeolGR2 TNAISVCGVSTSGGQTYH-FGVNTLSSD------------TLLKNE-QKPVSSLFLPV-T

BurtonGR2 TNAISVCGVSTSGGQTYH-FGVNTLSSD------------TPLQNE-QKPVSSLFLPV-T

MZebraGR2 TNAISVCGVSTSGGQTYH-FGVNTLSSD------------TPLQNE-QKPVSSLFLPV-T

PundGR2 TNAISVCGVSTSGGQTYH-FGVNTLSSD------------TPLQNE-QKPVSSLFLPV-T

TilGR2 TNAVSVCGVSTSGGQTYH-FGVNPLSSD------------SQLQNE-QKPVSSLFLPV-T

TilMGR2 TNAVSVCGVSTSGGQTYH-FGVNPLSSD------------SQLQNE-QKPVSSLFLPV-T

CroakerGR2 SNSISICGVSTSGGQSYR-FGVNPSSNE------------AQQQKD-QKLVSSMYLPV-T

StickleGR2 SSPISICGVSTSGGQSYH-FNPGSISSE------------APQQTE-HTPLSSLYLPV-T

CunnerGR2 PNPISICGVSTSGGQSFH-FGVNTSSSE------------SQQQKS-QKQVSNLFLPV-T

RCodGR2 SNTISICGVSTSSGPSYH-FGTTSSSNG------------AHQQKD-QKPVSSLFLPV-T

PorgyGR2 SNSISICGVSTSGGQSYR-FGVNPSSNE------------TQQQKD-QKTVTSLFLPV-T

BreamGR2 SNSISICGVSTSGGQSYR-FGVNPSNNE------------TQQQKD-QKTVTSLFLPV-T

BicolorGR2 PNPISICGVSTSGGQSYH-FGVNARNNE------------AQQQKD-QKPVTSLYLPV-T

PerchGR2 SNPISICGVSTSGGQSYH-FGVNTSSSE------------AQQQKD-QKLVSSLYLPV-T

ButterGR2 GSPISICGVSTSGGPSYH-FGVSASTAVS-----------MQQQQLDQKPVFMY-----R

PikeGR2 NSPISICGVSTSGGQSYH-FGVTSSSNPPTVNVSASDAAGASQQKDRKPPVFSLYPSLGT

RtroutGR2 PSPISICGVSTSGGQSYH-FGGNSSINTT----LASTTSGASQQKDQKPSVFSLYPPLVT

AsalmGR2 PSPISIGGVSTSGGQSYH-FGGNSSINTP----LASTTSGASQQKDQKPSVFSLYPPLVT

HerrGR2 SASISICGVSTSSGQSFH-FGGTAATATA---------TPSSPQQK-EQKVFSLYPALGP

CaveGR2 APSISICGVSTSSGQSYR-FGSPAATSTI-----------SIQQKD-QKPVFNVYTPQ-P

Zebra STPINICGVTTSSGQSFL-FGNSSPTAVV------------GLQKD-QKPDFNMYTPL-T

MinnGR2 STPINICGVTTSSGQSFL-FGAGPSTAAL------------SQQKD-QKPIFNVYTPL-T

CarpGR2 STPINICGVTTSVGQSFL-IGTSPSTAAV------------SQQKD-QKPVFNVYTPV-T

Sterlet TVPISVCGVSTSGGQTYH-YGVSASQA------------VNLQQQ-DQKPVFNMYPPL-T

Gar SSPISICGVSTSSGQSYH-YGVNASPT------------LNLQQQ-DQKPVFNLYPSL-A

Tgar NSPISICGVSTSSGQSFH-YGVNASPT------------LNLQQQ-DQKPVFNLYPPL-A

HerrGR1 TAPAG--GLSTMPAQGYC-FGASVPPLSMH------NEHATGVPQ-DQKPVFGLYPPL-A

AnchGR1 SGSAR--GLSSMASQGYCGYGASVPPLSMQ------SEHATSIPQ-DQKPVLGLYPPV-S

JeelGR1 HSPISVCGVSTSGGQSYH-YGVSSP-------------PAVGL-P-DQKPVFGLYPPL-G

PikeGR1 SSLG------TLSGSSYH-YGASAS-------------SAVSLQQ-DQKPVFGLYPPL-S

WhiteGR1 NSVG------SMIGPNYH-YGANTS-------------AAVSLQQ-DQKPVFGLYPPQ-P

RtrouGR1 NSAG------SISGPSYP-YGANTS-------------TAVSLQQ-DQKPVFGLYPPL-P

AsalmGR1 NSVG------SMSGPSYP-YGANTS-------------TAVSLQQ-DQKPVFGLYPPL-P

BtrouGR1 NSVG------SMSGQSYP-YGANTS-------------TAVSLQQ-DQKPVFGLYPPL-P

CaveGR1 GGLLM-LGGVGMDRQSYH-YGGNTS-------------SAMDL-P-DQKPIVGLFPPL-P

CarpGR1 SGPTT-LGDMG--GQGYH-YGANTA-------------SAVSL-P-DQKPPFGLFSPL-P

Myxine SE----------GPPAATMS--AASFANGTSYPSYLTVFPYPG-----------------

FuguGR1 VSRERWSTGSRYGESAGTQRAD-DGVQSIAVLGSFPSSF-------SSSSPRTAD-TVGS

TdonGR1 VSGESWSAGGRYGDSAGLPRAD-DGLPSTTVLGTFPSSF-------SSVSPRTAD-SVSP

CodGR1 LMGAGWGRGNGYGEMSSVMGRC------SAAGLAFPLGF-------PSSSSRITE-----

SeaHGR1 SLGESWMRGDGYGESTTIQRTN-DGLPNTSMLMSYPLSF-------SSATPRAGADPNSS

AlimGR1 GVGESWLGGKRYGESSGIPSGS-DGLQSAAALANFPVSF-------SSTSTRTGE-PSST

MedakaGR1 LLGERWIEGKGYGESPGKPSSS-DGLASASGLPGFPASF-------SNSSSRTAE-SGGG

OdancGR1 LVGERWIEGKGYGESSGKPSSG-DGLASASGLPGFPASF-------SSSSSRAAE-SGSA

BicolorGR1 LVGESWIRGKRYGESSGIQSTD-DRLPSASALGSFSVSF-------S----RTGE-NSSS

TSoleGR1 QMEESWSRVNKFGEPSGLQRAN-DGLS-----SAFIVSF-------PSPSTRTGE-GSSS

MummGR1 GVGEGWIGGKRYGESSGIQGTS-DGHPSAAALGNFPVSF-------TSSSVRTGE-NNST

GuppyGR1 GVGESWISGKRYGEASGIQSTS-DGLQSVAALGNFPVGF-------TSSSARTGE-SSST

MollyGR1 GVGESWISGKRYGEASGIQSTS-DGLQSGAVLGNFPVGF-------TSSSARTGE-SSST

PlatyGR1 GVGESWISGKRYGEASGIQSTS-DGLQSAAALGNFPVSF-------TSSSARTGE-NSST

PundGR1 LMGDGWARGKRYGETSGIQSSD-DGPTPVASLAPFSVGF-------SGSSPREGE-LSSS

TilGR1 LMGDGWARGKRYGETSGIQSSD-DGLTPVASLAPFSVGF-------SSSSPREGE-ISSS

NeolGR1 LMGDDWARGKRYGETSGIQSSD-DGLTPVASLAPFSVGF-------SGSSPREGE-ISSS

BurtonGR1 LMGDGWARGKRYGETSGIQSSD-DGPTPVASLAPFSVGF-------SGSSPREGE-ISSS

MZebraGR1 LMGDGWARGKRYGETSGIQSSD-DGPSPVASLAPFSVGF-------SSSSPREGE-ISSS

StickleGR1 LAGESWARGSRFGETAGLQRGEDEGLPSAAALSTFSVGF-------SSSSPRAGE-TVGS

CroakerGR1 VVGENWARGNRYGEPSGIQRSD-DGLPTAAALASFSVSF-------AGSSPRAGD-TSSP

RdrumGR1 VVGENWARGNRYGESSGIQRSD-DGLPTAAALASFSVSF-------AGSSPRAGD-TSSP

PerchGR1 LVGENWARGNSFGELSGLQRGD-DGIPSAAAVANFSVSF-------SSLSTRAGE-TSSS

SbassGR1 LVGESWARGNRYGESSGIQRGD-DGLPSAAAVAAFSVSF-------SSSSPRAGE-TSSS

JflouGR1 AVAESWTRGGRFGEPSGIQRGN-DGLPSAA-MSPFSVSF-------SSSSPRTGE-NSSS

EflouGR1 PLGESWTRGGRFGEPSGIQRGN-DGLPSAA-MAAFSANF-------CSSSPRAGE-TSSS

ButterGR1 PITDAWRRKYK--DDPTIQTG-NDAISP--------ATFSYTN---GSSSTRA-DT-GSS

FuguGR2 TLSGAWSREAE---TFQLFGV-NGARTEA-GPYYFSPSF-------TSSTNRQ-EG-VTA

TdonGR2 NLSGAWSREGE---SSAVHKA-PEALARS-SPY--PICF-------TSSASRQ-EG-VIA

CodGR2 GVREPWSQDGVT---------------P---SP--------------------------S

TsoleGR2 TISGTWNRVQDVGNGSVLPRG-NESFSS---SPTFPTTF-------ASSTSRQ-EG-GSS

AlimGR2 TIGGAWNRSPSLGDASPIHRV-GELFTT---SPTYSNSF-----------TRQ-EG-GAA

MummGR2 TIGGAWNRSQ--ADSSAIRRA-SEVFSS---SPGFPSSF-----------GRQ-DG-ATP

PlatyGR2 TISGAWNRNQ--GDNSAIRRA-SEIFSS---SPSFSSSF-------ASSISRQ-EG-GTP

MollyGR2 TISGAWNQNQ--GDSSAIRRA-SEVFSS---SSSFSSSF-------ASSISRQ-EG-GTP

GuppyGR2 TISGAWHRNQ--GDSSAIRRA-SEVFST---SPSFSSSF-------ASSISRQ-EG-GTP

MedakaGR2 TIGGAWIRNQGAGNN-SIHRA-SEAFSS---SPN-SASF-------ASSTSRS-EG-GTP

OdancGR2 TIGGAWIRNQGVGNNSTIHRA-SEAFSS---SPN-STSF-------ASSTSRS-EG-GTP

SbassGR2 TISGPWNRSQGVGDNSAMHGA-SEAFSS-----SYPISF-------ASSTSRQ-EG-VIA

NeolGR2 TIGGVWNRGQGIGNNSLVQRA-GEGFSS---SPSYPTSF-------T----RQ-EG-STA

BurtonGR2 TIGGIWNRGQGIGNNSLVQRA-GEGFSS---SPSYPTSF-------T----RQ-EG-STA

MZebraGR2 TIGGIWNRGQGIGNNSLVQRA-GEGFSS---SPSYPTSF-------T----RQ-EG-STA

PundGR2 TIGGIWNRGQGIGNNSLVQRA-GEGFSS---SPSYPTSF-------T----RQ-EG-STA

TilGR2 TIGGVWNRGQGVGNNSLVQRA-GEGFSG---SPSYPTSF-------TSSISRQ-EG-STA

TilMGR2 TIGGVWNRGQGVGNNSLVQRA-GEGFSG---SPSYPTSF-------T----RQ-EG-STA

CroakerGR2 TIGGPWNRGQGVGDNSAMHRA-SEAFSS---P-SYP-SF-------ASPTSRQ-EA-ITA

StickleGR2 TIGRAWNRNQGVGNNSAMLRA-NEAFSC---SQSYPT-----------SCARQ-EV-VTA

CunnerGR2 TISAPWNRGQTVVDNR----S-TEAFSS---SP-FT-----------IGFVKQ-EA-GTA

RCodGR2 TIGGAWSRIQNIGDNSAMLRA-SEAFSS---SSSYPISF-------SSSTSRQ-EI-VPA

PorgyGR2 TIAGPWNRSQGIGDNAVLNRA-SEAFSS---SPSFT------------SFSRQ-EA-VTA

BreamGR2 TIAGPWNRSQGIGDNAVLNRA-SEAFSS---TPPFSTSF-------SSSISRQ-EA-VTA

BicolorGR2 TISGVWNRGQGIGDNSAIHRA-SEAFSS---SPSFPSSF-------ASSTSRQ-EG-GT-

PerchGR2 TIGGAWNRIQSVGDNSAMLRA-SEAFSS---SPSYPTCF-------ASPNSRQ-EV-VPA

ButterGR2 PGGDGWGSGQAYGETSEMQRG-SENFSS---SPAFPSTYISP----VSSSNTS-VS-APS

PikeGR2 -AGEAWNSRSYGDG-----GLSSLPSNF---SSSYASSNPR-----------Q-DG-GAL

RtroutGR2 -VGEAWNNISYGDGASGMQGLSSPTSAF---SSSYASSTSK-----------L-GG-GA-

AsalmGR2 -VGEAWNNISYGDGASGMQGLSSPTS-F---SSSFASSTSR-----------Q-GG-GA-

HerrGR2 AGGEGWNRARPGFGEAGQQQRAGDGLGG---SQGFPSNNYA----------RS-DS---T

CaveGR2 LVGDGWGRSLGIQQRPGDGFASNQSF-----TTSYASG--------------T-NR-PEA

Zebra SSGDGWSRSQGFGNVSGMQQRASLCF-----SKNFSSSPYS----------RP-ED-STA

MinnGR2 SSEDSWSRGKGFGNASGMQQRASECF-----SKNYT-SPYA----------RP-ED-STA

CarpGR2 SSEDGWGRGYGFGNASEMQQRASESF-----SKNYT-SPYA----------RP-ED-STA

Sterlet TVVDGWNRSQGFGEATVSQMG-NETFSI---QGLPNPN-------YLSPTSRQ-DS--GS

Gar AVGDSWNRGQTFGDAAGMQRG-SETFAG---APGFSAN-------YAGSTSRA-DP--ST

Tgar AVGDSWNRGQTFGDAAGMQRG-SETFAG---APGFSAN-------YAGSTARA-DP--ST

HerrGR1 SLNDIWSRGNGFGEPSGMQRS-SDGGPT---TPTYPVT-------FNSPGSRA-EA-NGS

AnchGR1 SLGDSRSRGSGFGELPGIQRS-SDVLPT---TPSYLMN-------YNGSANRP-EA-SGS

JeelGR1 --ADGWGRPKGYGDPADMGRG-GELVSI---SQA------FPGGYISH-APRA-EATATA

PikeGR1 SVSDGWNPGTGHRDGSGVSSP-SASSFP---V--G----------FSSSTARP-EG-STS

WhiteGR1 SVSDSWNRGNGYGDGSGMSS----SSFP---V--S----------FSSPTARP-EA-SGS

RtrouGR1 SVSDSWNRGNGYATGSGMSS----SSFP---V--G----------FSSPKARP-EA-SGS

AsalmGR1 SVSDSWNRGNGYGAGSGMSS----SSFP---V--G----------FSSPTARP-EA-SGS

BtrouGR1 SVSDSWNRGNGYGTGSGTSS----SSFP---V--G----------FSSPTARP-EA-SSP

CaveGR1 TVNDGWLRGNGYGEASGMQRG-SEAMSQ---HPAVFSTFVYPDSRSENPVLRP-DA---S

CarpGR1 TLSDGWVRGNGYGDPSGMQRA-NETVLP---S-------TYP-------YSRP-EA-SAS

Myxine -YTSPAQGSAPPHKACLICRDEASGCHYGVLTCGSCKVFFKRAIE--------------G

FuguGR1 PVLSQPKPSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

TdonGR1 AMPGQPKPGGQ--KICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNTSVLLSSG

CodGR1 ----EEVRSGRAHKTCLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

SeaHGR1 VVPGQSKPNGQTHKVCLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQKS-----DG

AlimGR1 VVSGQSKPGGQGQKVCLVCSDEASGCHYGVVTCGSCKVFFKRAVE--------------G

MedakaGR1 VSSGHSKPSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

OdancGR1 VGSGHSKPSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

BicolorGR1 AVPGQSKPSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

TSoleGR1 AVPGPSKLSGPTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

MummGR1 SVTGQSKPGGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

GuppyGR1 AVTGQSKPGGQAHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

MollyGR1 AVTGQSKPGGQAHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

PlatyGR1 AVTGQSKPGGQAHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

PundGR1 VVPAQSKTSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

TilGR1 VVPAQSKTSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

NeolGR1 VVPAQSKTSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

BurtonGR1 VVPAQSKTSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

MZebraGR1 VVPAQSKTSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

StickleGR1 AGAGQSKPSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

CroakerGR1 VVPVQSKPSGQSHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

RdrumGR1 MVPVQSKPSGQSHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

PerchGR1 VVPSQSKPSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

SbassGR1 VVPVQSKPSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

JflouGR1 AVPGLSKPSGPTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

EflouGR1 AAAGQSKPSGQTHKICLVCSDEASGCHYGVVTCGSCKVFFKRAVEGWRARQNT-----DG

ButterGR1 ASSGPV-KAAGAQKLCLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQTS-----EG

FuguGR2 TSTVQGKSG--S-KICVVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

TdonGR2 TSTAQGKSG--G-KICVVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

CodGR2 TQGGKASGG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

TsoleGR2 ASPGQGKST--VHKICQVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

AlimGR2 ASTTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

MummGR2 TSTTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

PlatyGR2 TSTTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

MollyGR2 TSTTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

GuppyGR2 TSTTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

MedakaGR2 TS--TGKTG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

OdancGR2 SSTVQGKTG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

SbassGR2 PSSAQTKSG--THKICLVCSDEASGCHYGVFTCGSCKVFFKRAVK--------------G

NeolGR2 TSSTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

BurtonGR2 TSSTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

MZebraGR2 TSSTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

PundGR2 TSSTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

TilGR2 TSSTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

TilMGR2 TSSTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

CroakerGR2 --VTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

StickleGR2 TASSPGKSG--SRKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

CunnerGR2 LLPAQVKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

RCodGR2 QSS--TKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEG------------KG

PorgyGR2 LSSAQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

BreamGR2 TSSAQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

BicolorGR2 AASTQGKSG--GHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

PerchGR2 TSSTQGKSG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

ButterGR2 SNSSSGKSSGPAQKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNT-----DG

PikeGR2 TNTTTQAKAGTIHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGTLA---------RG

RtroutGR2 ASCTTQGKAGTTHKVCLVCSDEASGCHYGVLTCGSCKVFFKRAVEGTGA---------RG

AsalmGR2 ASCTTQGKAGTAHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGTGA---------RG

HerrGR2 GSVSGQKPGGAAHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

CaveGR2 TSTGTGKSGGATHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

Zebra TSSAGGKTG--THKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

MinnGR2 TPSTVGKSGTGVHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

CarpGR2 TSSAAGKSG--THKSCLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

Sterlet ----SPAASKSTHKTCLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNM-----DG

Gar PSPVPSKASGPAHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNA-----DG

Tgar SSPVPSKASGPAHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVE--------------G

HerrGR1 GGA-AAKSGGAAHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNT-----DG

AnchGR1 GGTTAAKSGGPAHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRVRQNT-----DG

JeelGR1 STSAGSSKSGATHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNT-----DG

PikeGR1 TASAPAKSSGPSHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNT-----DG

WhiteGR1 TSSAPAKPSGPTHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNT-----DG

RtrouGR1 ASSAPAKPSGPTHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNT-----DG

AsalmGR1 TSS--AKPSGPTHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNT-----DG

BtrouGR1 TSSAPAKHSGPTHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNT-----DG

CaveGR1 SSSPTGPPRGPTHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNT-----DG

CarpGR1 SSSGSVKPGGNTHKICLVCSDEASGCHYGVLTCGSCKVFFKRAVEGWRARQNA-----DG

Myxine QHNYLCAGRNDCIIDKIRRKNCPACRLRKCIQAGMMLG------------------ARKM

FuguGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLRAGMNLD------------------ARKN

TdonGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

CodGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

SeaHGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

AlimGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLD------------------ARKN

MedakaGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

OdancGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

BicolorGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

TSoleGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLEAGMNLD------------------ARKN

MummGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

GuppyGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

MollyGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

PlatyGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLEGK-------------VPSARKN

PundGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

TilGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

NeolGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLEVVRTSFRRVQSDICRRTAARKN

BurtonGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

MZebraGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

StickleGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLKAGMNLE------------------ARKN

CroakerGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

RdrumGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

PerchGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

SbassGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

JflouGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

EflouGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

ButterGR1 QHSYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLD------------------ARKN

FuguGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

TdonGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

CodGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

TsoleGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLVAGMNLE------------------ARKV

AlimGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

MummGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

PlatyGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLK------------------ARKT

MollyGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLK------------------ARKT

GuppyGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

MedakaGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE-----------------EARKT

OdancGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

SbassGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

NeolGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKL

BurtonGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKL

MZebraGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKL

PundGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKL

TilGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKL

TilMGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKL

CroakerGR2 QHNYLCAGRNDCIIDKIRRKNCPACRYSKCKMAGMNLE------------------ARKT

StickleGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCQMAGMNLE------------------ARKT

CunnerGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

RCodGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

PorgyGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

BreamGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKS

BicolorGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

PerchGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

ButterGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

PikeGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

RtroutGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLLAGMNLE------------------ARKT

AsalmGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

HerrGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKT

CaveGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKV

Zebra QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKS

MinnGR2 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLMAGMNLE------------------ARKT

CarpGR2 QHNYLCAGRNDCIIDKIRRKNCPACRYRKCLMAGMSLE------------------ARKN

Sterlet QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKT

Gar QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKT

Tgar QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKT

HerrGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

AnchGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

JeelGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKT

PikeGR1 QHNYLCAGRNDCIIDKVRRKNCPACRFRKCLQAGMNLE------------------ARKN

WhiteGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

RtrouGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

AsalmGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

BtrouGR1 QHNYLCAGRNDCIIDRIRRKNCPACRFRKCLQAGMNLE------------------ARKN

CaveGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

CarpGR1 QHNYLCAGRNDCIIDKIRRKNCPACRFRKCLQAGMNLE------------------ARKN

Myxine KKQARQRVHESTSPSQDSTMAGASDTVNPLCSNPHTTVTMVTTSSTSVTAARSP-SIPPV

FuguGR1 KKIIKMKMQHPT-------------NI-------------------NMPVPVIP-RSMSQ

TdonGR1 KKLIKMKTQRPASSS--------E-PV-------------------NLPVPVIP-RSMSQ

CodGR1 KKLIKMKVQQTS---------------------------------TALPAAVVP-SSMPQ

SeaHGR1 KKLKRREHQSVRALE--------P-AV------------------PSMPVAVIP-ACMPQ

AlimGR1 KKLHKVRPQRPPGPP--------E-PV-------------------NLPIPVIP-KNLPQ

MedakaGR1 KKLIKMK--RPSGSS--------E-PVN----N-----------NNNLPVPIIP-RSMPQ

OdancGR1 KKLIKMK--RPAGSS--------E-PVN-----------------NNLPVPIIP-RSMPQ

BicolorGR1 KKMIKMKVPRPPGSS--------E-PI------------------TNMPVPVIP-RCMPQ

TSoleGR1 KR----------------------------------------------PRPKII-PKMPP

MummGR1 KKLIKMKVQQPSRPS--------E-PA------------------SNMPVPIIP-RSMPQ

GuppyGR1 KKLNKIKVQTPSRPS--------E-PA------------------SSLPMPIIP-RSMPQ

MollyGR1 KKLNKIKVQTPSRPS--------E-PA------------------SSLAIPIIP-RSMPQ

PlatyGR1 KKLNKIKVQTPTRPS--------E-PA------------------SSLPMPIIP-RSMPQ

PundGR1 KKLIKMKVHRVGASE--------P-TI------------------SNMPVPVVP-RSMPQ

TilGR1 KKLIKMKVHRAGASE--------P-TI------------------SNMPVPVVP-RSMPQ

NeolGR1 KKLIKMKVHRAGASE--------P-TI------------------SNMPVPVVP-RSMPQ

BurtonGR1 KKLIKMKVHRAGASE--------P-TI------------------SNMPVPVVP-RSMPQ

MZebraGR1 KKLIKMKVHRAGASE--------P-TI------------------SNMPVPVVP-RSMPQ

StickleGR1 KKLTKMKV-------------------------------------PVMPVPVIP-RPMPQ

CroakerGR1 KKLMK----KPSGSS--------Q-PI------------------NNMPIPVIP-KCMPQ

RdrumGR1 KKLIE----EPPGSS--------Q-PI------------------NNMPVPVIP-KCMPQ

PerchGR1 KKMMKVP--RPP--------------------------------------------HPSP

SbassGR1 KKLIKMKVQRPSGSS--------E-PI------------------SNMPVPVIP-RCMPQ

JflouGR1 KKLIKMKVHRPTGSA--------E-PI------------------SNMPVPVIP-R-MPQ

EflouGR1 KKLIKMKVQRPPGAA--------E-PI------------------SSMPVSVIP-R-MPQ

ButterGR1 RKQIRTRVTH----DPA-AV-----APP----S-----------LNGWIESLVP-KTLPQ

FuguGR2 KKLNRLK----GVQQSN----PPKPTTP----C-----------LPVEPCSLVP-KCMPQ

TdonGR2 KKMNRLK----GVQQSS----PAKPAAP----S-----------PPAEARSLVP-KCMPQ

CodGR2 KKLNRIK----GLQQAN----PAE-QAP----P-----------PPAESRSLVP-KSMPQ

TsoleGR2 KKMNRLK----GVQQSN----PPE-LLT----P-----------PLEEPLALLP-KCLPQ

AlimGR2 KKLNRLK----GNHSSA----PPE-LTP----S-----------LPVETRSIVP-KCMPQ

MummGR2 KKLNRLK----GSQNSN----PPE-MMP----S-----------PPVEARSLVP-KCMPQ

PlatyGR2 KKLNRLK----GNQNSN----PPE-MMP----S-----------PPVEARSLVP-KCMPQ

MollyGR2 KKLNRLK----GNQSSN----PPE-MMP----S-----------PPVEARSLVP-KCMPQ

GuppyGR2 KKLNRLK----GNQSSN----PPE-MMP----S-----------PLVEARSLVP-KCMPQ

MedakaGR2 KKLNRLK----GCQNSN----PPE-MIP----S-----------PPVEARSLVP-KCMPQ

OdancGR2 KKLNRLK----GCQNSN----PPE-MIP----S-----------PPVEARSLVP-KCMPQ

SbassGR2 KKLNRLK----GAQPSN----PPE-MTT----P-----------PPIEARSLVP-KCMPQ

NeolGR2 KK-NRLK----GVQQSN----PPE-VTP----S-----------PPVETRSLVP-KCMPQ

BurtonGR2 KK-NRLK----GVQQSN----PPE-VTP----S-----------PPVETRSLVP-KCMPQ

MZebraGR2 KK-NRLK----GVQQSN----PPE-VTP----S-----------PPVETRSLVP-KCMPQ

PundGR2 KK-NRLK----GVQQSN----PPE-VTP----S-----------PPVETRSLVP-KCMPQ

TilGR2 KK-NRLK----GVQQSN----PPE-VAP----S-----------PPVETRSLVP-KCMPQ

TilMGR2 KK-NRLK----GVQQSN----PPE-VAP----S-----------PPVETRSLVP-KCMPQ

CroakerGR2 KRLARIKDSNRGNQQSN----PPE-LTP----P-----------PI-E--ACSPLKCLPQ

StickleGR2 KKLNRLK-------PNN----PPE-LTP----A-----------PPVETRSLLP-KCMPQ

CunnerGR2 KKLNRLK----GAQPSN----PPE-LTP----S-----------PPIEAHSLMP-KRMPQ

RCodGR2 KKLNRLK----GAQPSN----PPE-LNP----S-----------PPIETRSLLPVKSMPQ

PorgyGR2 KKLNRLK----GNLPSN----PPE-LTT----P-----------PPMEARSLVP-KRMPQ

BreamGR2 KKLNRLK----GNLPSN----PPE-LTT----P-----------PPMEARSLVP-KCMPQ

BicolorGR2 KKLNRLK----GANMSN----PPE-VTP----S-----------PPIEARSLVP-KCMPQ

PerchGR2 KKLNRLK----GAQPSN----PPE-LTP----P-----------LPVEARPLLP-KCMPQ

ButterGR2 KKQNKLKGPS--SSP---VVPPME-PVI----P-----------PRPEAHALVP-KSLPQ

PikeGR2 KKLNRLKG----LQQPV----E---PAP----T-----------PLPEARSLVP-KSMPQ

RtroutGR2 KKLNRLKG----VQQPT----TAE-LTP----R-----------PLPEARSLVP-KSMPQ

AsalmGR2 KKLNRLKG----VQQPT----TVE-LSP----R-----------PLPEARSLVP-KSMPQ

HerrGR2 KKLNRLKGVQ--QQQPAAAVAVSE-LSP----P-----------VMPEARPLVP-KAMPQ

CaveGR2 KKLKG--LKG--VQQPN----AAD-LSP----A-----------PVQEVRALVP-KAMPQ

Zebra KSKARQAGKV--IQQQS----IPE-RNL----P-----------PLPEARALVP-KPMPQ

MinnGR2 K-KGRQTGKV--IQQPT----IPE-RNL----S-----------PLPEARALVP-KPMPQ

CarpGR2 K-RGRQTGKV--IQQPS----IPE-RSL----P-----------PLPEVQALVP-KPMPQ

Sterlet KKLNKLKGIQAPVE----------QATP----L-----------PDERSQALVP-KSMPQ

Gar KKLNRLKGPGRAVE----------QPVS----L-----------PDEQTRAVVP-KSMPQ

Tgar KKLNRLKGPGRAVE----------QPAS----L-----------PDEQTRTLVP-KSMPQ

HerrGR1 KKLIRLTRQQSGGDT----------PRP----L-----------PDERQCALVP-KSMPQ

AnchGR1 KKLIRLTRQQSGGEGVG-------ARGP----L-----------LDERQCTLVP-KSMPQ

JeelGR1 KKLIRMKGQQAASSE---------PVPP----M-----------AEEGARALLP-KSMPQ

PikeGR1 KKLIRLKGQQA-SPE---------TSLP----A-----------PDERAFALIP-KSLPQ

WhiteGR1 KKLIRLKGQQT-TME---------PSPP----P-----------PDERACALIP-KSMPQ

RtrouGR1 KKLIRLKGQQT-TME---------PNPP----P-----------PDERACALIP-KSMPQ

AsalmGR1 KKLIRLKGQQT-TME---------PSPP----P-----------PDERACALIP-KSMPQ

BtrouGR1 KKLIRFKGQQA-TTE---------PNSP----A-----------PDERACTLIP-KSMPQ

CaveGR1 KKLIRIKGQQA-LPD---------PAHA----M-----------PDP-SSLLVP-KSMPQ

CarpGR1 KKLMRLRGHSS-SSE---------QAPA----L-----------PEERMCSLVP-KAMPQ

Myxine ISPPLVSTLQVIEPDIISAGFDNSRAMTTTYLLSSLNTLCEKQLVFLVKWAKAM-PGFRS

FuguGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVISAVKWAKAL-PGFRN

TdonGR1 LVPTMLSVLKAIEPETIYSGYDSTLPDTSSRLMSTLNRLGGQQVVSAVKWAKSL-PGFRN

CodGR1 LVPTMLSLLKAIEPEVVYSGYDNTLPDTSTRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

SeaHGR1 LVPAMLSVLQAIEPEIIYSGYDGTLPDTSSRLMSTLNKLGGQQVISAVKWAKSL-PGFRN

AlimGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVISAVKWAKSL-PGFRS

MedakaGR1 LVPTMLSVLKAIEPEVIFSGYDSTLPDTSSRLMSTLNRLGGQQVISAVKWAKSL-PGFRN

OdancGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPDTSSRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

BicolorGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPDTSSRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

TSoleGR1 LIPPMLSVLKAIEPEIIYSGYDGTMPDTSSRLMSTLNRLGGQQVISAVKWAKSL-PGFRN

MummGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVISAVKWAKSL-PGFRN

GuppyGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPXXXXXLGSTLSACHFH-VFILNRVYVSL-SGFRN

MollyGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVISAVKWAKSL-PGFRN

PlatyGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVISAVKWAKSL-PGFRN

PundGR1 LVPTMLSILKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVVSAVKWAKSX-XGFRN

TilGR1 LVPTMLSILKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVVSAVKWAKSL-PGFRN

NeolGR1 LVPTMLSILKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVVSAVKWAKSL-PGFRN

BurtonGR1 LVPTMLSILKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVVSAVKWAKSL-PGFRN

MZebraGR1 LVPTMLSILKAIEPEIIYSGYDSTLPDTSSRLMSTLNRLGGQQVVSAVKWAKSL-PGFRN

StickleGR1 LVPTMLSVLKAIEPEVIYSGYDSTLPDTSSRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

CroakerGR1 LVPTMLSMLKAIEPEVIYSGYDSTLPDTSTRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

RdrumGR1 LVPTMLSMLKAIEPEVIYSGYDSTLPDTSSRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

PerchGR1 VVPTMLSMLKAIEPEVIYSGYDSTLPEHSSRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

SbassGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPDTSSWLMTTLNRLGGQQVISAVKWAKSL-PGFRN

JflouGR1 LVPTMLSVLKAIEPEIIYSGYDSTLPDTSTRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

EflouGR1 LVPTMLSVLKAIEPEVIYSGYDSTLPDTSTRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

ButterGR1 LTPTMLSLLKAIEPEIIYAGYDSTIPDTSTRLMTTLNRLGGRQVVSAVKWAKAL-PGFRN

FuguGR2 LVPTMLSLLKAIEPETIYAGYDSTVPDTSTRLMTTLNRLGGQQVISAVKWAKAL-PGFRN

TdonGR2 LVPTMLSLLKAIEPETIYAGYDSSVPDTSTRLMTTLNRVGGRQVISAVKWAKALPPGFRN

CodGR2 LIPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVVSAVKWAKAL-PGFRN

TsoleGR2 LVPTMLSLLKAIEPETIYAGCDSTTAITSTRLMTTLNRLGGKQVVSAVKWAKAL-PGFRK

AlimGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

MummGR2 LVPTMLSLLKAIEPDTIYAGYDGTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

PlatyGR2 LVPTMLSLLKAIEPDTIYAGYDGTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

MollyGR2 LVPTMLSLLKAIEPDTIYAGYDGTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

GuppyGR2 LVPTMLSLLKAIEPDTIYAGYDGTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

MedakaGR2 LVPTMLSLLKAIEPDTLYAGYDSTLPDTSTRLMTSLNRLGGRQVISAVKWAKAL-PGFRN

OdancGR2 LVPTMLSLLKAIEPDTLFAGYDSTLPDTSTRLMTSLNRLGGRQVISAVKWAKAL-PGFRN

SbassGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKSL-PGFRN

NeolGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDNSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

BurtonGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDNFTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

MZebraGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDNSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

PundGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDNSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

TilGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDNSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

TilMGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDNSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

CroakerGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

StickleGR2 LIPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

CunnerGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

RCodGR2 LVPTMLSLLKAIEPDTIFAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

PorgyGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

BreamGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

BicolorGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

PerchGR2 LVPTMLSLLKAIEPDTIYAGYDSTLPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

ButterGR2 LTPTMLSLLKAIEPETVYAGYDSTLPDTSTRLMTTLNRLGGRQVVSAVKWAKAL-PGFRN

PikeGR2 LIPTMLSLLKAIEPETIYSGYDGTLPDTSTRIMTTLNRLGGRQVISAVKWAKSL-PGFRN

RtroutGR2 LTPTMLSLLKAIEPDTIYSGYDGTLPDTSTRIMTTLNRLGGRQVVSAVKWAKAL-PGFRN

AsalmGR2 LTPTMLSLLKAIEPDTIYSGYDGTLPDTSTRIMTTLNRLGGRQVVSAVKWAKAL-PGFRN

HerrGR2 LVPSMLSLLKAIEPETIYAGYDSTLPDTSTRLMTTLNRLGGRQVVSAVKWAKSL-PGFRN

CaveGR2 LVPTMLSLLKAIEPETIYAGYDSTLTDTSTRLMTTLNRLGGRQFVSAVKWAKTL-PGFRN

Zebra LVPTMLSLLKAIEPDTLYAGYDSTIPDTSVRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

MinnGR2 LVPTMLSLLKAIEPETIYAGYDSTVPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

CarpGR2 VVPTMLSLLKAIEPDTIYAGYDSTIPDTSIRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

Sterlet LTPTMLSLLEAIEPEIIYSGYDSTIPDTSTRLMSTLNRLGGRQVVAAVKWAKSL-PGFRS

Gar LIPTMLSLLKAIEPEIIYSGYDSTIPDTSTRLMSTLNSLGGRQVVSAVKWAKAL-PGFRN

Tgar LIPTMLSLLKAIEPETIYSGYDSTIPDTSTRLMSTLNSLGGRQVVSAVKWAKAL-PGFRN

HerrGR1 LTPTMLSLLKAIEPEVMYSGYDSTIPDTSTRLMTTLNRLGGKQVISAVKWAKSL-PGFRN

AnchGR1 LTPTMLSLLKAIEPEVMYAGYDSTIPDTSTRLMTTLNRLGGKQVISAVEWAKSL-PGFRN

JeelGR1 LIPTMLSLLKAIEPETIYAGFDSTIPDTSNRLMTALNRLGGLQVVSAVKWAKAL-PWFRN

PikeGR1 LVPTMLSLLKAIEPEAIYSGYDSTIPDTSTRLMTTLNRLGGQQVISAVKWAKSL-PGFRN

WhiteGR1 LVPTMLSLLKAIEPEAIYSGYDSTIPDTSTRLMTTLNRLGGQQVVSAVKWAKSL-PGFRN

RtrouGR1 LVPTMLSLLKAIEPEAIYSGYDSTIPDTSTRLMTTLNRLGGQQVVSAVKWAKSL-PGFRN

AsalmGR1 LVPTMLSLLKAIEPEAIYSGYDSTIPDTSTRLMTTLNRLGGQQVVSAVKWAKSL-PGFRN

BtrouGR1 LVPTMLSLLKAIEPEAIYSGYDSTIPDTSTRLMTTLNRLGGQQVVSAVKWAKSL-PGFRN

CaveGR1 LVPTMLSLLKAIEPEIVYSGYDSTIPDTSTRLMTTLNRLGGRQVISAVKWAKAL-PGFRN

CarpGR1 LVPTMLSLLKAIEPEIIYAGYDSTIPDTSTRIMTTLNRLGGRQVISAVKWAKAL-PGFRN

Myxine LHIDDQMVLIQYSWMGIMAFAMGWRSYINTNCELLYFAPDLIFNEQRMKQSAMYDLCLGM

FuguGR1 LDLDDQMTLLQCSWLFLMSFGLGWRSYEQCNGSMLCFAPDLVINKERMKLPFMNDQCEQM

TdonGR1 LHLDDQMILLQCSWLFLMSFSLGWRSYQQCNGSMLCFAPDLVINEERMRLPFMNDQCEKM

CodGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGNMLCFAPDLVINEERMKLPFMNDQCEQM

SeaHGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYKQCNGSMLCFAPDLVINQERMKLPYMTEQCEQM

AlimGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGKMLCFAPDLVINKERMNLPLMDDQCKQM

MedakaGR1 LHIDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINTDRMQLPFMTDQCDQM

OdancGR1 LHIDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINTDRMQLPFMTDQCEQM

BicolorGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINKERMKLPFMTDQCEQM

TSoleGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINKERMKLPFMSDQCEQM

MummGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGRMLCFAPDLVINEERMKLPLMGDQCEQM

GuppyGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGRMLCFAPDLVINEERMKLPLMGDQCEQM

MollyGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGRMLCFAPDLVINEERMKLPLMGDQCEQM

PlatyGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGRMLCFAPDLVINEERMKLPLMGDQCEQM

PundGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINKDRMKLPFMTDQCEQM

TilGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINKDRMKLPFMTDQCEQM

NeolGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINKDRMKLPFMTDQCEQM

BurtonGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINKDRMKLPFMTDQCEQM

MZebraGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINKDRMKLPFMTDQCEQM

StickleGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYDQCNGSMLCFAPDLVINKERMKLPFMTDQCEQM

CroakerGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINEERMKLPFMTDQCEQM

RdrumGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINEERMKLPFMTDQCEQM

PerchGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGTMLCFAPDLVINKERMKLPFMNDQCEQM

SbassGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGSMLCFAPDLVINKERMKLPFMTDQCEQM

JflouGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGNMLCFAPDLVINKERMKLPFMTDQCEQM

EflouGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYEQCNGNMLCFAPDLVINQERMKLPFMNDQCEQM

ButterGR1 LHLDDQMTLLQCSWLFLMSFGLGWRXFQQCNGSMLCFAPDLVINEERMKLPYMTDQCQQM

FuguGR2 LHLDDQMTLLQYSWLFLMSFSLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMADQCEQM

TdonGR2 LHLDDQMTLLQCSWLFLMSFNLGWRSCQQCNGNMLCFAPDLVINEERMNLPYMADQCKQM

CodGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCSGNMLCFAPDLVINEARMKLPYMADQCEQM

TsoleGR2 LHLDDQMTLLQCSWLFLMSFSLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMADQCEMM

AlimGR2 LHLDDQMTLLQCSWLFLMSFSLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMAEQFEQM

MummGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVVNEERMKLPYMAEQFEQM

PlatyGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMAEQFEQM

MollyGR2 LHLDDQMTLLQCSWLFLMSFSLGWRSYQQCDGNMLCFAPDLVINEERMKLPYMAEQFDQM

GuppyGR2 LHLDDQMTLLQCSWLFLMSFSLGWRSYQQCDGNMLCFAPDLVINEERMKLPYMAEQFEQM

MedakaGR2 LHLDDQMTLLQCSWLFLMTFGLGWRSYQQCNGNMLCFAPDLVVNEERMKLPFMADQFEQM

OdancGR2 LHLDDQMTLLQCSWLFLMTFGLGWRSYQQCNGNMLCFAPDLVVNEERMKLPFMADQFEQM

SbassGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGSMLCFAPDLVINEERMKLPYMADQCEQM

NeolGR2 LHLDDQMTLLQYSWLFLMTFSLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMTDQFEQM

BurtonGR2 LHLDDQMTLLQYSWLFLMTFSLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMTDQFEQM

MZebraGR2 LHLDDQMTLLQYSWLFLMTFSLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMTDQFEQM

PundGR2 LHLDDQMTLLQYSWLFLMTFSLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMTDQFEQM

TilGR2 LHLDDQMTLLQYSWLFLMTFSLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMTDQFEQM

TilMGR2 LHLDDQMTLLQYSWLFLMTFSLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMTDQFEQM

CroakerGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCSGNMLCFAPDLVINEERMKLPYMADQCEQM

StickleGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGHMLCFAPDLVINDERMKLPYMADQCEQM

CunnerGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMADQCEQM

RCodGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEDRMKLPYMADQCEQM

PorgyGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMADQCEQM

BreamGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMADQCEQM

BicolorGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMADQCEQM

PerchGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEDRMKLPYMADQCEQM

ButterGR2 LHLDGQMTLLQYSWLFLMSFGLGWRSFQQCNGTMLCFAPDLVINEERMKLPYMSDQCEQM

PikeGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCDGNMLCFAPDLVINEDRMKLPYMADQCEQM

RtroutGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCDGNMLCFAPDLVINQDRMKLPYMADQCEQM

AsalmGR2 LHLDDQMTLLQCSWLFLMSFSLGWRSYQQCDGNMLCFAPDLVINQDRMKLPYMADQCEQM

HerrGR2 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCDGNMLCFAPDLVINEERMKLPYMADQCEQM

CaveGR2 LHLDDQMTLLQSSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMGDQCAQM

Zebra LHLDDQMTLLQCSWLFIMSFGLGWRSYQHCNGNMLCFAPDLVINEERMKLPYMSDQCEQM

MinnGR2 LHLDDQMTLLQSSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEERMKLPYMNDQCEQM

CarpGR2 LDLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFAPDLVINEERMRLPYMNDQCEQM

Sterlet LHLDDQMTLLQCSWLFLMSFSLGWRSYKQSNGSMLCFAPDLVINDERMKLPYMFEQCEQM

Gar LHLDDQMTLLQCSWMFLMSFGLGWRSYQQSNGSMLCFAPDLVINEERMKLPYMSEQCEQM

Tgar LHLDDQMTLLQCSWMFLMSFGLGWRSYQQSNGSMLCFAPDLVINEERMKLPYMSEQCEQM

HerrGR1 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCSGGMLCFAPDLVINEERMKLPYMSDQCEQM

AnchGR1 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGNMLCFVPDLVMNEERMKLPYMADQCEQM

JeelGR1 LHLDDQMTLLQCSWLVLMTFSLGWRSFQQSNGGMLCFAPDLVINQERMKLPYMNDQCEQM

PikeGR1 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGGMLCFAPDLVINDERMKLPYMTDQCEQM

WhiteGR1 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGGMLCFAPDLVINDERMKLPYMTDQCEQM

RtrouGR1 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGGMLCFAPDLVINDERMKLPYMTDQCEQM

AsalmGR1 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGGMLCFAPDLVINDERMKLPYMTDQCEQM

BtrouGR1 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGGMLCFAPDLVINDERMKLPYMTDQCEQM

CaveGR1 LHLDDQMTLLQCSWLFLMSFSLGWRSYQQCSGSMLCFAPDLVINEERMKLPYMGEQCEQM

CarpGR1 LHLDDQMTLLQCSWLFLMSFGLGWRSYQQCNGGMLCFAPDLVINEERMKLPYMNDQCSQM

Myxine RNIGEEMMRMTMSPDEFRCMKAVLLLSTIPKEGLKCQT---------SFEELRMTYIREL

FuguGR1 LKICDEFVRLQVSYEEYLCMKVLLLLSTVPKDGLKSQT---------VFDEIRMMYIKEL

TdonGR1 LRICREFVRLQLSHEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

CodGR1 LKISNEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQP---------VFDEIRMTYIKEL

SeaHGR1 LKICTEFVRLEVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

AlimGR1 LKICNEFVRLQVSYEEYLCMKVLLLLSTVPKEGLKSQA---------IFDEIRMTYIKEL

MedakaGR1 LKICKEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMVYIKEL

OdancGR1 LKICKEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMAYIKEL

BicolorGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTGNRTHFTLKNHSSVFQKSFFFSGIKIDFKNHC

TSoleGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQG---------VFDEIRMAYIKEL

MummGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKEGLKCQA---------VFDEIRMTYIKEL

GuppyGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKEGLKSQA---------VFDEIRMTYIKEL

MollyGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKEGLKSQA---------VFDEIRMTYIKEL

PlatyGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKEGLKSQA---------VFDEIRMTYIKEL

PundGR1 LKICNEFVRLQVSYEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

TilGR1 LKICNEFVRLQVSYEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

NeolGR1 LKICNEFVRLQVSYEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

BurtonGR1 LKICNEFVRLQVSYEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

MZebraGR1 LKICNEFVRLQVSYEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

StickleGR1 LTICNEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

CroakerGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

RdrumGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

PerchGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKEGLKSQA---------VFDEIRMMYIKEL

SbassGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

JflouGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

EflouGR1 LKICNEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

ButterGR1 LKISNEFVRLQVTYEEYLCMKVLLLLSTVPKDGLKSQA---------IFDELRMSYIKEL

FuguGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDDIRMSYIKEL

TdonGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDDIRMSYIKEL

CodGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQS---------VFDEIRMSYIKEL

TsoleGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFEEIRMNYIKEL

AlimGR2 MKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFEEIRMSYIKEL

MummGR2 LKISSEFVRLQVSHEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

PlatyGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

MollyGR2 LKISSEFVRLQVSHEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

GuppyGR2 LKISSEFVRLQVSHEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

MedakaGR2 LKISNEFVRLQVSHEEYLCMKVLLLLSTVPKDGLKSQA---------VFDELRMSYIKEL

OdancGR2 LKISNEFVRLQVSHEEYLCMKVLLLLSTVPKDGLKSQA---------VFDELRMSYIKEL

SbassGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFEDIRMSYIKEL

NeolGR2 LKICSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

BurtonGR2 LKICSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

MZebraGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

PundGR2 LKICSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

TilGR2 LKICSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

TilMGR2 LKICSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

CroakerGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDDIRMSYIKEL

StickleGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQT---------VFDDIRMSYIKEL

CunnerGR2 LKISTELVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDDIRMSYIKEL

RCodGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDDIRMSYIKEL

PorgyGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDDIRMSYIKEL

BreamGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDDIRMSYIKEL

BicolorGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

PerchGR2 LKISSEFVRLQVSNDEYLCMKVLLLLSTVPKDGLKSQA---------VFDDIRMSYIKEL

ButterGR2 MKIANEFVRLQISHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

PikeGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLRSQA---------VFDEIRMSYIKEL

RtroutGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

AsalmGR2 LKISSEFVRLQVSHDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

HerrGR2 LKISNEFVRLQVSNDEYLCMKVLLLLSTVPKDGLKSQS---------VFDEIRMSYIKEL

CaveGR2 LKISNEFVRLQVSNEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

Zebra LKISNEFVRLQVSTEEYLCMKVLLLLNTVPKDGLKSQS---------VFDELRMSYIKEL

MinnGR2 LKISNEFVRLQVSNEEYLCMKVLLLLSTVPKDGLKSQT---------VFDELRMSYIKEL

CarpGR2 LKISNEFVRLQVSNEEYLCMKVLLLLSTVPKDGLKSQS---------VFEELRMSYIKEL

Sterlet LKISNELVRLQLSYDEYLCMKVLLLLSSVPKEGLKSQG---------VFDEIRMTYIKEL

Gar LKISNEFVRLQVSYDEYLCMKVLLLLSTVPKTGLRSQS---------IFDEIRMSYIKEL

Tgar LKISNEFVRLQVSYDEYLCMKVLLLLSTVPKTGLRSQS---------IFDEIRMSYIKEL

HerrGR1 LKISSEFVRLQVSYEEYLCMKVLLLLSTIPKDGLKSQG---------VFDEIRMSYIKEL

AnchGR1 LKISNEFVRLQVSDDEYLCMKVLLLLSTVPKDGLKSQS---------VFDEIRMTYIKEL

JeelGR1 LKISNEFVRLQVSYEEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMAYIKEL

PikeGR1 LKISTELLRLHVSYDEFLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

WhiteGR1 LKISTEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQV---------VFDEIRMAYIKEL

RtrouGR1 LKISTEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

AsalmGR1 LKISTEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

BtrouGR1 LKISTEFVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMTYIKEL

CaveGR1 LKIVNELVRLQVSYEEYLCMKVLLLLSTVPKDGLKSQA---------VFEEIRMSYIKEL

CarpGR1 LKITSELVRLQVSYDEYLCMKVLLLLSTVPKDGLKSQA---------VFDEIRMSYIKEL

Myxine HRAVGQQTSS-PVQCWKRFYQLTRLLDSMHN--------LVGGLLEFCF---MTFTQSEL

FuguGR1 GKAIVKREEN-ASQNWRRFYKLTKLLDSMQE--------MVEGLLQFCF---YTFVNK-T

TdonGR1 GKAIVKREEN-PSQNWQRFYQLTKLLDSMQE--------MVEGLIKFCF---YTFVNK-T

CodGR1 GKAIVKREEN-SSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-S

SeaHGR1 GKAIVKREEN-TSQNWQRFYQLTKLLDSMQG--------MVEDLLHICF---YTFMNK-T

AlimGR1 GKAIVKREEN-TSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---HTFVNK-T

MedakaGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

OdancGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

BicolorGR1 I----------------TYVILLKPFH----------------CTAICH---SGEVD---

TSoleGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

MummGR1 GKAIVKREEN-TSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

GuppyGR1 GKAIVKREEN-TSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

MollyGR1 GKAIVKREEN-TSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

PlatyGR1 GKAIVKREEN-TSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

PundGR1 GKAIVKRSKV-SKQLLL-------TSLCLNQ--------MVEGLLQICF---YTFVNK-T

TilGR1 GKAIVKREEN-PSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

NeolGR1 GKAIVKREEN-PSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

BurtonGR1 GKAIVKREEN-PSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

MZebraGR1 GKAIVKREEN-PSQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

StickleGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

CroakerGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVESLLQICF---YTFVNK-T

RdrumGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVESLLQICF---YTFMNK-T

PerchGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVKGLLQICF---YTFVNK-T

SbassGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVESLLQICF---YTFVNK-T

JflouGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

EflouGR1 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

ButterGR1 GKAIAKREEN-TSQNWQRFYQLTKLLDFMQE--------MVGGLLNFCF---YTFVNK-T

FuguGR2 GKAIVKREQN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLRFCF---YTFVNK-S

TdonGR2 GKAIVKREQN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLNFCF---YTFVNK-S

CodGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE-----RLQMVGGLLNFCF---YTFVNK-S

TsoleGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLDFCF---YTFVNK-S

AlimGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MGGGLLSFCF---YTFVNK-F

MummGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MGSGLLSFCF---YTFVNK-F

PlatyGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MGSGLLSFCF---YTFVNK-F

MollyGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDYLHQ--------MGSGLLSFCF---YTFVNK-F

GuppyGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MGSGLLSFCF---YTFVNK-F

MedakaGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MAGGLLSFCF---YTFVNK-S

OdancGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MAGGLLSFCF---YTFVNK-S

SbassGR2 GKAIVKREEN-SSQNWQRFYHIPLLDYWGRSGGLNIINIRVGAIFSTSHLKSYTKDWY-S

NeolGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

BurtonGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

MZebraGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

PundGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

TilGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

TilMGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

CroakerGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

StickleGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE-----RPQMVGGLLSFCF---YTFVNK-S

CunnerGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLNFCF---YTFVNK-S

RCodGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

PorgyGR2 GKAIVKREEN-SSYIWQRFYQLTKLLDSMHH--------TVGGLLSFCF---YTFVNK-S

BreamGR2 GKAIVKREEN-ASQNWQRFYQLTKLLDSMQE--------MVEGLLQICF---YTFVNK-T

BicolorGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

PerchGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLSFCF---YTFVNK-S

ButterGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHD--------LVGGLLNFCF---YTFVNK-S

PikeGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLNFCF---YTFVNK-S

RtroutGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------MVGGLLDFCF---YTFVNK-S

AsalmGR2 GKAIVKREEN-SSHNWQRFYQLTKLLDSMHE--------MVGGLLDFCF---YTFVNK-S

HerrGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHD--------MVGGLLNFCF---YTFVNK-S

CaveGR2 GKAIVRREEN-SSQNWQRFYQLTKLLDSMHD--------MVGGLMNFCF---YTFVNK-S

Zebra GKAIVKREEN-SSQNWQRFYQLTKLLDSMHD--------LVGGLLNFCF---YTFVNK-S

MinnGR2 GKAIVKREEN-SSQNWQRFYQLTKLLDSMHD--------MVGGLLNFCF---FTFVNK-S

CarpGR2 GKAIVKREEN-SSKNWQRFYQLTKLLDSMHD--------MVGGLLNFCF---YTFVNK-S

Sterlet GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------LVGGLLNFCF---YTFVNK-S

Gar GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------LVGGLLNFCF---YTFLNK-S

Tgar GKAIVKREEN-SSQNWQRFYQLTKLLDSMHE--------LVGGLLNFCF---YTFLNK-S

HerrGR1 GKAIVKREENSSSQNWQRFYQLTKLLDTMQE--------MVEGLLNFCF---YTFVNK-S

AnchGR1 GKAIVKRKEN-SSQNWQRFYQLTKLLDSMHD--------MVGGLLNFCF---YTFVNK-S

JeelGR1 GKAIVKREEN-SSQNWQRFYQLTRLLDSMQE--------MVGGLLNFCF---YTFVNK-S

PikeGR1 GKAIVKREEN-SSQNWHRFYQLTKLLDSMQE--------MVGGLLQICF---YTFVNK-S

WhiteGR1 GKAIVKREEN-SSQNWQRFYQLTKLLDSMQE--------IVGGLLQICF---YTFVNK-S

RtrouGR1 GKAIVKREEN-SSQNWQRFYQLTKLLDSMQE--------MVGGLLQICF---YTFVNK-S

AsalmGR1 GKAIVKREEN-SSQNWQRFYQLTKLLDSMQE--------MVGGLLQICF---YTFVNK-S

BtrouGR1 GKAIVKREEN-SSQNWQRFYQLTKLLDSMQE--------MVGGLLQICF---YTFVNK-S

CaveGR1 GKAIVKRDEN-SSQNWQRFYQLTKLLDSMQE--------MVEGLLNFCF---YTFVNK-S

CarpGR1 GKAIVKREEN-SSQNWQRFYQLTKLLDSMQE--------MVEGLLNFCF---YTFVNK-S

..

Myxine WSVEFPEMMSEIITAQLPHVLAGHAHALRFHKK---------------------------

FuguGR1 LSIEFPEMLVEIITDQIPKFKDGSIKPLLFHQK---------------------------

TdonGR1 LSVEFPEMLVEIITNQIPKFQEGGIKALLFHQK---------------------------

CodGR1 LSVEFPEMLAEIITNQIPKIKDGTVKPLLFHHK---------------------------

SeaHGR1 LSVEFPEMLAEIITNQIPKVKDGSVKQLLFHQK---------------------------

AlimGR1 LSVEFPEMLAEIITNQIPKFKDGSVKPLLFHQK---------------------------

MedakaGR1 LSVEFPDMLAEIITSQIPKFKDGGVKTLPVPSS---------------------------

OdancGR1 LSVEFPDMLAEIITSQIPKFKDGGVKALLFHQK---------------------------

BicolorGR1 ------------------------------------------------------------

TSoleGR1 LSVEFPEMLAEIITNQIPKFKDGSIKPLLFHQK---------------------------

MummGR1 LSVEFPEMLTEIITNQIPKFKDGSVKPLLFHQK---------------------------

GuppyGR1 LSVEFPEMLTEIITNQIPKFKDGSVKPLLFHQK---------------------------

MollyGR1 LSVEFPEMLTEIITNQIPKFKDGSVKPLLFHQK---------------------------

PlatyGR1 LSVEFPEMLTEIITNQIPKFKDGSVKPLLFHQK---------------------------

PundGR1 LSVEFPEMLAEIISNQIPKFKDGNVKALLFHQK---------------------------

TilGR1 LSVEFPEMLAELISNQIPKFKDGSVKALLFHQK---------------------------

NeolGR1 LSVEFPEMLAEIISNQIPKFKDGNVKALLFHQK---------------------------

BurtonGR1 LSVEFPEMLAEIISNQIPKFKDGNVKALLFHQK---------------------------

MZebraGR1 LSVEFPEMLAEIISNQIPKFKDGNVKALLFHQK---------------------------

StickleGR1 LSVEFPEMLAEIISNQIPKFKDGSVKPLLFHQK---------------------------

CroakerGR1 LSVEFPEMLAEIISNQIPKFKDGSVKPLLFHQK---------------------------

RdrumGR1 LSVEFPEMLAEIISNQIPKFKDGSVKPLLFHQK---------------------------

PerchGR1 FSVEFPEMLAEIITNQIPKFKDGSVKPLLFHQK---------------------------

SbassGR1 LSVEFPEMLAEIITNQIPKFKDGSVKPLLFHQK---------------------------

JflouGR1 LSVEFPEMLAEIITNQIPKFKDGSVKPLLFHQK---------------------------

EflouGR1 LSVEFPEMLAEIITNQIPKFKDGSVKPLLFHQK---------------------------

ButterGR1 LSVEFPEMLAEIISNQIPKFKAGSLKPLLFHQKDPAAVTDVP-HHSNSVTAT--PNN---

FuguGR2 LSVEFPEMLAEIISNQLPKFKAGSIKPLLFHQR---------------------------

TdonGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

CodGR2 LSVEFPEMLAEIISNQLPKFKAGSMKPLLFHQR---------------------------

TsoleGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

AlimGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

MummGR2 LSVEFPEMLAELISNQLPKFKAGSVKPLLFHQK---------------------------

PlatyGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQK---------------------------

MollyGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQK---------------------------

GuppyGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQK---------------------------

MedakaGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

OdancGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

SbassGR2 ITVSLHSLLKPLQGTK-CSYRT--------------------------------------

NeolGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

BurtonGR2 LSVEFPKMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

MZebraGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

PundGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

TilGR2 LSVEFPEMLAEIISNQLPKFKAGSIKPLLFHQR---------------------------

TilMGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

CroakerGR2 LSVEFPEMLAEIISNQLPKFRAGSVKPLLFHQR---------------------------

StickleGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

CunnerGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

RCodGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

PorgyGR2 LSVEFPEMLAEIISNQLPKFKDGSVKPLLFHQK---------------------------

BreamGR2 LSVEFPEMLAEIITNQIPKFKDGSVKPLLFHQK---------------------------

BicolorGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQRXLIPITDTMPXKSHHITSPSQPDSTNH

PerchGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQR---------------------------

ButterGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQK---------------------------

PikeGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQK---------------------------

RtroutGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQK---------------------------

AsalmGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQK---------------------------

HerrGR2 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQK---------------------------

CaveGR2 LSVEFPEMLAEIISNQLPKIKAGSVKPLLFHQK---------------------------

Zebra LSVEFPEMLAEIISNQLPKFKDGSVKPLLFHQK---------------------------

MinnGR2 LSVEFPEMLAEIISNQLPRFRAGSVKALLFHHK---------------------------

CarpGR2 LSVEFPEMLAEIISNQLPKFKAGSVKSLLFHQK---------------------------

Sterlet LSVEFPEMLAEMISNQLPKFKAGSVKSLLFHQK---------------------------

Gar LCVEFPEMLSEIISNQLPKFRAGSVKPLLFHQK---------------------------

Tgar LCVEFPEMLSEIISNQLPKFRAGSVKPLLFHQK---------------------------

HerrGR1 LSVEFPEMLAEIISNQLPKFKDGSVKPLLFHQK---------------------------

AnchGR1 LSVEFPEMLAEIISNQLPKFKAGSVKPLLFHQK---------------------------

JeelGR1 LSVEFPEMLAEIISNQLPKFKTGSVKPLLFHQK---------------------------

PikeGR1 LSVEFPDMLAEIISNQLPKFKDGSVKPLLFHNALNHD---QMP-----------------

WhiteGR1 LSVEFPEMLAEIISNQLPKFKDGSVKPLLFH-ALNHD---TMP-----------------

RtrouGR1 LSVEFPEMLAEIISNQLPKFKDGSVKPLLFH-ALNHD---TMP-----------------

AsalmGR1 LSVEFPEMLAEIISNQLPKFKDGSVKPLLFH-ALNHD---TMP-----------------

BtrouGR1 LSVEFPEMLAEIITNQIPKFKDGSVKPLLFH-ALNHD---TMP-----------------

CaveGR1 LSVEFPEMLAEIISNQLPKIKDGSVKPLLFHQK---------------------------

CarpGR1 LSVEFPEMLAEIISHQLPKFKDGSVKPLLFHQK---------------------------

Myxine ------------------------------------

FuguGR1 ------------------------------------

TdonGR1 ------------------------------------

CodGR1 ------------------------------------

SeaHGR1 ------------------------------------

AlimGR1 ------------------------------------

MedakaGR1 ------------------------------------

OdancGR1 ------------------------------------

BicolorGR1 ------------------------------------

TSoleGR1 ------------------------------------

MummGR1 ------------------------------------

GuppyGR1 ------------------------------------

MollyGR1 ------------------------------------

PlatyGR1 ------------------------------------

PundGR1 ------------------------------------

TilGR1 ------------------------------------

NeolGR1 ------------------------------------

BurtonGR1 ------------------------------------

MZebraGR1 ------------------------------------

StickleGR1 ------------------------------------

CroakerGR1 ------------------------------------

RdrumGR1 ------------------------------------

PerchGR1 ------------------------------------

SbassGR1 ------------------------------------

JflouGR1 ------------------------------------

EflouGR1 ------------------------------------

ButterGR1 ------------------------------------

FuguGR2 ------------------------------------

TdonGR2 ------------------------------------

CodGR2 ------------------------------------

TsoleGR2 ------------------------------------

AlimGR2 ------------------------------------

MummGR2 ------------------------------------

PlatyGR2 ------------------------------------

MollyGR2 ------------------------------------

GuppyGR2 ------------------------------------

MedakaGR2 ------------------------------------

OdancGR2 ------------------------------------

SbassGR2 ------------------------------------

NeolGR2 ------------------------------------

BurtonGR2 ------------------------------------

MZebraGR2 ------------------------------------

PundGR2 ------------------------------------

TilGR2 ------------------------------------

TilMGR2 ------------------------------------

CroakerGR2 ------------------------------------

StickleGR2 ------------------------------------

CunnerGR2 ------------------------------------

RCodGR2 ------------------------------------

PorgyGR2 ------------------------------------

BreamGR2 ------------------------------------

BicolorGR2 PTSPKKSDDERTEDPRRGVNDVFGSEYATWLAGLGE

PerchGR2 ------------------------------------

ButterGR2 ------------------------------------

PikeGR2 ------------------------------------

RtroutGR2 ------------------------------------

AsalmGR2 ------------------------------------

HerrGR2 ------------------------------------

CaveGR2 ------------------------------------

Zebra ------------------------------------

MinnGR2 ------------------------------------

CarpGR2 ------------------------------------

Sterlet ------------------------------------

Gar ------------------------------------

Tgar ------------------------------------

HerrGR1 ------------------------------------

AnchGR1 ------------------------------------

JeelGR1 ------------------------------------

PikeGR1 ------------------------------------

WhiteGR1 ------------------------------------

RtrouGR1 ------------------------------------

AsalmGR1 ------------------------------------

BtrouGR1 ------------------------------------

CaveGR1 ------------------------------------

CarpGR1 ------------------------------------